Archaeological Textile Research:

Technical, economic and social aspects of textile production and clothing from Neolithic to the Early Modern Era

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1. INTRODUCTION

This Habilitationsschrift **"Archaeological Textile Research: Technical, economic and social aspects of textile production and clothing from Neolithic to the Early Modern Era"** reflects two decades of applied research on archaeological textiles and related sources. The motivation is to improve understanding of the role of textile production and textile products in the history of humankind. Embedding finds and their context information into socio-economical and cultural discourse contributes to a cultural anthropology of textile use. For pre- and protohistory in the region of Central Europe, it is a challenge that textiles are among those organic materials that are rarely preserved under the prevailing climatic conditions (for different preservation conditions see WILD 1988, 7–12; GRÖMER 2016, 23–32).

Despite the scarcity of organic finds, nevertheless, for the studies of the author the analysis of actual textiles from archaeological contexts serves as main source of knowledge. This are mainly textiles from grave contexts that survived attached to metal artefacts, as well as textiles from saltmines. Minor importance for my research play waterlogged and dry conditions. Textile finds, together with tools, pictorial and written sources, yield information on the *chaîne opératoire* of textile production. Thus one of the research foci is to help identify different production processes and sequences such as preparing raw materials, making threads, weaving (and other methods of constructing fabrics), patterning and sewing techniques. Textile techniques and their uses in different periods of time are studied to gain information about developments in techniques such as inventions, innovations, traditions, and the various modes of production. This research about the technological aspects of textile craft is also set in context with the social and economic background of innovation in Central European Prehistory. The period from the 3rd to 1st millennium BC is specifically the focus of studies on textile technology.

Besides textile technology, the most important research undertaken by the author are about functions, resource management, dress and identity, as well as creativity and design. The function of textiles in Prehistory and Antiquity is identified from context information and the properties of the textiles. Finds consist of clothing, soft furnishings, textiles used for technical purposes (e.g. linings of scabbards), including grave goods or textiles as tools (e.g. carry sacks in mines). Research about resource management, use, reuse and "recycling" addresses questions which are also important today. The same applies to the field of dress and identity and the social value of clothing and textiles from the Bronze Age to the Medieval era. The material can also be studied in terms of representation and appearance of textile surfaces and patterns, visual codes, creativity and design – such as the relevance for non-verbal communication.

1.1 Back in time – research in textile archaeology in Austria in a scientific context

Research (on a scientific analytical level) on textiles from archaeological excavations in Austria was pioneered by Hans-Jürgen Hundt (at the time, located at the Römisch-Germanisches Zentralmuseum Mainz). As early as the late 1950s, he studied and published textiles from the saltmines of Hallstatt, later those from Dürrnberg and selected cemeteries dating to the Iron Age and Early Medieval era (e.g. HUNDT 1959, 1974, 1984, 1987). In his scientific approach to describing and understanding prehistoric textiles, he was influenced by publications by Karl SCHLABOW (e.g. 1937, 1961).

For textile archaeology in Austria, a research project by Lise Bender Jørgensen in the late 1980s is also of importance. In her European-wide diachronic study of textile types in Prehistory and the Early Medieval era (BENDER JØRGENSEN 1989, 2005), she concentrated on grave finds which included material from Austria. Those finds, which often came from excavations in the 19th century, were described for the first time.

Especially since the 1980s, textile research became more systematic in European archaeology. The need for communication between scientists working in Germany, Scandinavia and Great Britain in particular led to the establishment of the NESAT Conferences *North European Symposium for Archaeological Textiles* in 1981 by Lise Bender Jørgensen and Klaus Tidow (BENDER JØRGENSEN 2010) and to the foundation of a scientific periodical – the *Archaeological Textiles Newsletter* by John Peter Wild in 1985. All of that helped to establish a larger scientific community working on archaeological textiles – a community which has constantly grown since then and is now too numerous to name in full. An important milestone was the establishment of the Centre for Textile Research (CTR), funded by the Danish National Research Foundation, in 2005 (GLEBA 2006). Standardised methodologies and protocols for describing textiles from archaeological find contexts have been developed from early beginnings, such as Walton and Eastwood's system (WALTON & EASTWOOD 1988). The methodologies now encompass also strategies for visualisation, mapping systems for digital documentation (NOWAK-BÖCK & VOß 2015; PEEK 2013) and defining relationships, especially between mineralised textiles and their host materials (the concept of "microstratigraphy": HÄGG 1989) as well as contextualisation with all the objects found in an archaeological feature. In the last 20 years in particular, textile archaeology in Europe has developed into an innovative field of research, embracing interdisciplinary approaches, and adopting methods from the biological sciences and other natural sciences (ANDERSSON et al. 2010; BENDER JØRGENSEN & GRÖMER 2013).

In Austria, textile research is mainly based at universities and museums. In Western Austria, the "Study Group, Apparel and Textile Techniques" (*Arbeitsgruppe Bekleidung und Textile Techniken*) at the University of Innsbruck, mainly concentrates on textiles from Early Modern contexts such as Lengberg Castle (e.g. NUTZ 2015; CASE, MCNEALY & NUTZ 2017), as well as on research on textile tools in comparison with ethnographic material [1]. The University of Applied Arts in Vienna adds expertise on dyestuff analysis (HOFMANN-DE KEIJZER et al. 2013) and conservation of archaeological material (GENGLER 2005). At the Natural History Museum in Vienna, the research around the saltmine of Hallstatt (RESCHREITER 2013) led to various research projects concerning textiles[2], dealing with different aspects of analysis and contextualisation (GRÖMER et al. 2013) and sewing techniques (RÖSEL-MAUTENDORFER 2016). Within the last decade, the Natural History Museum has been established as a centre of expertise for textiles from archaeological excavation in Austria and far beyond (see Chapter 1.2 data mining and file E_Selected papers), including the work of young scholars (e.g. GRÖMER & RUDELICS 2015).

1.2. Data mining textile finds: on-site studies, regional and supra-regional view

Data mining still continues to serve basic research needs in textile archaeology in terms of describing and analysing archaeological textiles, although superior research questions and theoretical aspects are more and more applied to the material. The author contributes to this with the aim of building as broad a database as possible on archaeological textile finds from the Neolithic to the Middle Ages (occasionally also including archaeological finds from the Baroque era), with the emphasis on a regional view of Austrian territory. At a supra regional level, this also includes sites of interest from continental Europe and the Near East (for textiles analysed by the author since 2008, see file E_Selected papers).

For this kind of basic research, especially with the focus on Austria, networking strategies are vital: Serving as a textile research consultant in cooperation with regional and county museums, universities, the Federal Monuments Office and various excavation companies it is possible to gain access to archaeological textile material. This includes archive material from "old" excavations of the 19th and 20th centuries in existing collections, as well as finds from current excavations. This availability of finds for research activities also enables intensive on-site studies at sites of international importance. One example is the saltmine of Hallstatt in Austria with its approximately 600 textile remains from the period between 1500 and 300 BC, which was the theme of a doctoral thesis (GRÖMER 2007) and also published as a monograph (GRÖMER et al. 2013).

[1] https://www.uibk.ac.at/urgeschichte/projekte_forschung/abt/index.html.de (accessed: January 1, 2019).
[2] Project dealing exclusively with Hallstatt textiles: ***HallTex FWF*****: "Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt".** Project leader: Regina Hofmann-de Keijzer, Universität für Angewandte Kunst, Institut für Kunst und Technologie/Archäometrie Wien. 2008–2011. Funded by FWF (Fonds zur Förderung Wissenschaftlicher Forschung Austria/Austrian Science Fund, Translational – Research – Program, grant nr L431-G02.

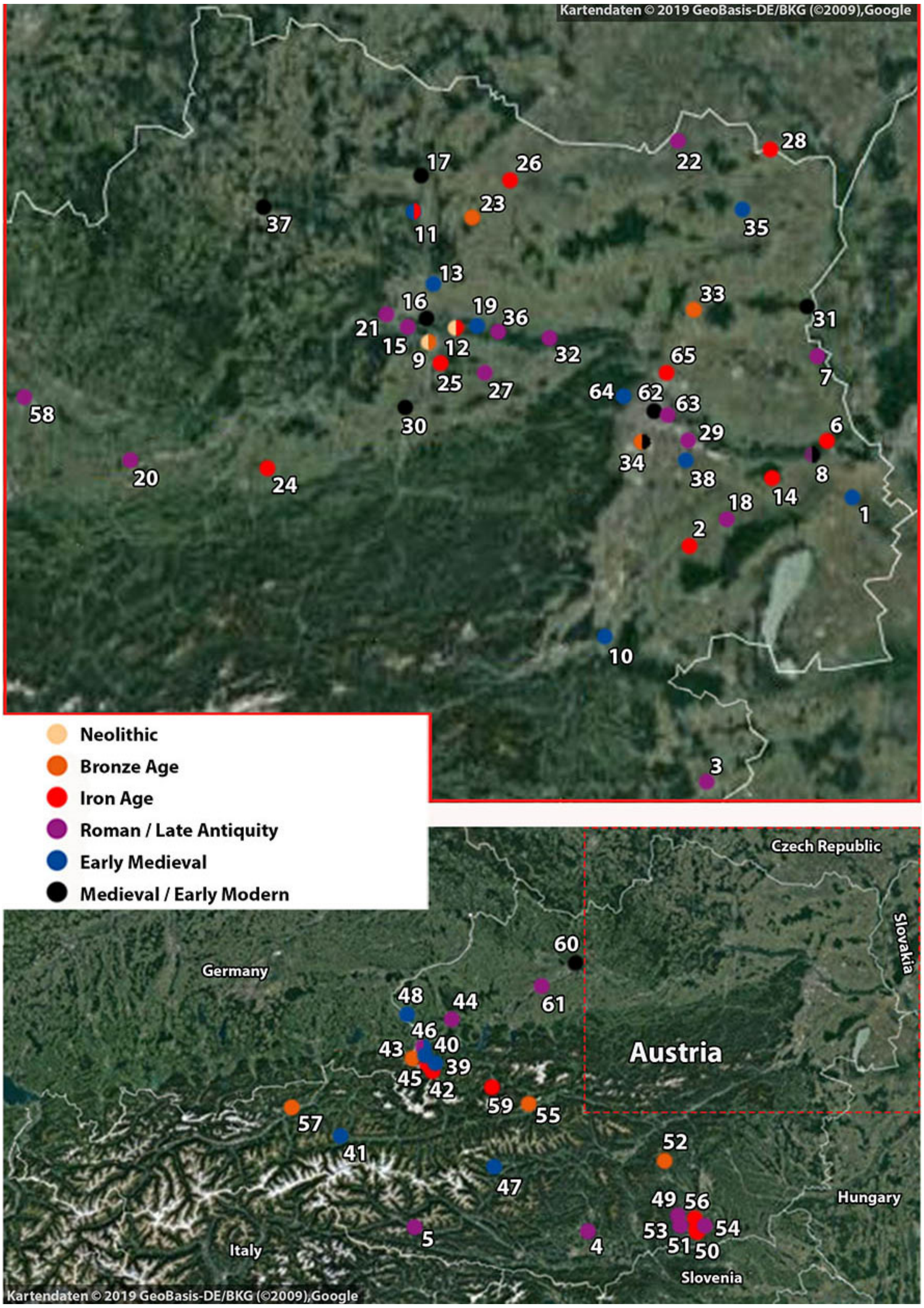

Fig. 1.1: Data Mining in Austria – sites of textile finds that have been analysed between 2008 and 2018, Neolithic till Early Modern. 1 Gattendorf, 2 Leithaprodersdorf, 3 Unterloisdorf, 4 Magdalensberg, 5 Oberdrauburg, 6 Bad Deutsch-Altenburg, 7 Baumgarten an der March, 8 Carnuntum, 9 Franzhausen, 10 Frohsdorf, 11 Gars Thunau, 12 Gemeinlebarn, 13 Gobelsburg, 14 Göttlesbrunn, 15 Göttweig, 16 Hollenburg, 17 Horn, 18 Mannersdorf am Leithagebirge, 19 Maria Ponsee, 20 Mauer an der Url, 21 Mautern, 22 Mitterhof, 23 Oberdürnbach, 24 Oberndorf, 25 Ossarn, 26 Roseldorf, 27 Saladorf, 28 Schrattenberg, 29 Schwechat, 30 St.Pölten, 31 Stillfried, 32 Tulln, 33 Ulrichskirchen, 34 Vösendorf, 35 Wilfersdorf, 36 Zwentendorf an der Donau, 37 Zwettl, 38 Zwölfaxing, 39 Adnet, 40 Anif, 41 Bramberg, 42 Dürrnberg, 43 Großgmain, 44 Irrsdorf, 45 Puch/ Urstein, 46 Salzburg, 47 St.Martin im Lungau, 48 Untereching, 49 Deutschlandsberg, 50 Goldes, 51 Höchschusterwald, 52 Kainach, 53 Kerschbaum, 54 Mantrach, 55 Mitterberg, 56 St.Andrä-Höch, 57 Radfeld, 58 Enns, 59 Hallstatt, 60 Steyregg, 61 Wels, 62 Vienna I., 63 Vienna III., 64 Vienna XVII., 65 Vienna XXI.
For detailed information see file E_Selected papers (image: V. Kern, NHM).

This generation of basic data, which relies on primary analyses of archaeological material, has been complemented by large-scale data mining strategies: literature research and archive studies to locate reports on previously published or analysed material. Usually textile finds are summarised in excavation and research reports without further analysis. Moreover, the earlier mentioned researchers Hans-Jürgen Hundt and Lise Bender Jørgensen often left small notes on Austrian textile finds in the 1960s to 1980s with primary basic analytical data (e.g. HUNDT 1974, 1977, 1984, 1987; BENDER JØRGENSEN 2005) – often without fibre analysis, which was not possible on mineralised artefacts before the general accessibility of scanning electron microscopy. Some of those Iron Age and Early Medieval textile finds have been reassessed with these new methods by the author (e.g. recently Schrattenberg: GRÖMER et al. 2019).

The basic research on a regional level (Fig. 1.1), on, for example, Roman textile finds from Austria, is mostly based on work that has been carried out as part of international research projects. As part of the project *DressID* (Clothing and Identity – New Perspectives on Roman Textiles[3]), funded by the EU Commission (PAETZ GEN. SCHIECK & TELLENBACH 2010), the author had the aim of studying Roman textiles from archaeological excavations in Austria and set them into a context with the textile culture in the other Roman provinces. To understand developments in textile production, extensive research on pre-Roman textiles from Austria has been undertaken. The results of this project were published as a monograph (GRÖMER 2014), from which one chapter is included in this Habilitationsschrift in order to shed light on the method of data generation and interpretation (see Chapter 2.1.).

Supra-regional studies (Fig. 1.2), covering the whole territory of Europe, were the task of the HERA-funded research project *CinBA (*Creativity and Craft Production in Bronze Age Europe)[4]. This project had the aim of understanding creative processes and innovation in pottery, textile and metalwork production (BENDER JØRGENSEN, SOFAER & STIG SØRENSEN 2018). Textile research was there embedded into a larger framework of studies on creativity. For textile studies, Austrian sites (Franzhausen, Hallstatt and Mitterberg) again served as case studies alongside Bronze Age oak coffin textiles from Denmark (BENDER JØRGENSEN, BERGERBRANT & RAST-EICHER 2013). As a member of the textile team of this project, which was led by the renowned Scandinavian textile expert Lise Bender Jørgensen, analytical studies were also made of finds from Bosnia-Herzegovina (GRÖMER, BENDER JØRGENSEN & MARIĆ BAKOVIĆ 2018) and studies of textile imprints on pottery from Austria and Croatia (GRÖMER et al. 2018). Both projects, *DressID* and *CinBA*, together with research on textiles from Hallstatt, resulted in a monograph about *The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe* (GRÖMER 2016), which gives an overview of the state of knowledge in textile research concerning archaeological finds in Central European Prehistory.

[3] ***DressID* "Clothing and Identitiy - New Perspectives on Roman Textiles"**. Project leader: Michael Tellenbach, Curt-Engelhorn-Stiftung für die Reiss Engelhorn-Museen Mannheim, duration: 2007–2012; Funding: EU Commission, Culture Program.

[4] EU-Project ***CinBA* "Creativity and Craft Production in Middle and Late Bronze Age Europe".** Project leader: Joanna Sofaer, Universität Southampton, UK (www.cinba.net), duration: 2010–2013. Funded by HERA – Humanities in the European Research Area. Grant Number: 09-HERA-JRP-CI-FP-020.

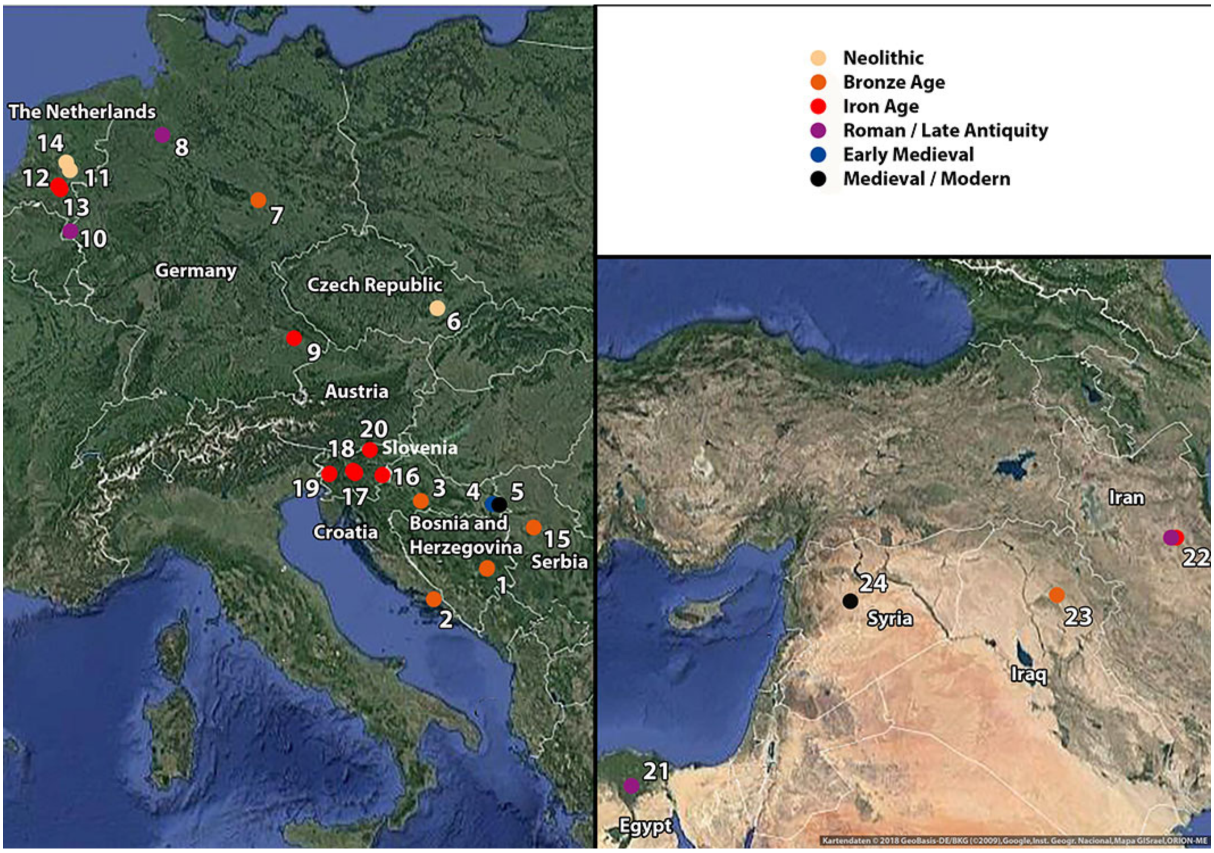

Fig. 1.2: Data Mining Continental Europe and Near East – sites of textile finds that have been analysed between 2008 and 2018, Neolithic till Early Modern. 1 Pustopolje, 2 Gradac, 3 Gušće, 4 Nuštar, 5 Vučedol, 6 Brodek, 7 Erdeborn, 8 Helzendorf, 9 Otzing, 10 Heerlen, 11 Schenkenshul, 12 Oss, 13 Slabroek, 14 Uddelermeer, 15 Surčin, 16 Libna, 17 Magdalenska Gora, 18 Molnik, 19 Most na Soči, 20 Slovenj Gradec, 21 Egypt, 22 Chehrābād, 23 Kirkuk, 24 Syria.
For detailed information see file E_Selected papers (image: V. Kern, NHM).

This monograph also includes contributions about dyes (HOFMANN-DE KEIJZER 2016) and tailoring (RÖSEL-MAUTENDORFER 2016) and was supported by a grant by the FWF (Austrian Science Fund, Grant No PUB 127-G19) after being peer-reviewed by several international specialists. With more than 9,600 views (by 19 March 2019), this is the author's most successful publication uploaded on the online research platform Academia.com. It demonstrates great public interest in the topic.

The most recent approaches to understanding textile production, design development and clothing strategies from a supra-regional perspective also include studies of textiles in the Near East. The saltmine Chehrābād in Iran (AALI & STÖLLNER 2015)[5], with hundreds of textile fragments and six mummified bodies of saltmine workers with associated garments is a

[5] DFG Project **Saltmen Iran – Chehrābād Saltmummy & Saltmine Exploration Project** (Projectleader: Abolfazl Aali, Archaeological Museum Zanjan, Iran; Thomas Stöllner, Ruhr-Universität Bochum, Deutsches Bergbaumuseum Bochum, Germany), duration: 2015-2017. Grant number STO 458/12-2; Project Gerda Henkel Stiftung **Die Salzmänner Irans - Das Kulturerbe des Salzmumien-Museums in Zanjan** (Projectleader: Thomas Stöllner, Ruhr-Universität Bochum, Deutsches Bergbaumuseum Bochum, Deutschland; Markus Egg, Römisch-Germanisches Zentralmuseum Mainz; Wolfgang David, Museum Frankfurt; Abolfazl Aali, Archaeological Museum Zanjan, Iran), duration: 2018-2020. Grant Number AZ 07/BE/17.

perfect assemblage for new research topics. This includes work on questions thus far rarely asked in archaeological textile research – such as functional clothing design, body language and range of movement.

Basic research about original textile finds is furthermore integrated into studies about the technological, economic and cultural meaning of textiles and clothing for past societies.

1.3. Publications and topics selected for the Habilitationsschrift

The papers selected for the Habilitationsschrift are overviews, whilst detailed case studies on selected find spots are addressed in file E_Selected papers. The overview demonstrates how applied textile archaeology is advancing our knowledge of various technical, economic and social aspects of past societies. The selected papers presented here are grouped into methodological, technical, descriptive and interpretive sections, starting with Chapter 2 which focuses on analytical and interpretive methods, with a discussion of the tools used to analyse the textile finds.

Three further sections are about textile techniques from different perspectives: Chapter 3 reflects on technology as elucidated through experimental archaeology, whereas the articles gathered in Chapter 4 provide overviews of textile techniques and designs from the Neolithic to the 1st millennium CE over a wide geographic area from continental Europe to the Near East. The economic aspects of textile production in Central European Prehistory are discussed in Chapter 5, including the levels of production and some discussion about both the producers and consumers of textiles.

These chapters are followed by observations from a more practical perspective through consideration of the functional aspects of textiles in Chapter 6 – what they were used for in daily life and for ritual purposes? This is discussed in relation to original textile finds taking a critical evaluation of the sources, data and methods into account on how to interpret them. This includes a wide range of functions which can be substantiated by the archaeological evidence, including hints at re-use and recycling.

The last two sections are about the impact of textiles on society. Starting with the discussion of specific textile designs in Chapter 7 and how their visual qualities can be understood as indicators of status, prestige and representation. Clothing and dress are emphasised in Chapter 8. Theoretical concepts about communication theory, clothing and identity, performance, body language and even functional clothing design are addressed in to illustrate and explain the significance of clothing in society – even as far back as prehistoric Europe.

ch.	title	published	pp.
2.1.	Datensammlung und Analysemethode	In: K. Grömer: Römische Textilien in Noricum und Westpannonien – im Kontext der archäologischen Gewebefunde 2000 v. Chr. – 500 n. Chr. in Österreich. Austria Antiqua 5, Graz 2014, 4–16. (reviewed by a commission for a publishing grant)	13
2.2.	Zur Interpretation von Funden aus Körpergräbern am Beispiel römischer Textilien aus Österreich	In: J. Banck-Burgess & C. Nübold (eds.), NESAT XI. The North European Symposium for Archaeological Textiles XI, 10.–13. Mai 2011 in Esslingen am Neckar. Verlag Marie Leidorf GmbH, Rahden/Westf. 2013, 93–100. (peer-reviewed)	8
2.3.	Organic remains from archaeological contexts. Forensic taphonomy applied to prehistoric and early medieval inhumation graves	(with M. Grassberger, 70%) In: Proceedings 8th International Meeting on Taphonomy and Fossilization, 14th–17th September 2017, Vienna, Austria. Neues Jahrbuch für Geologie und Paläontologie, Abh. 289/2, Stuttgart, August 2018, 203—216. (peer-reviewed)	14
3.1.	Technical data and experiments on corded ware	(with D. Kern, 60%) Journal of Archaeological Science 37, 2010, 3136–3145. (peer-reviewed)	10
3.2.	Efficiency and technique – Experiments with original spindle whorls	In: P. Bichler, K. Grömer, R. Hofmann-de Keijzer, A. Kern & H. Reschreiter (eds.): "Hallstatt Textiles" Technical Analysis, Scientific Investigation and Experiments on Iron Age Texiles. British Archaeological Reports, International Series 2005. 107–116.	10
3.3.	Late Neolithic weaving tools from Melk-Spielberg in Austria: experiments with crescent shaped weights	In: M. Siennicka, L. Rahmstorf & A. Ulanowska (eds.): First Textiles: The Beginnings of Textile Manufacture in Europe and the Mediterranean. Proceedings of the EAA Session Held in Istanbul (2014) and the 'First Textiles' Conference in Copenhagen (2015). Ancient Textiles Series 32, Oxford & Philadelphia 2018: Oxbow Books, 117–128. (peer-reviewed)	12
4.1.	Vom Spinnen und Weben, Flechten und Zwirnen. Hinweise zur neolithischen Textiltechnik an österreichischen Fundstellen	In: Archäologie Österreichs 17/2, 2006, 177–192. (reviewed by editorial board)	16
4.2.	Dressing Central European prehistory – the sheep's contribution. An interdisciplinary study about archaeological textile finds and archaeozoology	(with K. Saliari, 50%): In: Festschrift für Erich Pucher Pucher. Annalen des Naturhistorischen Museums Wien 120, Serie A, Wien 2018, 127–156. (peer-reviewed)	30
4.3.	Dull Hues versus Colour and Glamour. Creative Textile Design in the 2nd Millennium BC in Central Europe	(with R. Hofmann-de Keijzer, 70%) In: J. Sofaer (ed.), Considering Creativity. Creativity, Knowledge and Practice in Bronze Age Europe. Oxford 2018: Archaeopress Publishing, 55–66.	12
4.4.	Cloth Qualities from 800 BC – AD 800 in Austria: Context – Development – Handcraft	Archaeological Textiles Newsletter 51, autumn issue 2010, 14–21. (peer-reviewed)	9
4.5.	How to Make a Sassanian Tunic? Understanding Handcraft Skills based on a Find from the Salt Mine in Chehrābād, Iran	(with A. Aali, 85%) In: L. Quillien & K.Sarri (eds.), Textile Workers. Skills, Labour and Status of Textile Craftspeople between the Prehistoric Aegean and the Ancient Near East. Workshop held at 10th ICAANE in Vienna, April 2016. Oriental and European Archaeology 12. Vienna: Österreichischer Akademie der Wissenschaften Verlag, Wien 2019 (in print). (peer reviewed)	14

Table: Titles of selected publications, place and number of pages.

5.1.	Textile products, consumers and producers in the Hallstatt Culture.	In: Conference “Contextualising Textile Production in Italy in the 1st millennium BCE”, 11–13 Feb. 2016, ROM. Revista Origini XL, Gangemi Editore, Roma 2017, 95–112. (peer-reviewed)	18
5.2.	Discovering the People behind the Textiles: Iron Age Textile Producers and their Products in Austria	In: M. Gleba & J. Pásztókai-Szeöke (eds.): Making Textiles in Pre-Roman and Roman Times. People, Places, Identities. Ancient Textiles Series Vol. 13, Oxbow Books, Oxford 2013, 30–59. (peer-reviewed)	30
5.3.	Textile craft in prehistory – 1 Levels of production: household, specialised and mass production	In: K. Grömer, The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe. Veröffentlichungen der Prähistorischen Abteilung 5, Verlag des Naturhistorischen Museums Wien, Vienna 2016, 241–261. (peer-reviewed for a FWF-publishing grant)	21
6.1.	bekleiden – verdecken – verhüllen. Kontextualisierung und Theoriebildung zu eisenzeitlichen Grabtextilien	In: R. Karl & J. Leskovar (eds.): Interpretierte Eisenzeiten. Fallstudien, Methoden, Theorie. Tagungsbeiträge der 6. Linzer Gespräche zur interpretativen Eisenzeitarchäologie 2014. Studien zur Kulturgeschichte von Oberösterreich 42, Linz 2015, 89–103.	15
6.2.	Funktionstechnische Analyse von neuzeitlichen Kleidungsstücken aus der Michaelergruft, Wien 1.	(with M. Ullermann, 70%) In: Th. Kühtreiber, G.Scharrer-Liska, C. Theune (eds.), Leben mit dem Tod. Der Umgang mit Sterblichkeit in Mittelalter und Neuzeit. Beiträge der internationalen Tagung in St. Pölten, 11. bis 15. September 2018. Beiträge zur Mittelalterarchäologie in Österreich 35, 2019. (peer reviewed)	15
6.3.	Recycling of Textiles in Historic Contexts in Europe. Case Studies from 1500 BC till 1500 AD	In: I. Miloglav, A. Kudelić & J. Balen (eds.): Recikliraj, ideje iz prošlosti. Arheološki Muzej u Zagrebu. Filozofski Fakultet Sveucilišta u Zagrebu. Institut zu Arheologiju. Zagreb 2017, 75–98. (peer-reviewed)	24
7.1.	Textiles as Early Iron Age prestige goods – a discussion of visual qualities	In: R. Schumann & S. van der Vaart-Verschoof (eds.): Connecting Elites and Regions. Perspectives on contacts, relations and differentiation during the Early Iron Age Hallstatt C period in Northwest and Central Europe. Leiden 2017: Sidestone Press, 221–236. (peer-reviewed)	16
7.2.	To pleat or not to pleat – an early history of creating three-dimensional linear textile structures	(with A. Rast-Eicher, 50%) In: Annalen des Naturhistorischen Museums Wien, Serie A 121, Wien 2019, 83-112. (peer-reviewed)	30
8.1.	Clothing in Central European Prehistory	In: K. Grömer: The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe. Veröffentlichungen der Prähistorischen Abteilung 5, Verlag des Naturhistorischen Museums Wien, Vienna 2016, 319–448. (peer-reviewed for a FWF-publishing grant)	130
8.2.	Visuality – Movement – Performance. The costume of a rich woman from Franzhausen in Austria, c. 2000 BC	(with L. Bender Jørgensen, 50%) In: M. García Sánchez & M. Gleba (eds.): Vetus Textrinum. Textiles in the Ancient World. Studies in Honour of Carmen Alfaro Giner. Collecció Instrumenta 59, Barcelona 2018: Universitat de Barcelona Editions, 211–224. (peer-reviewed)	13
8.3.	Gedanken zur Kinderkleidung durch die Jahrtausende mit Schwerpunkt auf das römische Österreich	(with E. Hölbling-Steigberger, 70%) In: Mitteilungen der Anthropologischen Gesellschaft in Wien 140, 2010, 155–175. (reviewed by editorial board)	21
8.4.	Liturgical Vestments of the 16th to the 18th Century in Austria	Archaeological Textiles Review ATR 2016, 10–20. (peer-reviewed)	11

Table: Titles of selected publications, place and number of pages.

Chapter 2. "Analytical and Interpretative Methods": Research on actual textile finds is among the focus of the author and such the applied methodology is presented. The chapter includes one book section and two articles related to basic data generation, analytical methods and interpretation.

Chapter 2.1. "Datensammlung und Analysemethode [Data collection and analytical methods]", is drawn from the monograph "*Römische Textilien in Noricum und Westpannonien – im Kontext der archäologischen Gewebefunde 2000 v. Chr. – 500 n. Chr. in Österreich*" (GRÖMER 2014)*,* which was one of the main outputs of the research project *DressID*. It summarises in German pre-Roman and Roman textiles in the territory of what is now Austria. The chapter selected here explains data mining and basic analytical methods (fibre analysis, weaving techniques etc.), giving a summary of how to analyse and describe textiles from archaeological contexts. It also includes textiles from graves and settlements, hoards and saltmines with different states of preservation. Standard analytical tools and definitions about weave types and textile qualities are also presented.

The individual steps in the interpretation of grave finds are discussed in **Chapter 2.2. "Zur Interpretation von Funden aus Körpergräbern am Beispiel römischer Textilien aus Österreich [Interpretation of artefacts from inhumation graves, exemplified on Roman period textiles in Austria]"**. Most finds worked on from Austria do not derive from large block-liftings of complete inhumation graves (e.g. BANCK-BURGESS 2012; PEEK 2013; ŠTOLCOVÁ & ZINK 2013) which would enable a more detailed contextual analysis, for example about grave rites. This is why the model used here – demonstrated on interpretation of Roman period textiles from Austria – is based on the analysis of individual artefacts with textiles attached. The scheme shows the interpretive steps that have to be taken into account and what source criticism needs to be considered. This was presented at a conference for textile researchers that had the aim of setting standards for European textile research (NESAT XI in Esslingen, Germany) and was organised by the Landesamt für Denkmalpflege Baden Württemberg (BANCK-BURGESS & NÜBOLD 2013). The Austrian material analysed comes from different museums, the Federal Monuments Office, and above all with excavation companies. The chapter also discusses how intensive cooperation and discussion is essential in order to correctly incorporate and interpret the textile findings into their context. In most cases, a committed interdisciplinary approach is vital for accurate interpretation.

A case-study illustrates a specific kind of interdisciplinary research required for the interpretation of disturbed grave finds, where cooperation with forensic scientists is the key to understanding the mechanisms behind mineralised textiles corroded to metal objects especially in relation to the time-frames of this biochemical process. **Chapter 2.3. "Organic remains from archaeological contexts. Forensic taphonomy applied to prehistoric and early medieval inhumation graves"** is co-authored with a Viennese specialist in forensic medicine, Martin Grassberger. Starting with forensic taphonomy, the decomposition processes and its timing (GRASSBERGER & SCHMID 2014, 23–27; HAGLUND & SORG 2002), the article aims to incorporate that data into the interpretation of the archaeological evidence. The understanding of the mechanisms behind the preservation of organic remains (textiles, leather, fur, human skin and human hair), especially under the influence of metal corrosion is vital for understanding the remains. The examples given come from a range of sites studied by the author. A case study illustrating the application of the forensic data, especially in relation to the timing of the decomposition processes, is then discussed in relation to the interpretation of textiles from re-opened Early Medieval graves, for example St. Martin im Lungau in Austria. Forensic data, together with detailed analysis of the microstratigraphic succession of organic layers on metal artefacts were undertaken to facilitate interpretation of the function of textiles and leather – even in cases where the original burial context is no longer *in-situ*.

Chapter 3. "Textile techniques and experimental archaeology" takes as a central theme the link between an analytical approach and the practical understanding of human behaviour. Experimental archaeology concerning technological studies is an important method by which to understand both how ancient techniques work, details of the *chaîne opératoire*, and also about time consumption and cross-craft interaction. The latter points to the handicraft experience of different craftspeople such as woodworkers, potters or metal smiths, who are linked to each other by designing and producing tools to be used in textile production.

This chapter draws on more than 20 years of the author's experience as a member of the Experimental Archaeology Group of Vienna (GRÖMER, LÖCKER & MEHOFER 2001), which also contributed between the 1970ies and 1990ies in the international development of standards of how an experiment is to be defined, documented and made repeatable. In general, the aim of experimental archaeology is to reproduce certain objects, technological steps or even complete contexts (LAMMERS-KEIJSERS 2005). Detailed documentation enables scientists to reproduce the experiments. For experiments concerning handicraft skills, it is vital to have an extensive "pre-experimental phase" to become familiar with the relevant techniques, for example for experiments about time expenditure using handspinning techniques, the pre-experimental phase can require years of experience to gain a level of skill that enables proper conclusions to be drawn about ancient crafts. Guidelines and methodological principles for experiments investigating the functionality of textile tools have been defined by the Centre for Textile Research Copenhagen. They serve to make the results of the experiments reliable, comparable, clear and easy to relate to (ANDERSSON STRAND 2010, 2; MÅRTENSSON et al. 2009, 379–380; OLOFSSON et al. 2015; see also ULANOWSKA 2016).

Within the Experimental Archaeology Group of Vienna, the author is active in different kinds of experiments concerning textiles. Annual teaching activity in practical textile techniques such as spinning and weaving is carried out within the framework of the lecture and practical "Experimental Archaeology" at the Institute of Prehistory and Historical Archaeology, University of Vienna. Experiments with a focus on cross-craft interaction and for the identification of technical details in pottery have been performed by the author on thread imprints in corded ware (see Chapter 3.1). Other experiments have concentrated on investigating the functionality of certain types of tools (e.g. crescent-shaped weights, see Chapter 3.3) or textile techniques, for example concerning spinning techniques, and expenditure of time required by spinning, as well as performance of spindle whorls (Chapter 3.2), tablet weaving (e.g. RÆDER KNUDSEN & GRÖMER 2012) or loop braidings (GRÖMER, KANIA & BOUTRUP 2015). Other aspects of experimental archaeological work also embrace the reconstruction of garments, their functionality, body language and options of movement, which are then addressed in Chapter 8.2 and 8.5. Recent work in experimental archaeology by the author is dedicated to understand contexts, archaeological features and taphonomy or cremation experiments (see Chapter 9.2). One of them has been made to understand textile impressions of clay vessels used for briquetage (IPACH, SCHERF & GRÖMER 2014). In Section 3, three of the handicraft-based experiments which have been published as articles and book chapters are presented.

Chapter 3.1. "Technical data and experiments on corded ware" is a result of the cooperation with a FWF funded research project about "The Neolithic in the Traisen Valley" by Daniela Kern. In defining and describing corded ware pottery, conventional methods rely on the typology of the vessels' shapes and decoration patterns. In order to gain more specific data, the cord imprints have also been studied in detail. For this, a new methodological approach and tool set had to be developed to describe the imprints in detail. This facilitated new knowledge about the material – the cords – that were used to produce them. The article, published in the *Journal of Archaeological Science*, also includes experiments concerning the raw material of the cords. A range of potential material groups (including tree bast, grass, flax, human hair, horse hair and wool) were used to make cords which were then imprinted on plates of different clay preparation, temper and surface treatment. They were burned on an open fire to simulate the technological stages of the pottery process in the Late Neolithic. The original vessels with cord imprints and the experimental reconstructions were analysed using Scanning Electron Microscopy to identify microstructural patterns in the fibre material used. The experiments resulted in a deeper knowledge about the way these impressions were made and the raw material used for the corded ware impressions, which, for the majority of items from Traisen Valley was probably identified tree bast and grass.

Spinning with hand-spindles as used in Prehistory and the mechanics of the process have been the focus of various experiments, the most basic of which was published in 2005. It is included here as **Chapter 3.2. "Efficiency and technique – Experiments with original spindle whorls"**. Various scholars tested spindle whorls of different sizes, weights and shapes (e.g. ANDERSSON STRAND 2012; KANIA 2013; VERHECKEN 2010). Since it is more usual that reconstructed tools are used for experimenting, this paper is the author's original contribution to the debate because original spindle whorls were used. Permission for testing the whorls, stored at the Natural History Museum Vienna and the University of Vienna, was secured by designing carefully arranged experimental settings. The original artefacts derive from the Late Neolithic to Roman periods providing a variety of different spindle shapes and weights. Experimental settings to gain technical data included the measurement of the frequency of turns and time-measurements of operation time from one turn. The aim was to understand the correlation between the raw material, the spindle weight, the spinning technique and parameters of threads produced (as recorded by, for example, its diameter).

Different weaving techniques have also been explored by the author, usually starting with specific textile fragments to understand the way how they were made. In contrast, the experiments presented in **Chapter 3.3. "Late Neolithic weaving tools from Melk-Spielberg in Austria: experiments with crescent-shaped weights"** were based on tools not textiles. The experiments were driven by Alexandra Krenn-Leeb's research (at the University of Vienna) and were funded by a grant from the Lejre Archaeological Experimental Centre (now Sagnlandet – Lands of Legends) in Denmark and as part of the practical experimental archaeology programme at the University of Vienna. The aim of the tool-based experiments was to investigate the function of crescent-shaped weights and as such tested different textile techniques for which the tools could have been employed. The experimental variants include the use of the weights for two different weaving methods: band weaving and use of a warp-weighted loom. For each, different setups were applied to the weights, as well different numbers of weights: only 2 for the band loom and more than 10 for the warp-weighted loom (depending on the width of the fabric to be produced). Both experiments were based on extant contemporary textile finds. This also applied to the third experimental setup – the use of the crescent weights for twining techniques. Observations on the handling of the tools, the fabric produced and comparative analysis of use-wear during the experimental activities with use-wear on original artefacts provided valuable insight into the function of the tools.

Such experiments and their publication permit other researchers to repeat or follow the methodologies employed, to drive their own conclusions about tools and textiles, to verify or even disprove the conclusions drawn by the original experiments. Experimental archaeology therefore fills important gaps in our knowledge about textile techniques, which are the subject of Chapter 4.

Chapter 4. "Textile Techniques and Design through the Ages", is the basis of further studies which run alongside the experimental approach. Key questions are: A) what were the steps in textile production which formed the *chaîne opératoire* and B) how are these represented in extant textile finds in relation to textile tools of the same time period. These issues are the author's main postdoctoral research outcomes since the doctoral work on the textiles from the saltmine at Hallstatt, covering a timespan from 1500 to 400 BC (GRÖMER 2007)

Since then, a more supra-regional, wider diachronic approach has been underway. Data mining for archaeological textiles in Austria from the Neolithic to the Medieval and analysis of comparative material from continental Europe and the Near East have produced significant outputs for various research projects (see Chapter 1.2). That enabled detailed studies of all steps of textile production, the fibres and their preparation, spinning, and different weaving and patterning techniques. The aim was to make the processes behind various textile and techniques comprehensible and to set them into a broader context.

Chapter 4 includes five articles published in journals and as book chapters about different aspects of textile production and design. This embraces studies about textile products of certain time periods (Neolithic/Bronze/Iron Ages) or wider overviews encompassing differences, developments and changes through time (e.g. between 800 BC and 800 AD in Central Europe). The chapter ends with a case study of a detailed analysis of a garment and the different people involved in it (Sassanian, Chehrābād saltmine).

Chapter 4.1. "Vom Spinnen und Weben, Flechten und Zwirnen. Hinweise zur neolithischen Textiltechnik an österreichischen Fundstellen [Spinning and weaving, plaiting and twining. Examples of neolithic textile techniques from Austrian sites]". This early study in German is about Neolithic textile technologies in Austria. It summarises and categorises archaeological finds of preserved organic textiles, textile imprints, textile tools and contexts of the late 6th to the late 3rd millennia BC from the territory of today's Austria, exploring different steps in the *chaîne opératoire*. It goes beyond weaving techniques which are the author's main focus and also discusses basketry and twining techniques. This summary of archaeological evidence is an important part of fundamental research for our understanding of one of the main technologies employed by early farming societies. More finds are necessary to gain even finer chronological and regional trends within Neolithic Central Europe. As we can see so far, textile work was quite a conservative craft with no rapid changes for a long period, but some developments can be traced. Further research on new finds can still present surprises.

Interdisciplinary research is vital for textile archaeology in order to understand the mechanisms of textile production on a larger scale. **Chapter 4.2. "Dressing Central European prehistory – the sheep's contribution. An interdisciplinary study about archaeological textile finds and archaeozoology"** concentrates on sheep wool and originates from a cooperation with Konstantina Saliari from the Zoological Department of the Natural History Museum in Vienna. The aim was to understand the development of sheep breeds in Prehistory as it can be observed by archaeolozoological studies of from sheep bones in comparison with recent advances in the analysis of wool fibres from sheep hair and textiles from the Bronze Age to the Roman period. The methodology of wool fibre measurement has been adopted for archaeological textiles around half a century ago by Michael Ryder (e.g. RYDER 1982; 1992). In European textile archaeology a more sophisticated understanding and the general use of this method and critiques of its results have been influential in the last two decades (e.g. GLEBA 2012; RAST-EICHER 2008; 2013). Austrian material has played a vital role in this discussion (e.g. RAST-EICHER & BENDER JØRGENSEN 2013). Textiles from Hallstatt have been included in the studies as part of the *CinBA* project (GRÖMER & RÖSEL-MAUTENDORFER 2013; RAST-EICHER 2013). This interdisciplinary cooperation sheds new light on the relationship between people and domesticated animals in Prehistory, human attempts at selective breeding, and their aims and successes. Developments in sheep breeding in the timespan between the Late Neolithic and Roman periods can clearly be explained by the need for better raw materials for textile production: finer and whiter wool rather than coarser hair in dull and dark hues such as grey, brown and natural black. Fine, non-pigmented wool of good quality enabled the production of high quality textiles with a high comfort factor and the use of bright dyes such as yellow or red. These outcomes have been the goal of even early pre-Roman societies. The chapter draws together significant textile finds from Austria with the application of new methods as well as archaeozoological material to make past subsistence strategies understandable.

Chapter 4.3. "Dull Hues versus Colour and Glamour. Creative Textile Design in the 2nd Millennium BC in Central Europe" derives from the research project *CinBA*. The chapter represents one of the focus areas and regions to be worked with: the 2nd and 1st millennium BC in Central Europe. Textile creativity is explored by means of different surfaces and textures used, different patterns and decorative approaches – also the use of glitter and glamour in applying or incorporating metal elements into fabrics. Therefore, the evidence from the whole territory of continental Europe is discussed, much of this evidence is based on author's own research. A section is dedicated to enhancement through colour, as the Bronze Age is the first time in Central Europe when textile dyeing evolved. This is drawn from latest research on early use of dyes and dyestuffs in Central Europe by Regina Hofmann-de Keijzer, the regular co-author within different research projects, including *CinBA*. Structure and decorative effects are a form of creative exploration of the possibilities of the material. Decisions made at different steps in the *chaîne opératoire* influence the quality and effects of the final products, including its aesthetics and what the product can be used for. The mechanisms behind creativity and innovation are also underpinned by a methodological attitude to understand human needs and motivation. The definition of human needs by the American psychologist Abraham Maslow is a starting point here for further argumentation.

Roman and Early Medieval material was included into the studies in order to embrace textile technology and textile design from a broader perspective. A short overview of this research was presented in the international journal *Archaeological Textiles Review*, and is included here as **Chapter 4.4. "Cloth Qualities from 800 BC – AD 800 in Austria: Context – Development – Handcraft"**. A diachronic comparison of weave types, cloth qualities, patterns and design, as well as textile tools used for their production is discussed. The time-span chosen is interesting because a number of changes in textile techniques can be observed but these are not simply changes from the primary weave types to more complex ones. This might be explained by the development of textile types between 800 BC and 800 AD: Hallstatt period textile design represents a high impact of skill, creativity, love of colours, different textile structures and patterns, whilst Latène period textiles are much simpler. The same applies to Roman period textiles in today's Austria, which also represent simple weave types – except for some rare precious textiles with silk and gold threads. Those form a specific "luxury horizon" in the 2nd and 3rd century CE, as defined by John Peter WILD (2013) in his study about textile production in the Northern Provinces. After the breakup of the Roman Empire the textile variety comes back in the Migration period in terms of different weave and pattern types. The mechanisms behind these changes may lie in traditions, innovations, but are also influenced by contacts between different cultures and peoples. This study was part of the project *DressID* and leads to Chapter 5, which deals with the economic relevance of textile production in different societies.

This section concludes with a specific detailed study which arose from research projects about the saltmine Chehrābād in Iran. **Chapter 4.5.** picks out a central theme **"How to Make a Sassanian Tunic? Understanding Handcraft Skills based on a Find from the Salt Mine in Chehrābād, Iran"**. In the saltmine, a complete, slightly torn tunic dating to the 5th century CE was found in the mining debris. This object serves as a perfect case study about the people involved in different steps of making such a garment, but also in the use and discard of textiles. In this case, spinning, weaving, and tailoring techniques have been analysed in terms of the technical features and qualities of threads, the weave and sewing. Weaving faults in the fabric on the one hand, and a high level of skill in creating the seams and hems to a specific cutting pattern on the other, shed light on the professionalism of the craftspeople that stood behind the garment. This led to the suggestion that a group of different makers is responsible for the production of the item: a less careful or less skilled weaver perhaps working in a workshop and a professional tailor who maybe bought the cloth at the bazaar. This interpretation was cross-referenced with knowledge about the economy, production, trade, and subsistence strategies of that time and region. This approach suggested a complete object biography, which not only answers questions about how different people involved in production but also how and by whom the tunic was used (for example, the saltmine workers) and reasons for it being discarded.

Chapter 5. "**Economic aspects of textile production",** stands in direct relation to the discussion on textile technology and design in Chapter 4. Textiles and textile production are usually recognised as conservative and traditional forces in ancient societies. Research on organic remains, which has intensified during the last 20 years, together with research on textile tools, as well as pictorial and written sources, now make it possible to consider more complex research questions. These include the impact of tradition versus innovation, chronological and regional aspects of textile technology, and even modes of production (household production versus specialisation).

Considering the *longe durée* and the large-scale of textile manufacturing, regional and supra-regional development is essential in understanding textile production, as exemplified by research focusing on the 3rd millennium BC to the beginning of the 1st millennium CE in Central and Northern Europe. In addition, an overview is necessary of the developments in textile technology in the Eastern Mediterranean (e.g. in Greece) to identify different cloth traditions (see for this also Gleba 2015). Research projects such as *CinBA*, *DressID,* and *HallTexFWF,* as well as the work on textile material from sites in Austria and neighbouring countries, exemplify this approach.

The economic aspect of textile studies is represented in Chapter 5 in a book chapter and two articles of published conference presentations. For this, the economics of Iron Age textile production is a main research focus. The selected articles are firmly interconnected in showing various different aspects of the same research topic, which depend on a restricted number of sources. Nevertheless, all of them are presented here to show different perspectives of that material.

Chapter 5.1. "Textile products, consumers and producers in the Hallstatt Culture", deals with the economic significance of textile production in the Early Iron Age and its impact on society. Across all periods in European Prehistory, it is the Hallstatt Culture that provides the most detailed information about those aspects of textile craft. Various sources such as the extant textile finds, various textile tools (each deriving from different contexts) and pictorial sources enable a deep insight into different kinds of textile products, their producers and consumers. This work aims to shed a new light on textile production – moving away from the linear perspective of "spinning – weaving" production of garments to alternative approaches. This looks at different kinds of textile products (see also Chapter 6 about the function of textiles), as well as part-finished materials and part-finished products, such as processed fibres, balls of yarn or raw cloth, which might also be of value for trade, as gifts, dowry or even offerings in a ritual context. This approach is inspired by research on metal technology in Prehistory, where such a differentiated spectrum of goods has been discussed for a long time (e.g. VENCLOVA 2002). Analysis of pictorial sources as well as different kinds of archaeological evidence such as grave contexts provides a view on producers and consumers of textiles in the Hallstatt Culture. This multi-focus research identifies the habits of textile consumption of different strata of the social hierarchy in this time and area.

A more detailed study from Austrian sites is presented in **Chapter 5.2. "Discovering the People behind the Textiles: Iron Age Textile Producers and their Products in Austria"**. This work was part of the outcome of a workshop in the *DressID* project, which was published in an edited volume about textile production in the pre-Roman and Roman era, edited by Margarita GLEBA and Judit PASZTOKAI-SZEÖKE (2013). Beginning with a description of different sources to be studied and a general overview similar to the one in Chapter 5.1. to introduce into the topic, the main goal of this article is to discuss two important Iron Age case studies: Hallstatt and Dürrnberg. Both are important economic centres of their time, both served as production centres for salt with wide trading and distribution networks. However, significant differences may be observed concerning textile production. The textiles found on each site represent a different approach to creativity and design, which is on the one hand a chronological factor as well as a different tactic of production and trade of those necessities of daily life (Hallstatt, textile finds mainly from 1500–400 BC and Dürrnberg, mainly 6th to 3rd century BC). In addition, general questions about the work-flow in Iron Age textile production are addressed, including organisation of production and division of labour. The social status of textile craftspeople as well as questions about where they lived and worked are also considered here by focusing on the selected case studies. They demonstrate that textile production in Iron Age Austria was organised in various ways and is highly multi-faceted, depending on the geographical position and size of the settlement, the status of its inhabitants as well as their economic subsistence system.

Chapter 5.3. "Textile craft in prehistory – 1 Levels of production: household, specialised and mass production" summarises and concludes what can be deduced about modes of production of textile crafts in prehistoric Europe. It is closely related to the other articles presented in this section, but goes further by taking a wider perspective from the Stone Age to Roman period. This is a chapter drawn from a monograph about "*The Art of Prehistoric Textile Making. The development of craft traditions and clothing in Central Europe*" (GRÖMER 2016). The core of this chapter is a discussion of a theoretical model by Eva Andersson Strand (ANDERSSON 2003) about possible modes of production which she developed through her research on Viking period textile production in Birka and Hedeby. She characterises and defines the terms "household production", "household industry", "attached specialist production" and "workshop production for trade". The chapter presented here demonstrates the development of a general model for understanding how different weaving and patterning techniques have evolved in Central Europe from the beginning of the Bronze Age to the occupation of those territories by the Romans (GRÖMER 2016, fig. 140). This is vital for understanding the mechanisms of innovation, influences on technology coming from abroad, the economy and also the needs of the society in a specific period and geographical area.

Chapter 6. "Functional aspects of archaeological textiles" represents a completely different research goal of textile studies. The establishment of a systematic overview of the functions of textiles in certain past societies is an important objective. In a further perspective, the understanding of different functions of textiles sheds a more detailed light on the meaning of textile production within a society as well as on the handling of resources. A detailed scheme about primary and secondary use of textiles in prehistory that have been developed within the last few years (GRÖMER 2016, fig. 171).

Evidence for these activities is observable in the archaeological record. Three extended examples drawn from articles published as book chapters discuss these phenomena in this section: textiles in funerary practice in the Iron Age, a discussion of garments found in graves of the 18th century, and examples for textile recycling from the Bronze Age to the Early Modern era.

Chapter 6.1. "bekleiden – verdecken – verhüllen. Kontextualisierung und Theoriebildung zu eisenzeitlichen Grabtextilien [dressing – covering – wrapping. Contextualisation and theoretical approaches to textiles in Iron Age graves]", discusses a German contribution to a conference on the functions of textiles in the specific context of Iron Age graves. The interpretation of textiles from funeral contexts is complex and goes far beyond simply studying parts of the clothing of the deceased. Different circumstances of deposition in funeral rites suggest the use of textiles with a variety of purposes. From the archaeological evidence in Central European Iron Age, the six main purposes of textiles can be distinguished so far: 1) textiles used as garments for the deceased; 2) textiles used as burial gifts; 3) textiles serving as cover or wrapping for grave goods or the deceased (such as a shroud); and 4) textiles used as soft furnishings for the grave chamber. In addition to these purposes, where textiles have been used as part of the funeral intentionally, 5) textiles can sometimes be found in graves as an integral part of other artefacts and as such ended up in the grave even without being recognised. Examples are textile linings in sword scabbards or knife sheaths. 6) Recycled textiles are also identified among grave finds, such as the textile scraps stuffed into hollow bracelets of the early Latène period. This paper also sets out a methodological approach to defining the different uses of textiles in graves, as well as grouping them into functional and ritual categories of textile use. In addition, the practice of using textiles as wrapping for grave goods has been recognised by various researchers (e.g. BANCK-BURGESS 2014; GLEBA 2014). Different theories about the potential meanings for this custom are also discussed.

Chapter 6.2. "Funktionstechnische Analyse von neuzeitlichen Kleidungsstücken aus der Michaelergruft, Wien 1 [Functional analysis of Modern era garments found in the crypt Michaelergruft, Vienna 1]" also derives from a conference paper, but focuses on textile and garment use in Christian contexts in Modern Europe. The material discussed here is from a crypt in Vienna that is located near the imperial palace of the Habsburgs. Selected burials dating to the 18th century from the Michaelergruft serve as case studies for developing new theoretical and methodological approaches to investigating the textiles and garments found in the coffins. Garments found in crypts are usually analysed through clothing history, aspects of conservation and preparation. Textile analysis and modern analytical methods are also applied to the material. In discussing these garments, questions about the interpretation of the clothing arise as if they are everyday (or festive) garments or specific funeral costumes. In the following paper, there is a discussion of the criteria which distinguish between "functional garments" worn in daily life, "adapted garments" (everyday clothing that has been recycled, cut or altered to be used as garments for the dead), and "funeral costumes" that have been deliberately made for the purpose. This study adds some specific data to the practical discussion of what kind of garments were buried with the deceased. Such analyses also help to interpret textile finds from modern cemeteries with bodies buried directly in the ground, where just a few buttons, bronze hooks and pieces of cloth attached to them survive.

The study in **Chapter 6.3. "Recycling of Textiles in Historic Contexts in Europe. Case Studies from 1500 BC till 1500 AD",** was a contribution to a research project at the University of Zagreb in Croatia, which also devoted a small special exhibition to the topic in 2017. Studying the historical dimension of textile recycling was intended to contribute to one of the most important challenges the world faces today – the supply of resources. Awareness of a responsible, economical, and considerate exploitation of resources in the past can inform modern textile recycling, which is among the biggest topics of the early 21st century. Different kinds of textile recycling and their significance today and in historical periods are discussed: Textiles have been altered or adapted to a new use, been torn or even shredded to pass through the lifecycle again (as it is done in modern textile recycling mills). Various examples from the Bronze Age to the Early Modern era demonstrate the different purposes for which recycled textiles have been used: as caulking material for ships (textile rags stuffed between the planks), also stuffed into cavities of medieval castles; or as sealing for water management in copper mines. Textiles have also been used as coverings and for hygienic properties as well as makeshift material for the production of different goods (e.g. as material to handle ceramics during pottery). Clothing recycling involves the re-working of garments or the re-use of garments worn in daily life as funeral textiles. A specific case study is the use of recycled textiles as makeshift binding material for salt mining or re-sewn fragments of garments that served as cover for the hand. There are many different motivations for textile recycling throughout history: for example, an awareness of the time-consuming production process required to produce items, a responseful employment of resources or specific luxurious materials (e.g. gold threads, silk, purple) that are too precious to be wasted even after the discard of an item. In contrast, today, waste-reduction and an awareness of the ecological problems of pollution are drivers for textile repair, re-use and recycling (JOUNG & PARK-POAPS 2013).

Chapter 7. "Social aspects of textiles: Status/Prestige and Representation", is an invitation to re-think the significance of textiles and textile patterns for the expression of prestige in Prehistory and beyond – in contrast to the traditional thinking of textiles as simply being a background or carrier for other objects such as jewellery. Several written sources from Egypt, Ancient Greece, and the Roman Empire emphasise the value of cloth and status representation via cloth (DROß-KRÜPE & WAGNER 2014; EDMONTSON 2008; HARLOW & NOSCH 2014; WAGNER-HASEL 2006). Even today, the textile and fashion industries account for one of the most valuable sectors in the world trade[6]. High-value designers and fashion labels such as Dior or Chanel are luxury brands, conveying status and prestige on those people who can afford them.

Different theoretical approaches can serve as the basis for a discussion on the social aspects of textile use in terms of status and representation over time, especially for prehistoric societies without written sources. In this section, two articles, published as a book chapter and a journal article, represent interesting case studies about the potential for textiles from archaeological evidence as illustrations of topics such as status, prestige and representation.

Chapter 7.1. "Textiles as Early Iron Age prestige goods – a discussion of visual qualities" was a contribution to a conference "Connecting Elites and Regions" in Leiden, The Netherlands (SCHUMANN & VAN DER VAART-VERSCHOOF (eds.) 2017). The chapter debates what kinds of visual qualities have been created in textiles (textures, colours, patterns, weave types) in the 1st millennium BC and what may have been their impact on society. Different sources are discussed and important original material is presented to illustrate the way in which textiles were used as codes to reflect particular social and aesthetic values. In this context, it is especially noteworthy to study textiles from graves. Comparison of those coming from elite burials with those found in burials of the wider population in the late Hallstatt period are instructive in this context. Similar and different kinds of textile qualities can be recognised. Patterns and the use of colour also present vivid evidence: most striking is the use of blue and red for elite burials. Some interesting early trends in the visual expression of elites through

[6] E.g. https://fashionunited.com/global-fashion-industry-statistics (last accessed January 20, 2019).

textiles can be traced, although critiques emphasising the gaps in our knowledge due to the relative scarcity of textile finds in Central Europe must be kept in mind.

New theories in textile research also discuss the visibility of textile structures and pattern types from different vantage points: what can be seen from far away and from nearby? This poses questions about the proximity of social interaction among members of different social groups. Who was able to come near enough to an elite person wearing a sophisticated and "expensive" textile to see effects that can only be seen from nearby (such as spin patterns on a find from Hochdorf in the form of small-scale houndstooth checks in woad blue and red dyed with an insect dye; BANCK-BURGESS 2012)? For whom were these specific textile types and their "messages"intended? This study illustrates that Early Iron Age textiles of Central Europe were used to define and express a "social space", group relationships, and demonstrate visual codes of a society.

Chapter 7.2. "To pleat or not to pleat – an early history of creating three-dimensional linear textile structures" presents a detailed study about a specific textile structure from a wide diachronic perspective. This research, undertaken in a collaboration with the Swiss textile archaeologist Antoinette Rast-Eicher, presents original textile material embracing examples from the Neolithic to the Early Medieval eras. The chapter addresses techniques for creating three-dimensional linear structures through history and classifies such structures according to their construction during weaving (e.g. barred damask and three-dimensional spin pattern) or afterwards (e.g. plissé). Diachronic perspectives have been used as the basis for further arguments such as when and in which regions specific techniques were used, how they affect the overall shape and form of the textile (including discussion of modern terms such as the "fullness" of a fabric). It is also of interest, how such structures interact with the body of the person wearing them and their effects on body movement. Another important aspect under consideration is how the use of these structures can be understood as visual codes in terms of their visual effects in past societies.

Chapter 8. "Research on clothing: Implications for society", develops the ideas of the previous section, concentrating on actual garments and clothing. Material is drawn from a substantial chapter from a monograph and co-authored journal articles and edited volumes about specific garment types or clothing reconstruction projects.

Reconstructions of prehistoric garments are discussed in order to demonstrate the difficulties of interpreting placement patterns in graves. Clothing or garments and costume, the ensemble of garments, dress accessories, jewellery, shoes and head covers are distinctive factors of non-verbal communication. They are among the main aspects concerned in this section, as garments not only protect against heat, cold and wet weather conditions. The social meaning of garments (EDMONTSON 2008; SOMMER 2012), as important medium to communicate identities, gender, age, group membership and social status, can not be under-estimated. Costume history is always a reflection of social history.

Chapter 8.1. "Clothing in Central European Prehistory" was also a part of the monograph "*The Art of Prehistoric Textile Making. The development of craft traditions and clothing in Central Europe*" (GRÖMER 2016) which summarises current knowledge about dress and garments in the region under consideration. All the available data from the Neolithic to Iron ages in Central and Northern Europe is presented here in a conclusive overview. Starting with a survey of the different sources available for prehistoric clothing (e.g. complete garments, textiles in graves, placement patterns of clothing and accessories, pictorial and written sources), it also addresses the problem how to interpret them. Thus, not only single garments, but whole ensembles are discussed, including head coverings and shoes. This includes reflections on the potential for garments to be understood in terms of non-verbal communication and their impact on society. It also refers to aspects of "attraction and chastity", "protection of the body", "psychological effects of clothing" and "gendered design". It concludes with issues about the social function of clothing, visual codes, and the value of clothing within prehistoric societies.

After this broad overview, a detailed case study about a specific Bronze Age grave illustrates a central theme in **Chapter 8.2. "Visuality – Movement – Performance. The costume of a rich woman from Franzhausen in Austria, c. 2000 BC".** This was co-authored with the textile researcher Lise Bender Jørgensen from Trondheim University in the *CinBA* project. The reconstruction of the costume in grave 110 at Franzhausen is based on the metal dress accessories, jewellery, placement patterns, and textiles found in the grave itself. The reconstruction is set into context with body language, movement constraints, overall appearance and visual codes. The interaction between specific garment types and body language, posture, and gesture are analysed in order to offer new perspectives for social and cultural studies. As the Early Bronze Age is among the first eras in Central Europe when a complex social hierarchy is established, it is relevant to consider how that was reflected in the clothing of the elite. The massive head gear from grave 110 in Franzhausen, in particular, and its impact on movement, the need for space, and its appearance in different lighting are worthy of careful consideration.

Chapter 8.3. "Gedanken zur Kinderkleidung durch die Jahrtausende mit Schwerpunkt auf das römische Österreich [Children's garments through the millennia with a focus on Roman period Austria]" is among the outputs of the *DressID* project and was published in an edited volume about children from the perspectives of archaeology, physical anthropology, cultural and social anthropology, ethnology and European ethnography. This study focuses on how "gender and age" is reflected in children's clothing in Prehistory and the Roman period through textile finds, grave contexts and pictorial and written sources. Data about the Roman period grave inventories have been added by co-author Eva Hölbling-Steigberger. The article includes a definition of the term "childhood" and how it can be understood in Prehistory and Antiquity in contrast to modern societies. Children's garments as expressions of their social status and their roles or duties in society are analysed. The way a child is dressed – including similarities with and differences from contemporary adults' clothing – provide clues to the understanding of childhood within a specific society. Detailed research into different age groups in childhood (infant, baby, toddler, juvenile) is crucial for demonstrating the nuances of early life.

Chapter 8.4. "Liturgical Vestments of the 16th to the 18th Century in Austria" is a specialised clothing research area in which the author combines research about recent use of vestments in Catholic Church with the discussion of archaeological evidence. Finds from archaeological excavations such as priests' graves in Zwettl and Hollenburg in Austria were analysed with relatively new methods such as SEM-EDX (Scanning Electron Microscopy, Energy-dispersive X-ray spectroscopy) and interpreted in terms of their relevance to textile history. Ecclesiastical garments are specific types of clothing in western societies, worn by certain persons and only on special occasions. Their use for ritual and cult purposes, and also as funerary garments for the burial of catholic priests, are discussed in this article, including an important aspect of liturgical garments, which is the *long durée* of their use (which seems to be longer than for any other kind of garment). Case studies focus on garments from St Stephen's Cathedral in Vienna which were made in the 16th century and are still in use until today for religious services. Reasons for using such old garments lie in contemporary society's current needs and in the representation of the values and traditions of the Catholic Church in Central European history. Reflecting on archaeological excavations and dating practices of graves, it is interesting to consider that liturgical garments might have been in long use before ending up in a priest's grave (for example, a priest buried with a 17th century chasuble may have lived in the 19th century). This is a specific and significant challenge for dating ecclesiastical graves.

2. ANALYTICAL AND INTERPRETATIVE METHODS

2.1. Datensammlung und Analysemethode

chapter of a monography

GRÖMER, K. (2014): Datensammlung und Analysemethode. In: K. Grömer, Römische Textilien in Noricum und Westpannonien – im Kontext der archäologischen Gewebefunde 2000 v. Chr. – 500 n. Chr. in Österreich. Austria Antiqua 5, Graz 2014, 4–16.

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2 DATENSAMMLUNG UND ANALYSEMETHODE

Diese Monografie möchte einen umfassenden Überblick zur Fundgattung der Textilfunde (Gewebefunde) aus österreichischen Fundstellen bieten, wobei Materialien von der Bronzezeit bis zum Beginn des Frühmittelalters vorgestellt werden (Tab. 1). Die katalogmäßig erfassten Objekte entstammen sowohl eigenen Forschungen, als auch der Literatur. Es gelang, 176 Textilfunde von 42 vorrömischen Fundorten (exclusive Salzbergwerke, deren detaillierte Auflistung den Rahmen sprengen würde: Hallstatt - mehr als 250 Gewebekomplexe; Dürrnberg - ca. 600 Gewebe) zusammenzustellen, die einen Zeitraum von ca. 2000 v. Chr. bis zur Zeitenwende angehören. Aus römischer Zeit wurden 184 Textilien von 40 verschiedenen Fundstellen erhoben. Im Fließtext wird immer wieder auf den Katalog (auf die Katalognummern) verwiesen, da sich dort die maßgebliche Literatur aufgeführt findet.

Bedingt durch das Projekt DressID, in dem ein Großteil dieser Datensammlung entstanden ist, konzentrieren sich die auswertenden Kapitel auf die römische Epoche, grob auf die erste Hälfte des 1. Jahrtausends n. Chr.

		Anzahl Fundorte					Anzahl Textilien					
		Siedlung	Grab	Bergbau	Hort/ Einzelfund	Gesamt	Siedlung	Grab	Bergbau	Hort/ Einzelfund	Gesamt ohne Salz-bergwerk	Gesamt
Urgeschichte	Bronzezeit 2300 - 800 v. Chr.	3	3	3		9	3	5	9 (+58)		17	75
	Hallstattzeit 800 - 400 v. Chr.	1	16	1		18	3	70	203		73	276
	Latènezeit 400 - 15 v. Chr.	1	13	1		15	1	85	ca. 600		86	> 686
Römerzeit	Römische Kaiserzeit 1. / 2. Jh.	5	5		1	11	9	8		1		18
	3. Jh.		8		1	9	1	20		1		22
	Spätantike 4. / 5. Jh.	1	18		1	20	2	140		2		144

Tab. 1: Derzeit in Österreich bekannte Textilfunde (Stand Februar 2012): die Angaben in den Klammern beziehen sich auf die im Katalog als Sammelposten angeführten Funde aus den Salzbergwerken (bei diesen: Stand nach Grömer 2007).

2.1 ARCHÄOLOGISCHE TEXTILFORSCHUNG IN ÖSTERREICH

Die Fundgattung „Textilien“ wird in Österreich meist als nicht existent wahrgenommen, was vor allem an den Problemen bei ihrer Überlieferung, aber auch an den Schwierigkeiten bei ihrer Erkennbarkeit, Konservierung und Analyse liegen mag.

Forschungen an archäologischen Textilfunden[8] wurden in Österreich bis vor wenigen Jahren eher sporadisch durchgeführt und sehr vereinzelt, oft an nicht gut zugänglicher Stelle publiziert. Besonders Hans-Jürgen Hundt[9], damals im Römisch-Germanischen Zentralmuseum Mainz machte sich ab 1959 (✝ 1990) in der Konservierung,

[8] Prinzipielle Überlegung zur Arbeit mit archäologischen Textilfunden siehe BENDER JØRGENSEN 2007 und RÆDER KNUDSEN 2007.

[9] Siehe in der Literaturliste sein umfangreiches Schrifttum zu österreichischen Funden von Eisenzeit bis Frühmittelalter.

Untersuchung und Veröffentlichung von Textilfunden aus Gräbern aus der Eisenzeit und dem Frühmittelalter verdient. Daneben legte er den Grundstock für die Erforschung der Textilien aus den Salzbergwerken Hallstatt und Dürrnberg, eine Arbeit, die auch von Katharina von Kurzynski[10] weitergeführt wurde.

Gerade die Textilien aus dem hallstätter Salzbergwerk sind derzeit im Fokus verschiedener Forschungsprojekte und auch universitärer Arbeiten[11]. Die Doktorarbeit von Karina Grömer beschäftigte sich mit den bronzezeitlichen Funden aus Hallstatt, die Magisterarbeit von Helga Rösel-Mautendorfer mit der Nähtechnik (jeweils am Institut für Ur- und Frühgeschichte der Universität Wien), was auch im Projekt CinBA[12] fortgeführt wird. Unter der Leitung von Regina Hofmann-de Keijzer (Institut für Archäometrie, Universität für Angewandte Kunst Wien), sowie von Maarten van Bommel und Ineke Joosten (Cultural Heritage Agency of the Netherlands, Amsterdam) wurden in mehreren Projekten Farbstoffanalysen durchgeführt (zuletzt HallTexFWF)[13]. Die Textilien und Fellfunde aus Hallstatt waren auch schon mehrmals Gegenstand von Wollfeinheitsanalysen durch Michael Ryder[14], Irene Skals[15], sowie zuletzt Antoinette Rast-Eicher (Projekt CinBA). Farbstoffanalysen an den Textilien vom Dürrnberg führten Jan Wouters und Marie-Christine Maquoi (KIK/IRPA Brüssel) durch[16]. Weitere Arbeiten zu Konservierung und Restaurierung wurden am Material von Hallstatt getätigt[17].

Neben diesen zahlreichen Forschungen an den gut erhaltenen Salzbergwerkstextilien wurden auch immer wieder Beschreibungen und Analysen von Geweben aus Grabkomplexen durchgeführt. Forschungsreisen führten Ende der 1980er Jahre auch die Skandinavierin Lise Bender Jørgensen[18] (NTNU Trondheim, Norwegen) nach Österreich, um in verschiedenen Museen und Archiven vor allem eisenzeitliche Textilfunde aufzunehmen (Uttendorf, Dürrnberg, Mattsee, Mitterkirchen, Hallstatt-Gräberfeld, Schrattenberg, Schusterwald).

Ebenso gibt es von verschiedenen Autoren vereinzelt Textilbeschreibungen als kleine Anhänge zu Fundvorlagen von Gräberfeldern, etwa von Eva Grollegger[19] (Führholz, hallstattzeitlich und Frauenberg, römisch), oder Katharina v. Kurzynski[20] (Pottenbrunn, latènezeitlich), Natascha Müllauer[21] (Mannersdorf, latènezeitlich) und Ingeborg Petraschek-Heim[22] (Bischofshofen, hallstattzeitlich und Carnuntum, römisch).

Weiters führten Johanna Banck-Burgess und Penelope Walton Rogers Untersuchungen an Textilien vom bronzezeitlichen Kupferbergbau Radfeld durch.

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[10] KURZYNSKI 1996, 1998, 2003; Katalog der Textilfunde in STÖLLNER 2002.

[11] GRÖMER 2007. - RÖSEL-MAUTENDORFER 2011.

[12] CinBA: „*Creativity and Craft Production in Middle and Late Bronze Age Europe*“ Projektleitung: Joanna Sofaer, Universität Southampton. Förderung durch HERA - Humanities in the European Research Area, Grant Nr. 09-HERA-JRP-CI-FP-020. Projektdauer: 2010-2013. – *www.cinba.net*

[13] HallTex FWF: „*Dyeing techniques of the prehistoric textiles from the salt mine of Hallstatt. Analysis, experiments and inspiration for contemporary application*”. Projektleitung: Regina Hofmann-de Keijzer, Institut für Archäometrie, Universität für Angewandte Kunst Wien. Fonds zur Förderung Wissenschaftlicher Forschung (FWF), Translational - Research - Program (TRP): L 431, gefördert vom FWF. Projektdauer: 2008-2011. HOFMANN-DE KEIJZER, VAN BOMMEL und JOOSTEN 2005; HOFMANN-DE KEIJZER und HARTL 2009.

[14] RYDER 1990, 2001.

[15] SKALS 2007.

[16] Siehe in STÖLLNER 2005, 169. Unpubl. Bericht von Jan Wouters und M.-C. Maquoi (KIK/IRPA Brüssel).

[17] MORELLI 2005; GENGLER 2005.

[18] BENDER JØRGENSEN 2005.

[19] GROLLEGGER 1997, 2002.

[20] v. KURZYNSKI in RAMSL 2002, 369.

[21] MÜLLAUER 2006; MÜLLAUER und RAMSL 2007.

[22] PETRASCHEK-HEIM 1977, 2009; sowie in GRÜNEWALD 1982, 28-29.

2.2 DATENERHEBUNG IM PROJEKT DRESSID

Im Rahmen des Projektes DressID konnten von österreichischem Staatsgebiet textile Fundmaterialien von der Bronzezeit bis ins beginnende Frühmittelalter analysiert werden (Zeitrahmen ca. 2000 v. Chr. bis 500 n. Chr.), der Fokus lag dabei auf den römerzeitlichen Funden. Die in vorrömische Periode erweiterte Zeitspanne entspricht der Forderung des Projektes, das römische Textilschaffen in den Donauprovinzen aus seinen Wurzeln verstehen zu lernen.

Die Basis der Arbeiten bildeten zunächst umfassende Literaturrecherchen und der Aufbau von Datenbanken zu vorrömischen und römischen Funden. Während bei der Eisenzeit teils auf publiziertes Material der oben genannten Forscher zurückgegriffen werden kann (siehe auch Katalog), war gerade in Bezug auf Textilien aus römischer Zeit eine Forschungslücke zu beobachten. Lediglich wenige Gewebe aus dem Gräberfeld vom Frauenberg bei Leibnitz (14 Gewebe) waren durch Eva Grollegger, sowie einige Textilien aus Carnuntum (3 Gewebe) durch Frau Irmgard Petraschek-Heim bereits vorgestellt worden. Ein römischer Schuppenpanzer aus Baumgarten an der March wird derzeit an der Staatlichen Akademie der Bildenden Künste Stuttgart durch Janet Schramm restauratorisch und analytisch behandelt.

An einigen Funden konnten durch Mark von Strydonck[23] (KIK/IRPA in Brüssel, Belgien) ^{14}C-Datierungen gemacht werden, die für nachfolgende Analysen dankenswerterweise zur Verfügung gestellt wurden.

Bei der Recherche nach archäologischem Textilmaterial konnte mit verschiedenen Museen und Institutionen zusammengearbeitet werden[24]: Einen Schwerpunkt bilden die Ausgrabungen des Bundesdenkmalamtes, vor allem in Niederösterreich, wobei sowohl Altbestände in den Archiven als auch Funde direkt „frisch“ von der Ausgrabung analysiert wurden. Als Kooperationspartner sind hier der Verein Archäologie Service und der Verein ASINOE (Archäologisch-Soziale Initiative Niederösterreichs) hervorzuheben. Weiters wurden aus den Sammlungsbeständen des Archäologischen Parks Carnuntum/Museum Carnuntinum, des Archäologischen Parks Magdalensberg, des Institutes für Ur- und Frühgeschichte Wien, des Museums Mannersdorf, des Museums Nussdorf, des Naturhistorischen Museums Wien, des Niederösterreichischen Landesmuseums, des Oberösterreichischen Landesmuseums, des Salzburg Museums, des Stadtmuseums Wels und des Wien Museums Fundmaterialien in Augenschein genommen.

Bei den neueren Grabungen des Bundesdenkmalamtes und anderer ausgrabenden Institutionen wurde in den letzten zehn Jahren vermehrt Augenmerk auf organische Funde gelegt – sowohl während der Ausgrabung und Bergung, wie auch bei der Konservierung. In vielen Fällen wurden die Fundstücke der Bearbeiterin noch vor der Restaurierung zur textilanalytischen Arbeit zur Verfügung gestellt.

[23] V. STRYDONCK und VANDEN BERGHE 2009, 91-92.
[24] Namentliche Nennung der Kooperationspartner in den Danksagungen.

2.2.1 Kontexte und Erhaltungsbedingungen

Die aus der Literatur stammenden und im Projekt untersuchten Textilien[25] liegen aus verschiedenen Kontexten vor und sind durch unterschiedliche Erhaltungsbedingungen[26] konserviert.

Besonders eindrucksvoll sind die zahlreichen prähistorischen Gewebe aus den Salzbergwerken Hallstatt (Bz-8, HaZ-15) und Dürrnberg (LtZ-30), die durch vorzügliche organische Erhaltung im Salz einen besonderen Einblick in die Webtechnik, die verwendeten Fasern und Farben bieten. Ebenso sind Textilien aus Feuchtbodenerhaltung wie in den Grundwasserbereichen der Aufbereitungsanlage am Kupferbergbau Mitterberg (Bz-10ff.), oder in der römischen Stadt auf dem Magdalensberg (Rö-2-4) noch organisch erhalten (Abb. 1/1). Bei diesen ist lediglich die Farbigkeit durch die Lagerung im Boden verfälscht. Sie sind zu Braunschattierungen abgedunkelt.

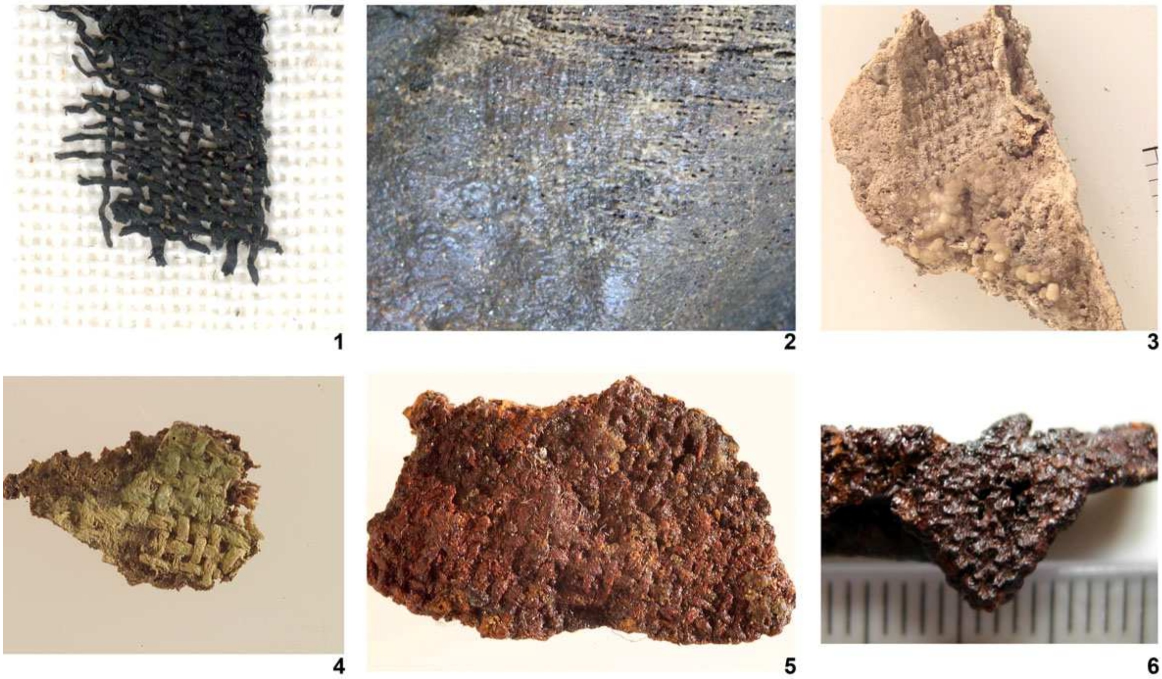

Abb. 1: Erhaltungsbeispiele von römischen Textilien in Österreich: 1 organisch erhalten, Siedlungsfund Magdalensberg (Rö-2); 2 konservierende Maßnahme in der Antike, Mumie Carnuntum (Rö-10); 3 Abdruck in Mörtel, Wels (Rö-154). Unten: Textilien mit Metallkorrosion aus Gräbern: 4 organisch erhalten, Göttweig (Rö-18); 5 korrodiert, Ersetzung der organischen Substanz, Mautern Melkerstraße (Rö-102); 6 Abdruck des Textiles in der Korrosionsschicht, Pottenbrunn (Rö-107). Verschiedene Maßstäbe (Fotos: A. Schumacher, NHM).

Weitere Quellen für die Datenerhebung zur Textilkunde sind Abdrücke von Geweben an Keramik und Mörtel. Diese sehr verstreuten Stücke kommen in Siedlungen, aber auch in Gräbern vor. Als römische Beispiele sind etwa die Abdrücke von Textilresten im Mörtel von einem Sarkophag aus Wels (Rö-154) oder ein Gewebeabdruck auf einem Gefäß aus Wien (Rö-184) zu nennen. Obwohl in diesen Fällen das Textil selbst nicht mehr vorhanden ist (Abb. 1/3), können dennoch wertvolle technische Daten zu den eingedrückten Stoffen erhoben werden. Bei Abdrücken auf Keramik und Mörtel muss

[25] Die nach den Fundorten stehenden Kürzel beziehen sich auf den Katalogteil.

[26] Zu den verschiedenen Erhaltungsbedingungen siehe auch FARKE 1986. Zuletzt zusammenfassend GRÖMER 2010, 30-41.

jedoch eine gewisse Schrumpfung (bis 5 %) in Betracht gezogen werden[27], zudem ist zu beachten, dass die Überreste das Negativ des einstigen Gewebes darstellen.

Ein seltener Fall sind antike konservierende Maßnahmen, dank derer Textilreste überdauerten. So wurde im 3. Jh. n. Chr. in Carnuntum (Rö-10ff.) ein Mädchen einbalsamiert, durch das Bestreichen der Leinenbinden mit einer harzähnlichen Substanz blieben diese gut erhalten (Abb. 1/ 2).

In Gräbern können Textilien auch durch den Kontakt mit Metallgegenständen überdauern. Textilien sind in Gräberfeldern unter diesen Gegebenheiten sogar relativ zahlreich. Bei der Konservierung von organischen Materialien durch die Korrosionsprodukte von Metallen[28] ist normalerweise die ursprüngliche Farbigkeit nicht mehr gegeben. Gelangen Textilien zusammen mit Metallobjekten in den Boden (etwa bei Trachtbestandteilen in Gräbern), so kann es an den Berührungspunkten der zumeist kupfer- oder eisenhaltigen Metalle und benachbarten textilen Resten über Metallkorrosion zur Entstehung einer dauerhaften Materialkombination kommen. Dabei ziehen lösliche Metallsalze unter Feuchteinwirkung auf den textilen Werkstoff und durchdringen ihn. Während der Lagerung im Boden kommt es dann zu einer chemischen Verbindung der Materialien, wobei die textile Komponente abgebaut wird. Dieser als Mineralisierung bezeichnete Vorgang kann zu einer vollständigen Ersetzung des organischen Materiales führen[29]. Es gibt viele graduelle Abstufungen zum Zustand der Textilien bei Metallkorrosion. So ist etwa im Fall des Gewebes vom Münzhort aus Deutschkreutz (Rö-1) oder im Kindergrab von Göttweig (Rö-18, Abb. 1/4) noch organische Substanz erhalten. Hingegen findet sich im spätantiken Grab von Mautern-Melkerstrasse, Grab 23 (Rö-102, Abb. 1/5) bereits eine vollständige Mineralisierung bis zum Abbau des Textiles, sodass nur noch die „Hülle“ oder Abdrücke des Gewebes vorhanden sind (etwa bei Pottenbrunn, Rö-107, Abb. 1/6).

Für weitergehende Interpretationen ist es wichtig zu betonen, dass bei den Stücken auf Metallelementen nur kleine Ausschnitte der damaligen Zusammenhänge, etwa des mit einer Fibel verschlossenen Gewandes erhalten blieben. Die Kanten des Textilfragmentes entsprechen dann der Einflussregion der im Erdreich entstandenen Metallverbindung[30].

2.2.2 Die Textildatenbanken und der daraus resultierende Katalog

In die Textildatenbanken wurden von den neu erfassten und von den bereits publizierten Gewebefunden (sortiert nach Zeiten) folgende Daten aufgenommen:

- *Fundort*: Generell werden die Funde nach Bundesländern geordnet, dann nach der Katastralgemeinde (KG) und Gemeinde (Orts- OG, Markt- MG, Stadtgemeinde SG), sowie größerer Verwaltungseinheit (Verwaltungsbezirk VB). Dies folgt den Gepflogenheiten des Bundesdenkmalamtes und seines fundberichtenden Organes, den „Fundberichten aus Österreich“. Sollten die in der Literatur eingeführten Namen von der Bezeichnung der Katastralgemeinde abweichen, so werden sie auch so bezeichnet. Z.B: der bekannte hallstattzeitliche Fundplatz Kleinklein, KG Burgstall, MG Großklein, VB Leibnitz, wird unter „Kleinklein“ eingeordnet.
- *Aufbewahrung*: Standort des Textiles zum Zeitpunkt der Fundanalyse.

[27] Vgl. dazu etwa WILD 1970, 94.
[28] Methodisches im Umgang mit mineralisierten Strukturen siehe zuletzt NOWAK-BÖCK 2010, 174 ff.
[29] Nach MITSCHKE 2001, 29.
[30] Vgl. MITSCHKE 2001, 30.

- *Befundkategorie und Konservierungsart*: Unter diesem Punkt wird darauf eingegangen, ob es sich etwa um einen Grabfund oder eine Siedlung handelt, sowie auch um die Art der Konservierung (Metallkorrosion, Feuchtbodenerhaltung, Abdrücke etc.).
- *Fundjahr*: Zeitpunkt der Ausgrabung/Auffindung.
- *Befund*: Kontext, in dem die Textilien aufgefunden wurden, etwa genaue Angaben zum Grabfund, wenn Textilien an einem Trachtbestandteil ankorrodiert sind etc.
- *Allgemeine Angaben zum Textil*: Dies umfasst eine Kurzansprache des Gewebes mit Farbe, Material, teils Größe, Form und Anzahl der zum Gewebekomplex gehörenden Teile, sowie das Bezugssystem (etwa bei an Metallobjekten ankorrodierten Textilien) und Lage am Objekt.
- *Technische Angaben zum Fadenmaterial*: Fadenkonstruktion (Garn oder Zwirn), Fadenstärke, Drehrichtung und Drehwinkel von beiden Fadensystemen. Die Bezeichnung Kette und Schuss wird nur verwendet wenn identifizierbar, sonst Angabe Fadensystem 1 und 2.
- *Gewebetechnische Angaben zur Webtechnik*: Bindungsart, Besonderheiten in der Bindung, Gewebedichte, Webkanten.
- *Musterung*: Musterbeschreibungen, teils fadengenaue Auszählungen, Farbe etc.
- *Anmerkungen*: Detailbeobachtungen zu Webfehlern, Verschleiß, Walkung, an- oder zusammengenähte Teile, Nähte/Säume, etc.
- *Datierung*: Die Datierung des Fundes wird der jeweiligen Literatur entnommen, in wenigen Fällen erfolgten ^{14}C-Analysen.
- *Textilanalyse, Faseranalyse*: Es wird angeführt, wer welche Analyse durchgeführt hat.
- *Literatur*: Zitiert wird vorrangig die Primärliteratur zur katalogmäßigen Vorlage der Textilfunde und maßgebliche Literatur zum Fundort.

Im Katalog sind die Angaben zum Fundort und zum Befund (meist Grab) teils stark verkürzt wiedergegeben. Sie dienen lediglich der groben Orientierung und Kontextuierung der Textilfunde. Ausführliche Beschreibungen der Befunde siehe in der angegebenen Literatur. Der Tafelteil fokussiert ebenso auf die Textilfunde und ihren Details. Es sind keine kompletten Grabinventare abgebildet; die klein dargestellten Befundübersichten dienen nur der Lokalisierung der Objekte mit Geweberesten.

2.3 Methodik Textilanalyse

Der Zustand archäologischer Textilien ist meist sehr fragmentarisch, sodass eine sehr sorgfältige Vorgehensweise für ihre Konservierung, Restaurierung und museale Lagerung nötig ist[31]. Bei der Datenaufnahme ist ein systematisiertes Erfassungskonzept wichtig, zudem sind bei der Analyse der Fundobjekte[32] vor allem zerstörungsfreie Methoden vorzuziehen. Zur Bedeutung von Blockbergungen für die Kontextanalysen siehe Kap. D1.1.

Im Folgenden sollen nun anhand von Beispielen die Möglichkeiten und auch Grenzen der Textilanalyse (hier: gewobene Stoffe) vorgestellt werden, die sich durch die einzelnen in der Textilarchäologie gängigen Methoden ergeben. Wichtige

[31] Ein Leitfaden zur Bergung, Konservierung, Dokumentation und Lagerung archäologischer Textilien wurde kürzlich von Jones et al. 2007, 245-253 publiziert. Siehe auch Farke 1986.

[32] Konzepte für eine systematische Beschreibung archäologischer Textilien: Walton und Eastwood 1988; Mitschke 2001, 32-46 (besonders für Textilien an korrodiertem Metall).

Analyseschritte (Abb. 2) bei der Untersuchung eines archäologischen Textiles sind Faser- und Farbstoffanalysen, Bestimmung der Fadenkonstruktion, der Gewebetechnik und nähtechnischen Details. In Kap. D1.1 wird auf die Herausarbeitung des Verwendungszweckes bzw. der Funktion der Textilien mit Hilfe von Analyse, der Mikrostratigrafie, des archäologischen Kontextes und Analogieschlüssen eingegangen. Ergänzt werden die Erfassungen durch fotografische Dokumentation[33], Schemazeichnungen zur Mikrostratigrafie und Umzeichnungen relevanter Einzelheiten wie Nahttypen, Verzierungen, webtechnischen Besonderheiten oder Gewebekanten.

Für die Textilarchäologie wurden in den letzten Jahren viele weitere Methoden wie besondere visuelle Untersuchungen[34] oder naturwissenschaftliche Methoden aus anderen Gebieten adaptiert, so Isotopenanalysen[35] zur Bestimmung der Herkunft. Da diese jedoch bei der Untersuchung der römischen Textilien Österreichs nicht durchgeführt wurden, werden sie in diesem Rahmen nicht näher thematisiert.

2.3.1 Faseranalyse

Bei der Analyse moderner Fasern werden die verschiedensten Methoden angewandt, neben Mikroskopie auch chemische Tests (z. B. Anfärbereaktionen) oder auch Brennproben[36]. Obwohl für eisenzeitliche Fasern aus Hallstatt früher auch derartige Methoden gewählt wurden[37], kommen bei der modernen Textilarchäologie andere Verfahren zum Einsatz. Bei einem kompletten Analysegang sollte das Objekt zunächst mit Auflicht- und Durchlichtmikroskop untersucht werden, bevor man das Rasterelektronenmikroskop einsetzt.

Bei Geweben, die noch in organischer Substanz vorliegen, etwa jenen aus Hallstatt, ist eine Analyse des Fasermaterials auch nur mit dem Auflicht- und Durchlichtmikroskop möglich (Abb. 2b). Dazu müssen Proben genommen werden. Vor allem bei vollständig mineralisierten Textilien kann eine erfolgreiche Faserbestimmung nur noch mit dem Rasterelektronenmikroskop[38] durchgeführt werden. Letzteres bietet bei der Arbeit im Niedrigvakuum zudem die Möglichkeit, zerstörungsfrei zu arbeiten. Auch zahlreiche österreichische Funde wurden durch Sylvia Mitschke[39] im Rahmen des Projektes DressID am Curt-Engelhorn-Zentrum Archäometrie der Reiss-Engelhorn-Museen in Mannheim analysiert. Von ihr wurde eine umfangreiche Vergleichssammlung verschiedener tierischer, pflanzlicher und mineralischer Fasern mit Bilddatenbank angelegt.

Bei den Fundaufnahmen zu vorrömischen Geweben wurden auch Untersuchungen am Rasterelektronenmikroskop in Zusammenarbeit mit Matthias Mehofer und Matthias Kucera von der VIAS - Vienna Institute for Archaeological Science durchgeführt. Bei der großen Probenkammer der modernen Rasterelektronenmikroskope (Durchmesser 0,40 m, maximale Höhe 0,20 m) können die archäologischen Funde meist zur Gänze eingebracht werden. Die Textilien werden im Niedrigvakuum nicht verändert, nicht bedampft oder ähnliches[40].

[33] Siehe BRUSELIUS SCHARFF 2007.
[34] Vgl. HAMMARLUND 2004.
[35] FREI 2010.
[36] Vgl. FREUND 1972; SCHWERTASSEK 1960, 611-670.
[37] Siehe etwa kriminologisches Gutachten durch A. Satlow und W. Specht in HUNDT 1959, 96-100.
[38] Siehe etwa kürzlich FISCHER 2010; MITSCHKE (im Druck).
[39] Allgemein: MITSCHKE und SCHWAB 2010, 56-63; MITSCHKE (in Vorbereitung).
[40] MEHOFER und KUCERA 2005.

Bei der Analyse an Fasern mit Probennahme richtet sich die benötigte Menge nach der erforderlichen Analysemethode. Für eine reine Bestimmung des Rohmaterials im Durchlichtmikroskop sind Mengen im Mikrogramm-Bereich nötig, es werden einzelne Fasern entnommen, die auf einem Objektträger (Glasplättchen) mit einem wasserhaltigen Einbettungsmedium (Glycerin:Wasser = 2:1) als Präparate aufbereitet werden können[41] (Abb. 2a). Vor allem für Farbstoffanalysen sowie für ^{14}C-Datierungen sind größere Probenmengen notwendig (ca. 20-30 mg). Zur Farbstoffanalyse an österreichischem Fundmaterial sei auf die Arbeiten vom Team um Regina Hofmann-de Keijzer verwiesen[42].

Abb. 2: Probennahmen für Auflicht- und Durchlichtmikroskopie, Institut für Archäometrie der Universität für angewandte Kunst Wien (Fotos: K. Grömer).

Eine Gefahr für eine korrekte Faseranalyse besteht durch Kontaminierung. So fanden sich beim bereits genannten Leinengewebe aus Pottenbrunn (Rö-108) auch eindeutige Baumwollfasern, was für ein Textil aus dem 4. Jh. n. Chr. in der römischen Provinz Norikum eher ungewöhnlich wäre. Bei eingehender Untersuchung stellte sich heraus, dass die Baumwollfasern eine Kontaminierung darstellen, verursacht durch die Wattestäbchen, die der Restaurator zum Auftragen des Festigungsmittels Paraloid verwendet hatte[43].

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[41] Zum Procedere siehe WÜLFERT 1999, Mikroskopie an Textilfasern 273 ff.
[42] HOFMANN-DE KEIJZER et al. 2005. – HOFMANN-DE KEIJZER 2010.
[43] Freundliche Mitteilung M. Yasar, Werkstätten des Bundesdenkmalamtes.

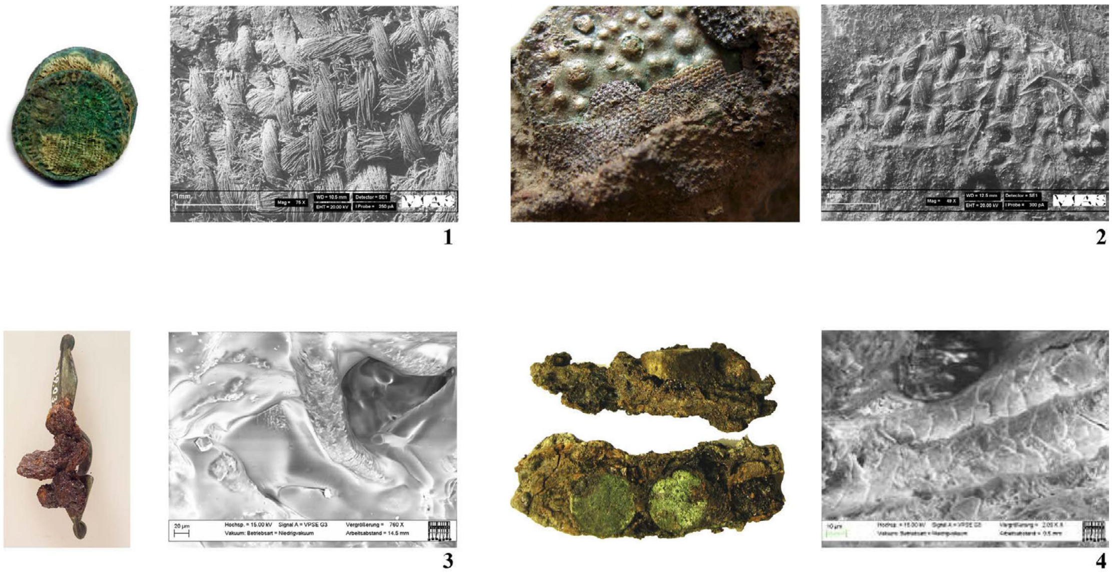

Abb. 3: Einfluss der Konservierung auf die Sichtbarkeit gewebetechnischer Strukturen und bei der Fasernalyse: 1 Deutschkreuz (Rö-1); 2 Pottenbrunn (Rö-108); 3 Mitterhof, Grab 3 (Rö-106); 4 Mautern-BGG, Grab 20 (Rö-29) (Fotos: K. Grömer, REM-Aufnahmen VIAS und S. Mitschke, CEZ-REM).

Die Mikroskopie ist eine Oberflächenuntersuchung, daher können Verschmutzung oder eine restauratorische Überfestigung eine Bestimmung erschweren, wenn nicht gar unmöglich machen. Als Beispiel dient hier der völlig unbehandelte Leinenstoff auf einer römischen Münze aus Deutschkreuz (Abb. 3/1) sowie in Gegenüberstellung ein ebenfalls römischer Fund aus Pottenbrunn (Abb. 3/2). Die Gewebe (ein feines Leinengewebe und ein gröberer Wollstoff) an einer Gürtelschnalle aus dem reichen Männergrab V. 192 aus Pottenbrunn wurden bereits mit Paraloid behandelt, wodurch Details teilweise nicht mehr zu erkennen sind.

Besonders stark sind restauratorische Überprägungen bei Altfunden: Das an einer Fibel ankorrodierte Gewebe aus einem Mädchengrab des 5. Jh. im norddanubischen Mitterhof (Abb. 3/3) wurde in den 1970er Jahren gefunden und zu seiner Konservierung dick mit Festigungsmitteln bestrichen. Hier kann nicht mehr mit Sicherheit entschieden werden, ob die Erhebungen auf den Fasern von der Schuppenstruktur von Wollfasern oder von mit Festigungsmitteln überlagerten Auflagerungen herstammen. Als Verdeutlichung für das Aussehen antiker Wollfasern soll hier eine Rasterelektronenmikroskop-Aufnahme des zeitgleichen Gewebes von einem Grab aus Mautern-Burggartengasse dienen (Abb. 3/4).

Die nähere Spezifikation von Bastfasern - ob Flachs oder Hanf - ist bei organisch erhaltenen Geweben mit diversen Methoden mit Probennahme beantwortbar. Einerseits können die Querschnitte der Fasern typische Merkmale zur Unterscheidung von Flachs und Hanf zeigen, andererseits sind diese beim Durchlichtmikroskop mittels Herzog-Test[44] unterscheidbar, was etwa am Material von Hallstatt durchgeführt wurde[45].

Die Analyse von tierischer Faser, im Mikroskop erkennbar an der typischen Schuppenstruktur, bietet neben der Bestimmung der Tierart (Schafwolle, Ziege, Roßhaar etc.) weiters faszinierende Untersuchungsmöglichkeiten mittels Wollfeinheitsmessungen[46], die an Schafwolle durchgeführt werden. Bei dieser Methode werden die Querschnitte von 100 Fasern gemessen. Die Faserdiagramme lassen sich in

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[44] Nach WÜLFERT 1999, Polarisationsmikroskopie 283-293, zum Herzog-Test bes. 290-293.
[45] Vgl. GRÖMER 2007, S. Abb. 9.
[46] Vgl. Zur Methode mit kritischen Stellungnahmen RAST-EICHER 2008.

Bezug auf die Aufbereitung der Wolle und der Entwicklung des Haarkleides primitiver Schafrassen deuten. In Österreich wurden derartige Analysen erstmals an Fellen und Textilien aus Hallstatt von Michael Ryder[47] in den 1980er Jahren durchgeführt. Neuere Untersuchungen an prähistorischen Geweben aus Hallstatt, Mitterberg und Dürrnberg mit kritischer Hinterfragung der Interpretationen Ryders unternahm ab 2010 Antoinette Rast-Eicher im Rahmen des Projektes CinBA.

2.3.2 Allgemeines zu textiltechnologischen Daten

Zur Definition textiltechnologisch relevanter Daten können die verschiedensten Werke herangezogen werden[48]. In der textilarchäologischen Forschung in Nordeuropa werden großteils die Definitionen von Irene EMERY oder jene von Penelope WALTON und Gillian EASTWOOD verwendet, seltener das eigentlich für die Völkerkunde erarbeitete umfassende Standardwerk „Systematik der Textilen Techniken“ von Annemarie SEILER-BALDINGER, die eine Gliederung des Textilmateriales nach den Herstellungsverfahren und den dazu notwendigen Hilfsmitteln vorschlägt. In einer neueren Arbeit beschäftigt sich auch Sophie DESROSIERS 2010 mit textiler Terminologie und Klassifikation. Weiters sind in der deutschsprachigen Textilarchäologie die Arbeiten von Johanna BANCK-BURGESS, Heidemarie FARKE, Hans-Jürgen HUNDT, Antoinette RAST-EICHER, Kurt SCHLABOW und Klaus TIDOW relevant.

Abb. 4: Arbeit mit dem Dino-Lite Digital Microscope an Schuppenpanzerteilen von Baumgarten (Rö-6). Messungen mit der Software DinoCapture 2.0 (Foto: K. Grömer).

Während für Faser- und Farbstoffanalysen oft Probennahmen unumgänglich sind, erfolgte die gewebetechnische Untersuchung meist makroskopisch, mit freiem Auge sowie im Stereoauflichtmikroskop[49] bei 5- bis 100-facher Vergrößerung. Verwendet wurden auch diverse Hilfsmittel wie Lineal, Präpariernadeln, Schablonen für die Messung von Fadenstärke und Drehwinkel. Ab 2011 wurde ein direkt mit dem PC verbundenes Digitalmikroskop (Abb. 4)[50] eingesetzt, wobei mit Vergrößerungen zwischen 30- und 250-fach gearbeitet werden kann. Die zugehörige Software ermöglicht es, Fadenstärken und Drehwinkel (Stärke der Fadendrehung) zu ermitteln (Abb. 4 rechts).

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[47] RYDER 1990 und 2001.
[48] Siehe unter den einzelnen genannten Autoren im Literaturverzeichnis.
[49] Kombistereolichtmikroskop Wild Heerbrugg, Type MDG 17.
[50] Dino-Lite Digital Microscope AM-7013 MZT. Software DinoCapture 2.0, Version 0.9.0b.

Technische Daten (Abb. 5), die von einem Gewebe aufgenommen werden, sind Bindung, Fadendichte, Fadenstärke, Zwirn oder Garn, S- oder Z-Drehung, diverse Nähte und Säume sowie gegebenenfalls Verzierungen.

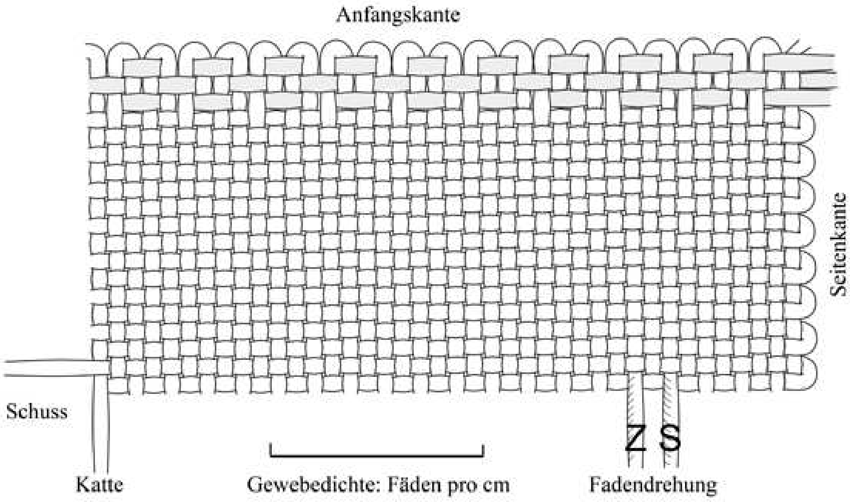

Abb. 5: Gewebetechnische Merkmale (Grafik: K. Grömer nach BANCK-BURGESS 1999 und WALTON-EASTWOOD 1988).

2.3.3 Fadenkonstruktion

Die Fäden, aus denen ein Gewebe besteht, können mit diversen technischen Daten erfasst werden, das Rohmaterial (siehe Faseranalyse) ist genauso relevant wie die Fadenstärke und ob es sich um gesponnene Einzelfäden (**Garne**) handelt, oder um aus zwei oder mehreren miteinander verdrehten Fäden (**Zwirne**). Dabei werden die Fäden üblicherweise entgegen ihrer Spinnrichtung miteinander verzwirnt.

Die **Drehrichtung** der Garne ist ein herstellungstechnisches Detail, das entsteht, indem der Faden beim Spinnen nach rechts oder links gedreht wurde. Es wird eine S- und Z-Drehrichtung unterschieden, je nachdem, ob im senkrecht gehaltenen Faden die Fasern parallel zum schräglaufenden Teil des einen oder anderen Buchstabens verlaufen. In der technischen Beschreibung wird bei archäologischem Material für die Garne meist ein Kleinbuchstabe benützt, z. B: s-Garn oder z-Garn[51]; für die Angabe der Drehrichtung bei Zwirnen[52] Großbuchstaben, so S-Zwirn oder Z-Zwirn. Dies kann durch die Angabe der Drehrichtung des Einzelgarnes ergänzt werden[53]. Die Schreibweise wäre dann Sz für ein S-gezwirnten Zwirn aus z-gesponnenen Garnen und Zs für Z-gezwirnten Zwirn aus s-gesponnenen Garnen.

Fadenstärken werden jeweils auf Zehntelmillimeter genau gemessen, wobei bei prähistorischen bis frühmittelalterlichen Garnen aufgrund der handgesponnenen Fäden eine gewisse Schwankungsbreite gegeben ist. Diese wird bei den Messungen mit angegeben. Bei den verschiedenen Statistiken wurden die Stücke jeweils dort eingereiht, wo ihr Schwerpunkt liegt.

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[51] So etwa bei BENDER JØRGENSEN 1992. – Definition bei BANCK-BURGESS 1999, 134.
[52] Definition etwa bei BANCK-BURGESS 1999, 134.
[53] Etwa bei BENDER JØRGENSEN 1992 Schreibweise Zs. EASTWOOD und WALTON 1988 Schreibweise Z2s. Bei KURZYNSKI 1998b die Schreibweise Z>s/s

Definition	Fadenstärke	m Garn / 1 g Vlies
sehr fein	0,2 - 0,3 mm	26 m / 1 g
fein	0,4 mm	13 m / 1 g
mittelfein	0,5 mm	10 m / 1 g
mittelfein	0,7 mm	7,5 m / 1 g
grob	0,8 - 1 mm	4,5 m / 1 g
sehr grob	> 1,2 mm	2 - 3 m / 1 g

Tab. 2: Fadenstärken: Vergleich der Definition der Güteklassen von prähistorischen Geweben in Österreich (nach GRÖMER 2007, S. 47).

2.3.4 Webtechnik: Bindung und webtechnische Details

Bindungsarten

Die Bindung eines Gewebes beschreibt die Art der Überkreuzung der Kett- und Schussfäden. Die Kettfäden werden auf den Webstuhl[54] aufgebracht, die Schussfäden werden als Eintrag beim Weben in das Webfach eingebracht. Die Bestimmung von Kette und Schuss ist nur dann sicher gegeben, wenn sich an dem Textil noch die entsprechenden Webkanten finden, ansonsten wird die neutrale Bezeichnung Fadensystem 1 bzw. Fadensystem 2 verwendet.

Die einfachste Bindung ist **Leinwandbindung**, bei der einander Kette und Schuss abwechselnd überkreuzen (Abb. 6).

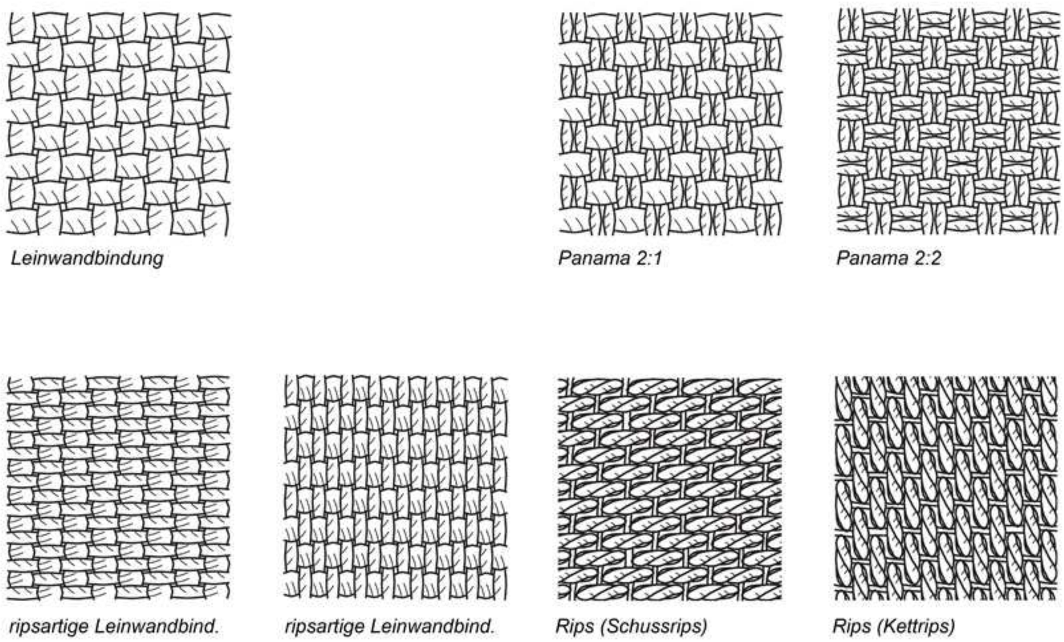

Abb. 6: Leinwandbindung und Abwandlungen (Grafik: K. Grömer).

[54] Zusammenfassend zum Webvorgang: GRÖMER 2010, 97-142.

Ist bei Leinwandbindung in einem Fadensystem eine wesentlich dichtere Fadenstellung vorhanden, so spricht man von ripsartiger Leinwandbindung. Eine wichtige Sonderform der Leinwandbindung ist **Rips** (oder Reps)[55], wobei jeweils ein Fadensystem (entweder Kette oder Schuss) mehrfach oder ungleich geführt werden kann. Charakteristisch ist dabei, dass im Stoff nur das eine Fadensystem sichtbar ist, dies erreicht man durch hohe Kett- oder Schussdichte (je nachdem spricht man von Schuss-[Eintragsrips] oder Kettrips). Quer zur Richtung der sichtbaren Fäden weisen Ripsstoffe feine Rippen auf[56]. Ripsartiges Aussehen kann auch durch das Eintragen von dicken Schussfäden in eine feinfädige Kette erreicht werden.

Eine Abwandlung der Leinwandbindung sind Würfelbindungen. Diese entstehen, wenn die Kett- und Schussfäden statt einfach jeweils doppelt oder mehrfach – aber unverzwirnt – geführt werden, wenn einander also in den Bindungspunkten immer Fadengruppen statt Einzelfäden kreuzen. Weisen diese Gruppen in Kette und Schuss gleich viele Fäden (etwa zwei) auf, spricht man von **Panamabindung 2:2**. Unter **Panama 2:1**[57] versteht man jene Abart der Leinwandbindung, bei der in Kette oder Schuss zwei Fäden geführt werden, im anderen Fadensystem nur ein Faden.

Die **Köperbindung**[58] (Abb. 7) wird dadurch charakterisiert, dass Kett- und Schussfäden über längere Strecken flottieren. Bei der minimalsten Ausführung wird ein Schussfaden je unter zwei und über einem Kettfaden geführt (**Köper 2:1**).

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[55] Dieser Begriff wird nicht von allen Forschern verwendet (z. B. nicht bei MITSCHKE 2001, 20 f.), erscheint aber in diesem Rahmen bei römischen Textilien als wesentliches Merkmal, da dieser Gewebetyp sowohl in visuellen Merkmalen wie Oberflächenstruktur, als auch in seinen haptischen Eigenschaften von herkömmlicher Leinwandbindung abweicht. Verwendung bei WALTON und EASTWOOD 1988, iii und iv als warp-faced und weft-faced tabby. Auch bei BANCK-BURGESS 1999, 248.

[56] Vgl. SEILER-BALDINGER 1991, 97 f., Abb. 155.

[57] BANCK-BURGESS 1999, 30 f., Abb. 5/3 verwendet den Begriff „Doppelfäden in einem System“, bei HUNDT 1987, Hallstatt Textil Nr. 98 „Halbpanama“. Im englischsprachigen Raum wird jedoch durchaus der Begriff „half-basket-weave“ verwendet, z. B. WILD 1970 und BENDER JØRGENSEN 1992, 13.

[58] Vgl. zu den Köperbindungen und ihren Abwandlungen HUNDT 1981, 10 ff., Webschemata Abb. 5-21; SCHLABOW 1974, 180 ff ; SEILER-BALDINGER 1991, 98 f.

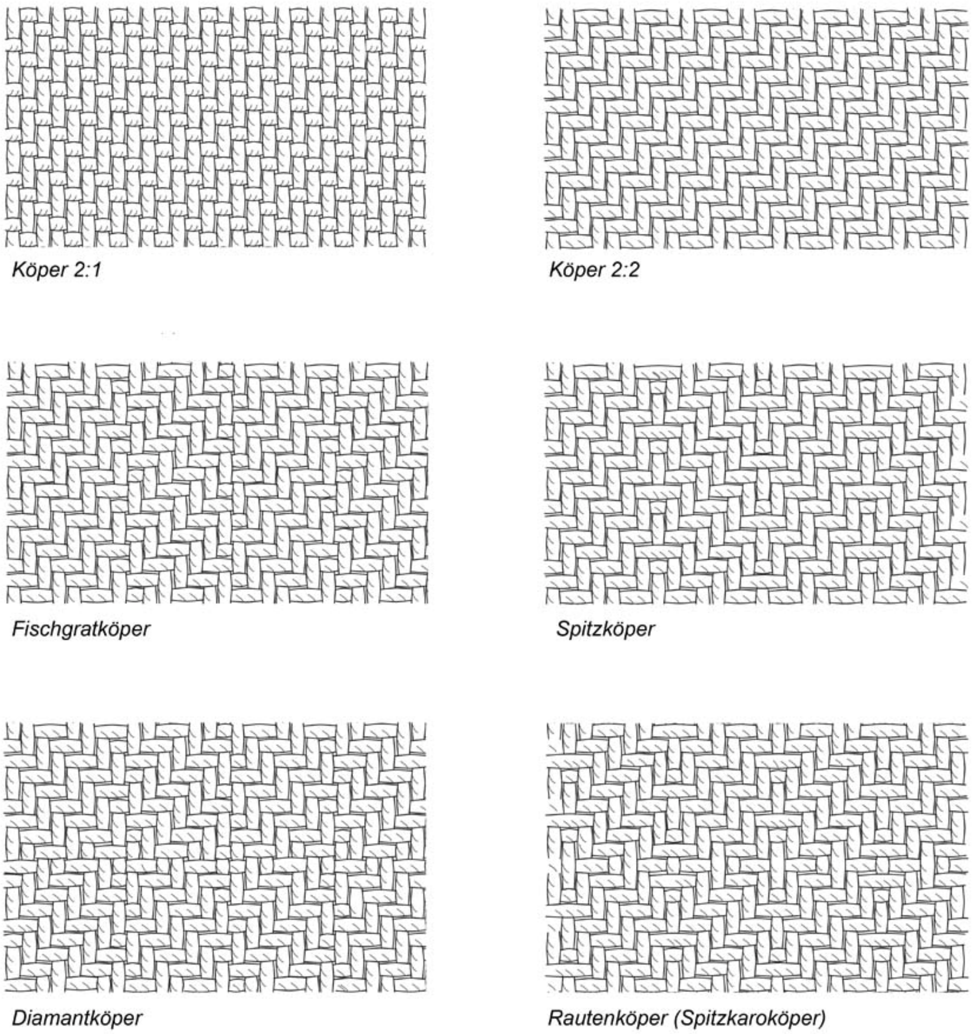

Abb. 7: Köperbindung und Varianten (Grafik: K. Grömer).

Beim **Gleichgratköper 2:2** verläuft der Schuss jeweils regelmäßig über/unter zwei Kettfäden, wobei aber von einem Schuss zum nächsten die Bindungsstellen seitlich verschoben werden. Diese Verlagerungen haben im Stoff eine schräglaufende Streifung (Köpergrate) zur Folge. Gleichgratköper erzeugen auf beiden Warenseiten gleich lange Flottierungen und sind somit gleichseitig.

Bei einem **Spitzköper** oder Zick-Zack-Köper, einer Abwandlung des Gleichgratköpers, kehren sich die Gratlinien in einem spitzen Winkel um, also laufen diagonal ansteigende und absteigende Grate an der Umkehrstelle spitz zusammen. Dies kann entweder in Kettrichtung oder im Schuss erfolgen, man unterscheidet dann einen waagrechten und einen senkrechten Spitzköper.

Der Musterrapport des **Fischgratköpers** wird durch den Ketteinzug festgelegt, wobei ein Wechsel der Gratrichtung vorgenommen wird. Beim Gratwechsel werden die Bindungspunkte, die Stelle, an der ein Kettfaden mit einem Schussfaden eine Verkreuzung bildet, um einen oder mehrere Schussfäden verschoben, sodass die Grate nicht spitz zusammenlaufen. Durch den gebrochenen Einzug der Kette entsteht die charakteristische Versetzung der Grate gegeneinander (Bezeichnung auch gebrochener 2:2 Spitzköper).

Rautenköper entstehen, indem man einen Spitz- oder Fischgratköper nach einer bestimmten Anzahl Schussfäden zurückwebt. Diamantköper sind durch eine Spiegelung von Fischgratköper gebildet, Spitzkaroköper entsteht durch das Zurückweben von Spitzköper.

Gewebedichte

Die Fadendichte oder Gewebedichte wird in beiden Fadensystemen durch die Anzahl der Fäden pro cm angegeben, wodurch feine von groben Geweben unterschieden werden können. Bei der Ausmessung moderner Webwaren wird üblicherweise auf 2-10 cm Strecke die Fadenzahl gemessen, dies ist jedoch vor allem an kleinstückigem korrodiertem Material nicht möglich. Es handelt sich daher bei den Gewebedichte-Angaben (wie auch bei den Fadenstärken) stets nur um Annäherungswerte, wobei gerade bei handgefertigten Textilien Gewebedichte wie Fadenstärke einer gewissen Schwankungsbreite unterliegen. Zudem ist zu beachten, dass nur der derzeitige Zustand bestimmbar ist[59]. Manche Gewebe sind durch den Gebrauch und Verschleiß bereits stark ausgedünnt und locker. Waren jedoch noch Stellen erkennbar, die wahrscheinlich das ursprüngliche Bild wiedergaben, wurden für die Messungen am ehesten diese den ausgedünnten Stellen vorgezogen. Die Gewebequalität, d. h. die Feinheit wird von der Fachkollegenschaft bei prähistorischem Material meist anders bewertet als bei römischen bzw. frühmittelalterlichen Fundkomplexen[60] (Tab. 3). Dies ist dadurch zu verstehen, weil prähistorische Gewebe in ihrer Gesamtheit gröber sind als jene aus jüngeren Perioden.

Definition prähistorische Gewebe nach Schlabow 1974 und Grömer 2007	**Fäden pro cm**	**Definition frühmittelalterliche Gewebe** nach Mitschke 2001
grobes Gewebe	< 5	grobes Gewebe
mittel-normales Gewebe	6 - 10	grobes Gewebe
feines Gewebe	11 - 15	mittelfeines Gewebe
sehr feines Gewebe	16 - 20	mittelfeines Gewebe
sehr feines Gewebe	> 20	feines Gewebe

Tab. 3: Gewebedichte. Vergleich der Definition der Güteklassen von prähistorischen und frühmittelalterlichen Geweben (Grafik: K. Grömer).

[59] Siehe zu Veränderungen der Gewebe durch Bodenlagerung bei BANCK-BURGESS 1999, 93-94, auch Taf. 1-2.
[60] Vgl. die Definition der Güteklassen frühmittelalterlicher Gewebe bei MITSCHKE 2001, 44 und jene prähistorischer Textilien bei SCHLABOW 1974.

2.2. Zur Interpretation von Funden aus Körpergräbern am Beispiel römischer Textilien aus Österreich

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Zur Interpretation von Funden aus Körpergräbern am Beispiel römischer Textilien aus Österreich

Karina Grömer

Die Strukturen des EU-Projektes „DressID“[1] ermöglichten eine umfassende Aufnahme von archäologischen Textilresten aus dem Gebiet des heutigen Österreichs. Erste kleine zusammenfassende Vorberichte zu verschiedenen Aspekten konnten bereits publiziert werden (z.B. Grömer / Hölbling-Steigberger 2010; 2011). Eine Gesamtvorlage des textilen Fundbestandes wird in Kürze erscheinen (Grömer, im Druck).

1. Interpretationsebenen von Textilien in Gräbern

Im österreichisch/bayerischen Raum begann Hans-Jürgen Hundt ab den 1960er Jahren an Metallobjekte ankorrodierte Textilreste aus eisenzeitlichen und frühgeschichtlichen Grabfunden zu analysieren (Hundt 1974; 1984). Dabei beschränkten sich jedoch Aufnahme und Auswertung im Großen und Ganzen auf die gewebetechnische Charakterisierung, die meist als Appendix an die Analyse des Gräberfeldes beigefügt wurde. Eine Synergie oder besondere Deutung der Objekte erfolgte nur in herausragenden Fällen, wie etwa bei den Textilresten aus dem hallstattzeitlichen Fürstengrab vom Hohmichele (Hundt 1962).

Mittlerweile haben sich im deutschsprachigen Raum verschiedene Vorgehensweisen zur Erfassung und Analyse textiler Reste in Gräbern etabliert, wobei neben Einzelforschern wie Antoinette Rast-Eicher (2008; 2011) oder Sylvia Mitschke (2001) vor allem die süddeutschen Landesdenkmalämter in Bayern (Vgl. Nowak-Böck 2010 und dieser Band) und Baden-Württemberg (z.B. Banck-Burgess 2008; Peek, in diesem Band) mit ihrem Schwerpunkt zur Kleiderforschung maßgeblich beteiligt sind.

Dennoch soll hier das methodologische Konzept zur Interpretation der österreichischen Grabfunde kurz vorgestellt werden. Da Blockbergungen in Österreich bisher nicht durchgeführt wurden, geht dieses primär vom Einzelfund aus. Es wurde ein System von Interpretationsebenen (**Abb. 1**) angewandt, um dem in unterschiedlicher Dokumentationsqualität vorliegenden Material (Altfunde vs. Beobachtungen und Fotomaterial direkt bei der Ausgrabung) in adäquater methodischer Weise zu begegnen. Dieses wurde bewusst als Stufenpyramide (in Draufsicht) gestaltet, um so auch die Unsicherheitsfaktoren im System deutlich zu machen.

1.1. Ebene 1 – Der Fund

Zuoberst steht der Einzelfund mit Textilanhaftung; das Schmuckstück (z.B. Armreif), der Trachtbestandteil (z.B. Fibel, Gürtelschnalle) oder eine andere Grabbeigabe (Messer etc.). In seltenen Fällen sind aus den österreichischen Gräbern Textilreste ohne korrespondierendes Metallobjekt vorhanden. Der Fund ist im System die einzige objektive Ebene.

1.2. Ebene 2 – Technische und kontextuelle Analyse des Einzelfundes

Die folgenden Analysemethoden werden hier nicht hierarchisch aufgefasst, sondern als ineinander greifender Prozess der Beschreibung des Objektes (**Abb. 1, mittelgraue Ebene**).

Technische Beschreibung und Mikrostratigrafie: Das methodische Handwerkszeug zur gewebetechnischen Beschreibung wurde bereits vielfach vorgestellt (Emery 1966; Walton / Eastwood 1988). Ebenso gehört die von Inga Hägg (1989) definierte mikrostratigrafische Untersuchung längst zum gängigen Rüstzeug des Textilarchäologen, der mit mineralisierten Strukturen arbeitet. Dazu gibt es von den verschiedenen Instituten teilweise mit Farben und Strukturen kodifizierte Darstellungsweisen (vgl. Peek; Nowak-Böck, in diesem Band). Mit der Wollfeinheitsmessung hat sich zuletzt Antoinette Rast-Eicher (2008) kritisch auseinandergesetzt. Diskussionen zu Vorgehensweisen und Möglichkeiten bei Faser-, Farbstoff- und Isotopenanalyse erfolgen im vorliegenden Band (Mitschke; Vanden Berghe; Knipper; Frei; von Holstein).

Fundinterpretation („Trachtlage“ oder Beigabe): Bei jedem einzelnen Objekt, vor allem bei den kleidungsrelevanten Stücken wie Fibeln oder Gürtelbestandteilen ist anhand der Dokumentation eine Entscheidung zu treffen, ob es etwa als Trachtbestandteil aufgefasst werden kann oder als reine Beigabe. Als Trachtbestandteil werden jene Objekte gewertet, die aufgrund ihrer Positionierung am Körper, ihres Erscheinungsbildes, sowie der mikrostratigrafischen Position des Textils den Anschein machen, als ob sie an Kleidungsstücken angebracht waren, mit denen die bestattete Person „bekleidet“ war. Kritische Auseinandersetzungen zur Deutung von Gegenständen als Trachtlagen oder Beigaben siehe etwa bei Banck-Burgess (1999) oder Rast-Eicher (2008; 2011).

Räumlicher Kontext: Bei Beigaben und Trachtbestandteilen ist die exakte Positionierung, die Lage zum Körper der bestatteten Person aussagekräftig: die Kippung, die Lage des Textils in einer körpernahen oder körperfernen Position, an der Schauseite des Objektes oder an einer den Blicken verborgenen Position (z.B. im Inneren eines Armreifs). Diese Beobachtungen sind wiederum mit Blick auf die mikrostrati-

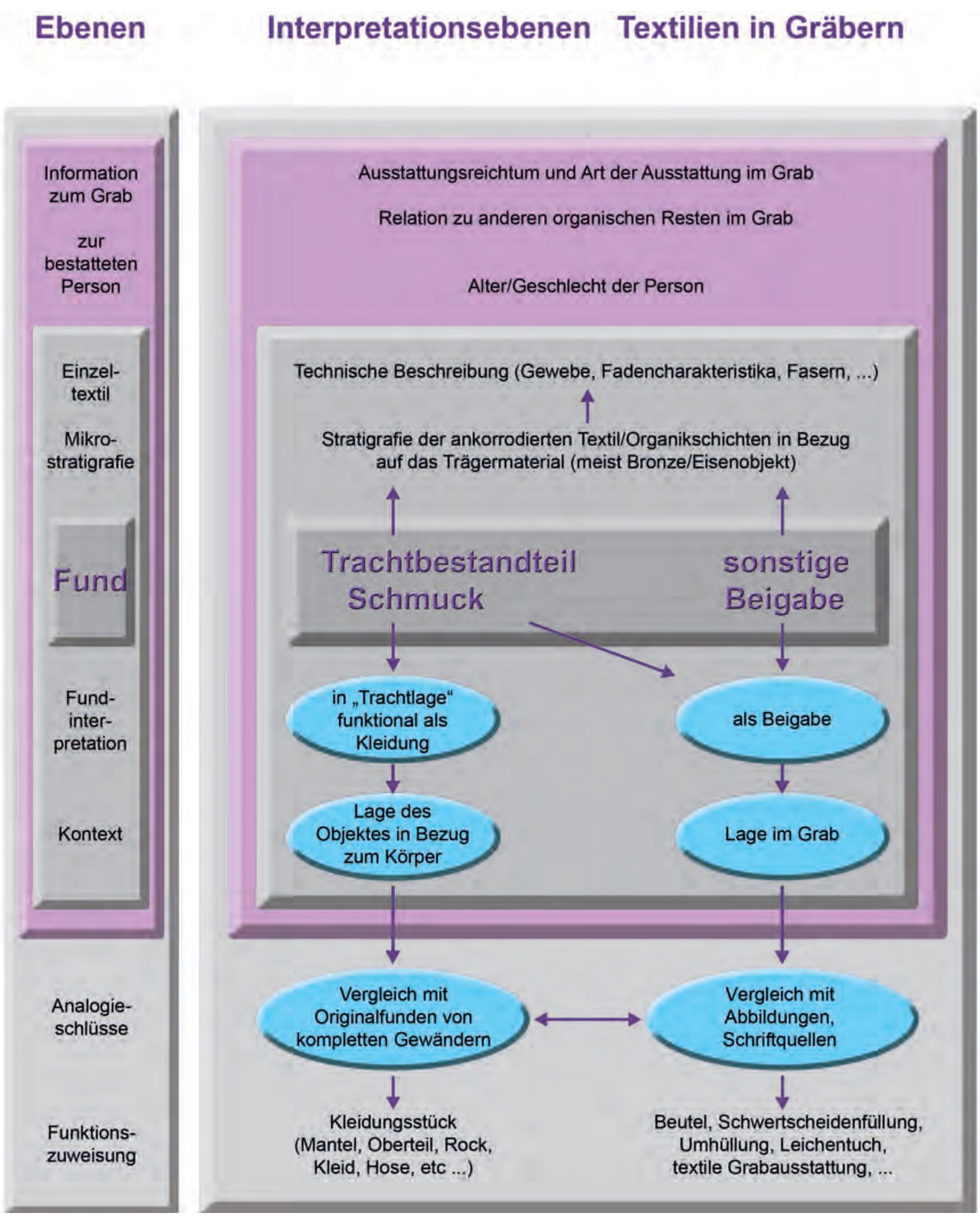

Abb. 1: Interpretationsebenen von Textilien in Gräbern (Grafik: K. und P. Grömer).

grafische Analyse zu bewerten. Blockbergungen (Rast-Eicher 2011; Peek, in diesem Band) würden die besten Voraussetzungen für diese Fragestellungen bieten.

1.3. Ebene 3 – Generelle Informationen zum Grab und zur bestatteten Person

Befasste sich Ebene 2 mit der technischen und kontextuellen Analyse des Einzelfundes, so muss diese für weitergehende Interpretationen in Informationen über das Grab und die bestattete Person eingebettet werden. Diese umfassen etwa den Reichtum des Grabes im Vergleich zu zeitgleichen Funden derselben Region. Das Geschlecht und Alter der bestatteten Person ist für die Interpretation der darin gefundenen Textilreste ebenso relevant wie der Sozialstatus der Person oder Hinweise auf Tätigkeiten, d.h. ob es sich etwa um das Grab eines Handwerkers, eines Kriegers/Soldaten handelt.

1.4. Ebene 4 – Analogieschlüsse und funktionale Interpretation

Als unterste Ebene in der Stufenpyramide sind Analogieschlüsse heranzuziehen und eine Funktionszuweisung zu treffen – wohl wissend, je weiter man sich vom Fund selbst entfernt, desto unsicherer/diskussionswürdiger werden die getroffenen Interpretationen. Es sind immer Entscheidungen (diese Wortwahl erfolgt bewusst!) zu treffen, wie die

Abb. 2: Tulln-Feuerwehrschule Grab 463: Textillagen auf dem Armreif (Grafik: K. Grömer).

Gegebenheiten bewertet werden. Das kann selbst unter Heranziehung des methodischen Konsenses bei verschiedenen Wissenschaftlern zu unterschiedlichen Ergebnissen führen. Als Analogieschlüsse gelten hier bildliche Darstellungen, Schriftquellen, Originalfunde von kompletten Gewändern etc. Methodische Herangehensweisen zur Arbeit mit Bild- und Schriftquellen bieten z.B. die Beiträge von Annette Schieck und Robert Fuchs, in diesem Band (vgl. dazu auch Grömer 2010, 301-306). Sind alle Parameter günstig, kann eventuell auf Kleidungsstücke (Mantel, Oberteil, Hose etc.) rückgeschlossen werden, oder auf das funktionale Element von Textilien bei Grabbeigaben als Beutel, Umhüllung, Messerscheidenfütterung etc. (vgl. etwa Banck-Burgess 1999; Bartel 2003). Die genaue Formgebung ist jedoch aus den kleinen Fragmenten nicht erschließbar.

2. Fallbeispiele aus spätantiken Körpergräbern in Österreich

Vorab sei betont, dass sich die Gewebefunde bei Skelettbestattungen im 4. und 5. Jh. in Österreich als nicht sehr komplex darstellen. Einige charakteristische Fallbeispiele von Trachtbestandteilen und ihrer Interpretation seien hier aus der Fülle des Materials herausgegriffen und verkürzt dargestellt:

2.1. Tulln-Feuerwehrschule Grab 463 (Abb. 2)[2]

Ebene 1 Fund: Textilreste auf einem Armreif (Fnr. 5862)

Ebene 2a Technische Analyse: Zwei verschiedene Textilien: *Fnr. 5862-1:* Feines leinwandbindiges Gewebe, Fadensystem 1: 0,2 mm z-Garn, 14 Fäden pro cm, Fadensystem 2: 0,2 mm z-Garn, 16 Fäden pro cm; *Fnr. 5862-2:* Etwas gröberes Gewebe in Panama 2:1, Fadensystem 1: paariges 0,3 mm zz-Garn, 10 x 2 Fäden pro cm, Fadensystem 2: 0,3 mm z-Garn, 9-10 Fäden pro cm.

Ebene 2b Mikrostratigrafie: Drei zusammenkorrodierte Armreife mit Hautresten des Trägers an der Innenseite, in den Zwischenräumen der Reife finden sich eventuell leinwandbindige Reste. An der Außenseite der Reifen direkt anliegend mehrlagig (bis zu 4-lagig) das leinwandbindige Textil Fn. 5862-1. Mikrostratigrafisch darüber als oberste Lage an mindestens zwei Stellen ein panamabindiger Rest (Fn. 5862-2).

Ebene 2c „Trachtlage" oder Beigabe: Armreifen direkt am Arm; Wertung als Trachtlage.

Ebene 2d Räumlicher Kontext: Armreifen am Unterarm, Textillagen an körperabgewandter Seite.

Ebene 3a Informationen zum Grab: Neufund, Grabauswertung von archäologischer Seite her noch nicht abgeschlossen.

Ebene 3b Alter und Geschlecht: Bisher keine anthropologische Bestimmung, nach archäologischen Funden (Armreife): weiblich.

Ebene 4a Analogieschlüsse: Größere Stofffülle im Unterarm/Handgelenksbereich bzw. weite Ärmel findet sich etwa auf dem Grabrelief in Trier (Pausch 2003, Abb. 167): Hinweise auf eine um den Arm geschlungene Palla bietet die Darstellung der Serena auf dem Diptychon des Stilicho aus dem 4. Jh. (Croom 2002, Abb. 39).

Ebene 4b Funktionale Interpretation: Es sind bei kritischer Durchsicht der Quellen verschiedene Erklärungen für die Gewebe denkbar: Einerseits könnte das mehrlagige Textil an der Armreifaußenseite ein Rest eines langen, nicht eng anliegenden und stoffreichen Ärmels sein, der gebauscht bzw. in Falten mehrlagig über den Armreifen zu liegen kam. Die körperfernste Schicht, das panamabindige Gewebe, gehörte eventuell einst zu einem Übergewand – nach schriftlicher Überlieferung und diversen Abbildungen wäre dies die *palla* (Cleland et al. 2007, 136f.). Andererseits spricht die Stofffülle beim Armreif auch dafür, dass dies ein um den nicht mit Ärmel bedeckten Arm geschlungenes Übergewand (*palla*) sein könnte. Der sehr kleine panamabindige Rest könnte dabei auch die Gewebekante der *palla* darstellen. Dieser Stoff könnte aber auch zu einem weiteren Kleidungsstück oder Leichentuch gehören.

2.2. Linz-Altstadt Grab 1 (Abb. 3)[3]

Ebene 1 Fund: Textil auf einer Gürtelschnalle

Ebene 2a Technische Analyse: Stark zersetzte Reste eines gebrochenen Spitzköpers 2:2 in Wolle; Fadensystem 1: 0,3-0,4 mm z-Garn; 14 Fäden pro cm, Fadensystem 2: 0,4-0,5 mm z-Garn; 16 Fäden pro cm.

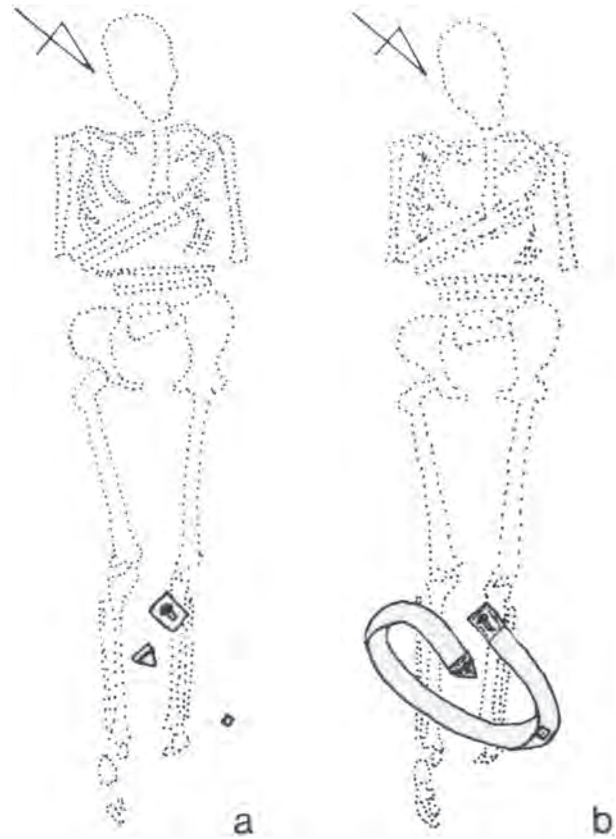

Abb. 3: Linz-Altstadt, Grab 1: Lage des Gürtels im Grab (nach Ruprechtsberger 1999, Abb. 14).

Ebene 2b Mikrostratigrafie: Altfund, keine Angabe (Textil wurde entfernt).

Ebene 2c „Trachtlage" oder Beigabe: Der Gürtel lag mit den Beschlägen zusammengerollt auf den Unterschenkeln; Wertung als Beigabe

Ebene 2d Räumlicher Kontext: Textilreste nach Angaben des Ausgräbers auf der körperfernen Oberseite des Schnallenbeschlages; der Gürtel lag mit der Schauseite nach oben.

Ebene 3a Informationen zum Grab: Nach dem charakteristischen Gürtel wird die Person als Soldat betrachtet. Ende 4./Beginn 5. Jh.

Ebene 3b Alter und Geschlecht: Männlich, matur.

Ebene 4a Analogieschlüsse: –

Ebene 4b Funktionale Interpretation: Der archäologische Bearbeiter erkannte, dass der Gürtel dem Toten nicht angelegt worden, sondern im eingerollten Zustand bei den Beinen des Mannes deponiert war (Abb. 3). Dennoch wurde das Gewebe am Gürtel zu einem Kleidungsstück des Verstorbenen gehörig interpretiert (Ruprechtsberger 1999, 34f.).

Nach der abermaligen Analyse des räumlichen Kontextes im Grab scheint es aber wahrscheinlicher, dass wir entweder eine textile Umhüllung des Gürtels vor uns haben oder

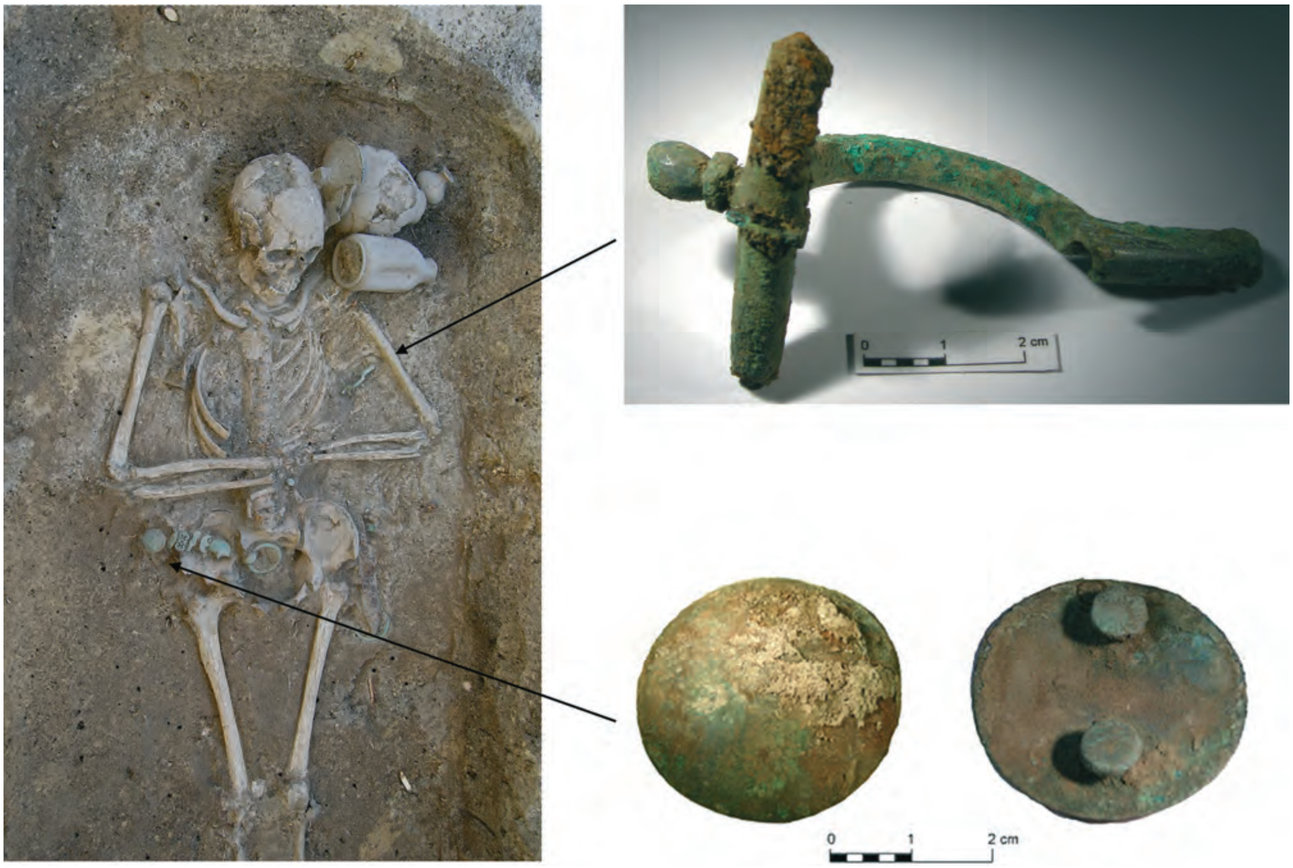

Abb. 4: Schwechat, Grab 120: Gesamtbefund mit Gürtel und Fibel und eingeblendeten Details zur Fibel und einem Beschlag (Grafik: K. Grömer).

ein Leichentuch, das den Verstorbenen samt seinem Gürtel einhüllte.

2.3. Schwechat, Grab 120 (Abb. 4-6)[4]

Komplexere Gräber mit Geweben an mehreren Objekten in einem Grab sind in Österreich eher selten. Im Falle von Grab 120 aus Schwechat wurden Textilreste sowohl im Brustbereich an einer Bronzefibel entdeckt sowie im Beckenbereich an mehreren Beschlägen. Zudem hatte der Mann an der linken Körperseite in Höhe der Hüfte ein Eisenmesser mit einer Messerscheide mit bronzenem Thekenbeschlag. Manche Gewebe ließen sich über mehrere Positionen verfolgen.

Wie bei den anderen Beispielen wurden zunächst die Einzelfunde analysiert; bei vorliegender vereinfachter und verkürzter Aufgliederung der Textilreste werden jene von den einzelnen Gürtelbestandteilen zusammengefasst.

Ebene 1 Fund: **Textilreste auf Fibel** (Fnr. 305.05)

Ebene 2a Technische Analyse: Leinwandbindiges Gewebe, Wolle, in beiden Fadensystemen 0,3-0,4 mm z-Garn; 14-16 Fäden pro cm.

Ebene 2b Mikrostratigrafie: Textil eventuell mehrlagig auf der Unterseite der Fibel.

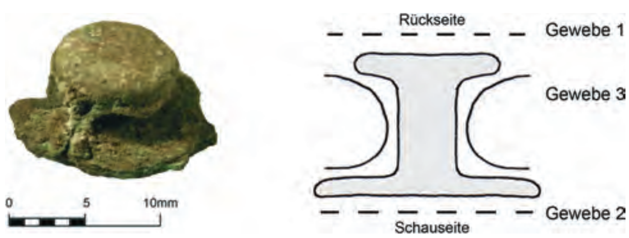

Abb. 5: Schwechat, Grab 120: Niete Fnr. 305.31 mit Mikrostratigrafie (Grafik: K. Grömer).

Ebene 2c „Trachtlage" oder Beigabe: Lage der Fibel am linken Brustkorb der Leiche auf Höhe Oberarmmitte (also von der Schulter etwas verrutscht); Wertung als Trachtlage.

Ebene 2d Räumlicher Kontext: Textil auf körpernaher Unterseite der Armbrustscharnierfibel.

Ebene 3a Informationen zum Grab: Neufund, Grabauswertung von archäologischer Seite her noch nicht abgeschlossen, 3. Jh.

Ebene 3b Alter und Geschlecht: Männlich (laut archäologischer Zuweisung), noch nicht anthropologisch bearbeitet.

Ebene 4a Analogieschlüsse: Auf dem Elfenbeindyptichon des Generals Stilicho, 4. Jh. (Croom 2002, Abb. 8) hält eine Fibel an der Schulter einen Mantel. Es gibt zahlreiche schriftliche

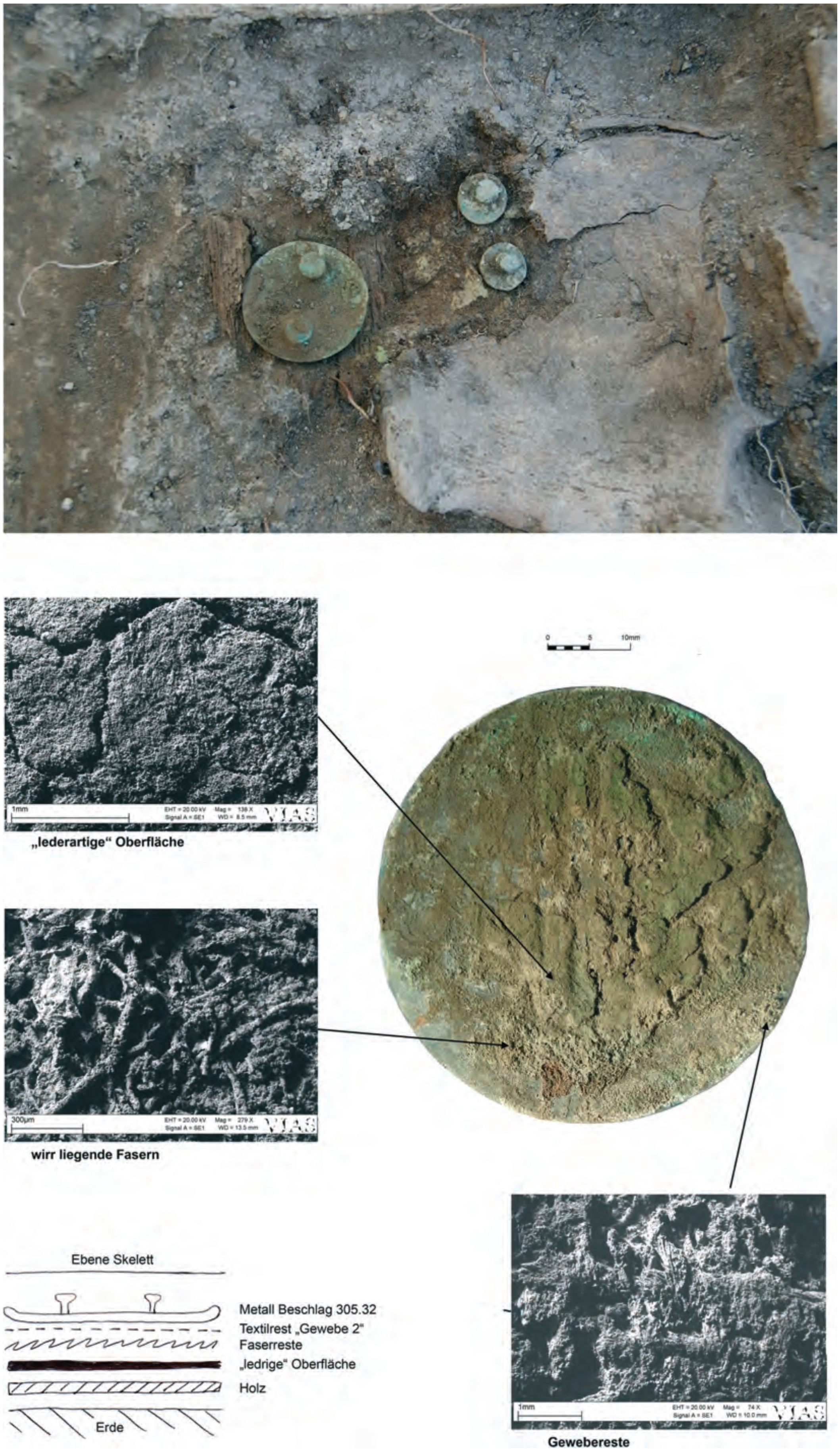

Abb. 6: Schwechat, Grab 120: Situation unter dem Becken des Skelettes, Beschlag 305.32 mit Mikrostratigrafie (Grafik: K. Grömer).

Nennungen von Mänteln mit Bezeichnungen wie *sagum* oder *paludamentum* (Cleland et al. 2007, 137, 164).

Ebene 4b Funktionale Interpretation: Die Stoffreste an der Fibel – befindlich zwischen dem Körper und dem Trachtbestandteil – sind als direkte Reste des Kleidungsstücks zu interpretieren, das gefibelt wurde. Man darf darin wohl die Überreste eines leichten Mantels sehen; der Mantelstoff würde demnach aus mittelfeinem Wolltuch bestehen. Welcher konkrete Manteltyp es war, ist nicht belegbar.

Ebene 1 Fund: Textilreste auf Gürtelbestandteilen im Beckenbereich

Ebene 2a Technische Analyse: An den verschiedenen, stilistisch nicht zusammenpassenden Teilen der Gürtelbeschläge im Beckenbereich finden sich drei verschiedene Gewebe:

Gewebe 1 leinwandbindiges Gewebe aus tierischer Faser, Fadensystem 1: 0,2 mm s-Garn; 18-20 Fäden pro cm, Fadensystem 2: 0,2 mm s-Garn; 18-20 Fäden pro cm.

Gewebe 2 ripsartige Leinwandbindung aus tierischer Faser, Fadensystem 1: 0,2 mm z-Garn; 12 Fäden pro cm, Fadensystem 2: 0,3 mm s-Garn; 21 Fäden pro cm.

Gewebe 3 sehr feines leinwandbindiges Gewebe, Bastfaser, beide Fadensysteme: 0,2 mm Garn; Fäden pro cm nicht auszählbar.

Ebene 2b Mikrostratigrafie: Bsp. Bronzeknöpfe 305.31 (**Abb. 5**): Am Niethals wurde das dünne leinwandbindige Gewebe 3 aus Pflanzenfasern entdeckt, an der körpernahen Seite der Niete fanden sich Reste von Gewebe 1, an der körperfernen Schauseite Gewebe 2.

Bsp. Beschlag 305.32 (**Abb. 6**), Lage unter dem Beckenknochen: Auf der Schauseite des Beschlags fanden sich verschiedene organische Abdrücke, direkt an der Schauseite zeigten sich schwach sichtbare leinwandbindige Gewebereste (Gew. 2), darauf wirr liegendes Fasermaterial und eine „lederartige" Oberfläche, sowie auf dieser abgedrückt Holzreste. Diese wurden bei der Ausgrabung dokumentiert und lagen direkt auf der Erde.

Ebene 2c „Trachtlage" oder Beigabe: Alle Beschläge sind im Beckenbereich um den Körper herum gefunden worden; Wertung als Tragelage.

Ebene 2d Räumlicher Kontext: Gewebe 1 findet sich an der Rückseite (körpernahen Seite) der Gürtelbeschläge; Gewebe 2 an der Schauseite der Beschläge. Gewebe 3 wurde am Niethals einiger Nieten entdeckt.

Ebene 4a Analogieschlüsse: Gürtel, gegürtetes Kleidungsstück, wie auf den Grabsteinen aus Padua und Narbonne (Pausch 2003, Abb. 70 und 71) oder bei Stilicho.

Ebene 4b Funktionale Interpretation: Bei Gewebe 1, das als eine Textillage an der körpernahen Seite der Gürtelbestandteile erhalten ist, handelt es sich um das gegürtete Gewand. Dieses dürfte bei einer römerzeitlichen Männerbestattung als Tunika (Pausch 2003, bes. 89) anzusprechen sein. An den Schauseiten der Objekte konnte Gewebe 2 dokumentiert werden. Möglicherweise gehören diese Fragmente zu einem Kleidungsstück, das über dem gegürteten Gewand getragen wurde (nicht identisch mit dem Mantel). Eventuell ist Gewebe 2 aber auch ein einhüllendes Leichentuch. Zudem kann davon ausgegangen werden, dass zumindest Teile des Trägermaterials der Gürtelbeschläge (Lederriemen o.Ä.) mit feinem Textil (Gewebe 3) bezogen wurden, da sich eindeutige Reste an den Niethälsen fanden. Aus den weiteren, im Beckenbereich aufgefundenen organischen Resten ist abzulesen (vgl. Mikrostratigrafie bei Beschlag 305.32), dass die Leiche auf den von einem Fell bedeckten Holzbrettern eines Sarges oder Totenbrettes lag.

Zusammenfassend darf man sich die Grablege wohl so vorstellen, dass der bestattete Mann eine feine Wolltunika trug, die ein mit vielen nicht zusammenpassenden Beschlägen besetzter Gürtel hielt, sowie einen gefibelten Mantel aus leichtem Wollstoff. Gewebe 2 aus dem Beckenbereich stimmt in seinen gewebetechnischen Details nicht mit dem Wollmantel überein, war also ein weiteres, über dem gegürteten Gewand getragenes Kleidungsstück, oder gehörte eventuell zu einem Leichentuch. Der Mann war in einen Holzsarg/ auf ein Totenbrett gebettet, das mit einem Fell bedeckt war.

3. Fazit und Ausblick

Es war ein wesentliches Forschungsdesiderat im Rahmen des Projektes DressID, Daten zu römischen Gewebefunden aus Österreich zu gewinnen. Es ist in diesem Rahmen vor allem die Frage nach der Interpretation und den angewandten Methoden wesentlich. Die Einzelfunde wurden dabei nach verschiedenen Interpretationsebenen analysiert, wodurch den Textilien unterschiedliche Funktionen im Grabbrauch zugeschrieben werden können. Es finden sich in den Gräbern etwa Verpackungen/Verhüllungen von Gegenständen sowie „technische Textilien", die etwa beim Aufbau von hölzernen Messerscheiden eine Rolle spielten. Besonders interessant ist die Diskussion der Gewebe an Trachtbestandteilen, die teilweise mit konkreten Kleidungsstücken in Zusammenhang zu bringen sind (Mäntel, Tuniken, Schleier...). Wenn wir auch in keinem Falle eine Formgebung bestimmen können, sind jedoch Informationen zu den verwendeten Materialien und Stoffqualitäten wesentliche Ausgangspunkte für weitergehende Forschungen.

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Anmerkungen

1 Das interdisziplinäre und multinationale Projekt „DressID: Clothing and Identities – New Perspectives on Textiles in the Roman Empire" (Leitung: Reiss-Engelhorn-Museen Mannheim) wird finanziell von der EU-Kommission unterstützt, Informationen zum Projekt: www.DressID.eu (inkl. Publikationsliste).

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2.3. Organic remains from archaeological contexts. Forensic taphonomy applied to prehistoric and early medieval inhumation graves

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Article

Organic remains from archaeological contexts. Forensic taphonomy applied to prehistoric and early medieval inhumation graves

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With 8 figures

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Abstract: Organic remains are rare in archaeological sites in Europe due to the prevailing climatic conditions. This paper focuses on prehistoric and early medieval burials in Central Europe that yield textile, leather, skin and insect remains. Forensic taphonomy can help us to understand the "normal" decomposition process of a body (death – decay – skeletonization), the time-frames involved and the variables affecting decay rate, including temperature, climate, and access of insects. Under average Central European conditions, organic material in a prehistoric burial can be reasonably expected to have decomposed completely after a maximum of 10 years. In rare cases, textiles, leather, and human skin and soft tissues can be preserved in graves. This typically happens in the contact zone with metal objects, where corrosion products of the metals penetrate and thus preserve adjacent organic material, both as mineralised replicates as well as organic residue. Thus, under specific chemical conditions, and micro-climatic conditions such as pH-value, moisture and temperature the decay process is slowed down or even stopped. In this paper, the organic remains attached to metal objects are analysed using micro-stratigraphy, and case-studies involving preserved textiles, leather and human skin are presented. Analysis of the timing of the decomposition processes, as well as microstratigraphic succession of the individual organic and inorganic layers facilitate an interpretation of the function of the textiles and leather, even in cases where the original burial context is not preserved (or was not documented) *in-situ* (e.g., due to grave robbery in ancient time, re-opening of graves, excavation by non-experts).

Key words: Forensic taphonomy, timing of decomposition process, archaeology, organic remains, graves, Prehistory, Early Medieval

1. Introduction

Material culture studies undertaken by archaeologists usually involve durable materials like stone artefacts, pottery, metal objects as well as human bones (Eggert 2001; Renfrew & Bahn 2008, pages 51-72). In prehistoric and early medieval graveyards in Central Europe, organic remains such as skin, cloth, and leather are usually not preserved, as a result of climatic conditions in this region. Only in some rare cases does such organic material survive. This paper will introduce a taphonomy-based approach to the study of textile, leather, skin and insect remains in graves. In prehistoric and early medieval Central Europe there are two basic types of burials; cremations – the deceased person was burnt and the ashes was put into the grave; and inhumations – the corpse is buried equipped with various grave goods depending on period and region. In this study we focus on inhumation graves.

Archaeological studies of inhumation graves explore the biological and social components of death, especially by focusing on the study of the human

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skeleton and by the analysis of the acts linked to the management and treatment of the corpse, such as the burial practices (e.g., Gowland & Knüsel 2006; Renfrew & Bahn 2008: 199-203). Taphonomic processes of inhumation burials, i.e. anthropological taphonomy (Garland & Janaway 1989), especially the processes that affect human remains after their deposition, the preservation or non-preservation of every element, is also of interest to archaeologists who are studying cemeteries (see e.g. Aspöck 2011; Neugebauer 1991). In order to help understand those taphonomic processes, interdisciplinary cooperation with forensic sciences is of great importance. Forensic taphonomy, one aspect of forensic sciences (see İşcan & Steyn 2013: 7), provides contextual information to crime scenes. Haglund & Sorg (2006: 3) define forensic taphonomy as "the use of taphonomic models, approaches, and analysis in forensic contexts to estimate the time since death, reconstruct the circumstances before and after deposition, and discriminate the products of human behaviour from those created by the earth's biological, physical, chemical, and geological subsystems." Finally, it is also important to emphasize the role played by humans (as taphonomic agents) on the remains (see also Dirkmaat et al. 2008), in contrast to the traditional study of taphonomy, because not only natural factors (such as water, temperature, animals) may influence the remains after death.

Such, the timing of decomposition stages and the variables affecting the decay rate and the application of those studies to the analysis of organic remains in inhumation graves in prehistoric and early medieval Central Europe are in focus now.

1.1. Forensic taphonomy: decomposition processes and their timing

The various processes of decomposition are reviewed here in a simplified way (after Boddington et al. 1987; Garland & Janaway 1989: 22-26; Grassberger & Schmid 2014; Haglund & Sorg 2002, 2006; İşcan & Steyn 2013: 39-47) as they are necessary to understand the archaeological record.

An important part in forensic postmortem investigations is the estimation of the time since death, the so-called postmortem interval (PMI) (İşcan & Steyn 2013: 39). Such studies are often undertaken at so called „Body Farms", Anthropology Research Facilities run by universities, the first one established in 1981 in Knoxville, Tennessee, USA (Bass & Jefferson 2005). On these taphonomic research facilities human bodies are put in different environmental conditions to study how the decomposition process is affected by prevailing environmental factors. Thus, a number of external (environmental) and internal (relating to the body itself) factors cause substantial variation in the timeframe that the different decomposition stages last (see edited volumes by Haglund & Sorg 2002, 2006). There is considerable research effort worldwide to study these phenomena in different geographic and climatic regions, including studies on the rate of decomposition using animals as substitutes for human corpses (see İşcan & Steyn (2013: 39-40, tab. 2.3; or Grassberger & Frank 2004).

The very early stages of taphonomic changes are relatively constant and happen at a fairly predictable rate. As they are usually not relevant for archaeological research questions, they might be summarized as following: the first signs of death, livor mortis and a stiffened body last between the 4 hours post mortem until approximately 4 days (Grassberger & Schmid 2014: 23-27, tab. 2.1, 2.3; İşcan & Steyn 2013: 41-42).

Directly after death, autolysis starts, a process of self-digestion of the cells. Autolysis fuels the next process, putrefaction with the decomposition of proteins, the breakdown of the cohesiveness between tissues and the liquefaction of most organs. This is caused by bacterial and/or fungal digestion. In the bloat stage anaerobic bacteria are active. The rise of internal pressure resulting from the buildup of gases produced by bacteria causes an inflation or "bloating" of the body.

In the active decay stage (with overlap to early skeletonization) oxidative, aerobic microbial processes and (if present) insect activity predominate. The end of active decay is signaled by the migration of maggots away from the body in order to pupate. This insect activity is important for studies on archaeological material. At the advanced decay stage most of the flesh is removed from the carcass – but still specific insects might be active on the now dryer remains. The dry decay stage, resulting in complete skeletonization, is the last phase of decomposition. Complete skeletonization is defined as the somewhat arbitrary point at which all the soft tissues have (at least visually) decayed and the skeleton is exposed. Bone and teeth are the most stable components, but due to chemical and physical factors as well as biological agents within the burial environment, also bone is affected over time.

The later stages of decomposition (i.e. active and advanced decay) are highly variable and only wide estimates of the time since death can be obtained (Fig.

Stage	Description	Time Prieto et al. (2004)	Time Komar (1998)
Decomposition early phase	Putrefaction: Advanced decomp without bone exposure. Moist decomp, nail and hair attachement, purging of fluid	8 days - 2 months	>2 months - 3.5 months
Decomposition	Active decay and early skeletonization: abundant decomposed tissue with some bone exposure	1 month - 6 months	1.5 month - 18 months
later phases	Advanced decay, advanced skeletonization: bones greasy, some decomposed tissue, cartilage and tendons	2 months - 2.5 years	4 months - 18 months
Complete skeletonizations	dry bones	> 3 years	2 months - 8 years

Fig. 1. Stages of decomposition with timing in studies from Spain (Prieto et al. 2004) and Canada (Komar 1998; adapted after İşcan & Steyn 2013, tab. 2.3).

1). The stages of decay until complete skeletonization are dependent on numerous factors (see İşcan & Steyn 2013, tab. 2.4). Internal factors that affect the nature and rate of decay include body weight, age at death, illness and the presence of wounds. Thin and emaciated bodies skeletonise more quickly than overweight persons. Also, antemortem or postmortem wounds allow better access of microorganisms and insects than bodies with intact skin (Garland & Janaway 1989: 16). The principal external environmental factors are temperature, humidity and overground exposure. Concerning temperature (climate and seasonality), various studies indicate faster decomposition with higher temperatures than with colder ones. Higher humidity causes faster decay than dry environments. Comparing air exposure with inhumation graves, environmental conditions such as sun light, rain and temperature affect bodies laid out on the surface, but also animal scavenging and insect access significantly influence the decay rate. There is also some variation in the decomposition processes within the graves (see Rodriquez & Bass 1985): the deeper the grave the more slow the processes of decay take place. The use of coffins and even clothing or other wrappings of the body are also influencing factors (Janaway 1987), especially for the accessibility of insects and small mammals.

In a decomposition study in different climatic environments from Spain (Prieto et al. 2004) and Canada (Komar 1998) the following data were obtained: Putrefaction with advanced decomposition without bone exposure takes between 8 days and 3.5 months; early skeletonisation with some bone exposure can be recognized in Spain after 1 months and can last up to 18 months in Kanada, whereas complete skeletonization is scheduled between 2 months and 8 years (Fig. 1).

1.2. Preservation of organic remains: the influence of metal corrosion products

The decay rate of clothing and of other associated organic material was investigated in a ground-breaking work by Robert Janaway (1987, 2002) who observed archaeological material in various experimental studies and studied the formation of corrosion products. An important factor for the preservation of organic matter in prehistoric and early medieval graves is metal objects (Chen et al., 1998) that are buried in proximity to the dead person. Metals in graves were used for personal adornment (e.g. belt buckles, pins, brooches or bracelets) as well as burial gifts such as bronze vessels or weapons. They were placed in the graves according to culturally specific ritual beliefs and practices (Gowland & Knüsel 2006).

Metals from archaeological excavations of the periods and region in focus include usually iron and copper alloys (e.g. bronze), whilst silver, lead and gold are much rarer. According to the type of corrosion, these metals can be divided into different groups. Gold resists corrosion; copper alloys at first easily corrode, but then subsequently form a corrosion-resistant film and become resistant to further attack. Iron corrodes rapidly without forming a layer of protective corrosion products.

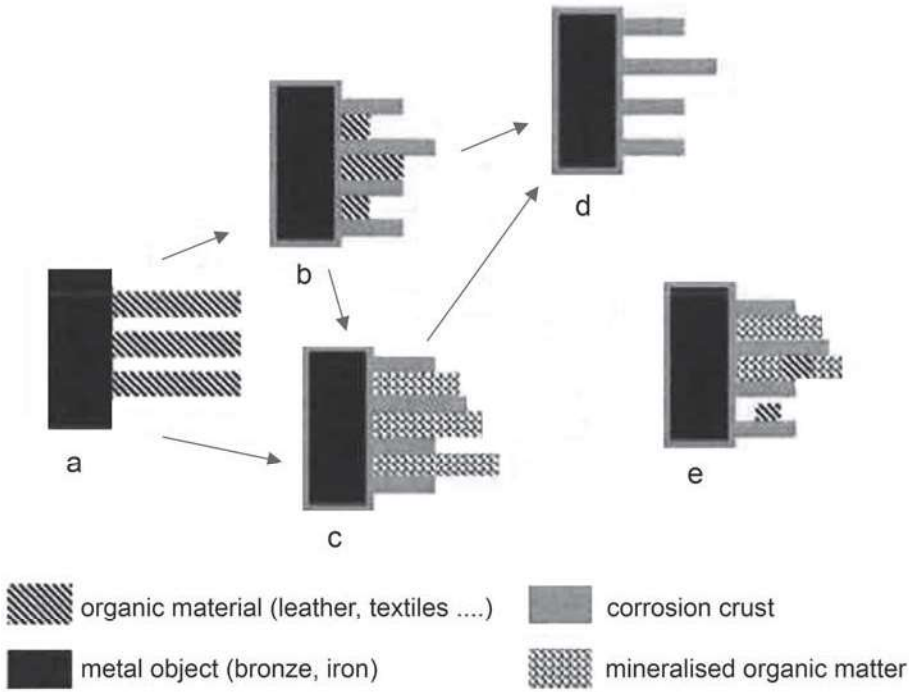

Fig. 2. Different stages of organic preservation (after Peška et al. 2006, fig. 1).

Generally, the preservation of organic matter associated with metal artefacts in graves is dependent on two factors which Janaway (1987: 135) described through the example of textiles, the factors are: "the rate of degradation of the textile fibres and the rate of corrosion, transport and deposition of the metal ions onto and into the textile". In these cases, the metal ions act as biocidal agents and therefore limit biological decay (see also Chen et al. 1998). The effectiveness of electrochemical reaction of metal corrosion depends on the presence of water in the burial environment. Under wet conditions the soluble metal salts penetrate the organic material and a chemical combination of material takes place. Additionally, a combination of specific chemical conditions (also caused by decomposition liquids inside the body), and micro-climatic conditions such as pH-value and temperature may be responsible for slowing the decay process or even stopping it. Such, localised micro-events cause different preservation within one grave. In addition, the type of organic matter plays a role, as preservation of materials based on proteins such as keratin (e.g. wool fibers, leather) and cellulose-based materials (e.g. wood or plant fibers) occurs under different conditions. This is particularly related to the pH-value, e.g. cellulose materials are easily degraded in acidic conditions and proteins are attacked by strong bases (Janaway 1987: 133-134).

Following the studies of Peška et al. (2006: 41-42) on Bronze Age material from Czech Republic and Austria, the preservation of organic matter can vary from organic material to pseudomorphs, and imprints of organic matter in the corrosion layer. Peška et al. (2006) describe the successive, sometimes simultaneous mechanisms related to different kinds of organic traces in the archaeological record (Fig. 2):

a) Contact between metal and the organic material.

b) Organic material preserved within a corrosion layer: The material usually does not cover an extensive area, only the area that is encompassed by the metal corrosion products. In some cases, even chemically intact organic matter, for example fibres may survive.

c) Pseudomorphs/3D mineralised remains: The organic matter is completely altered in a process of mineralisation; the biochemical structure of organic material has totally changed, e.g. from the protein keratin (wool fibers, leather) or cellulose-based cells (e.g. wood, plant fibers) to corrosion products. For further analytical tools such as weave type analysis on textiles it is of importance that the shape and the former surface struc-

ture of the organic material usually remains unaltered.
d) Casts and imprints: The organic matter decays and an imprint of organic material remains on the surface of the metal object.
e) Frequently a combination of all three stages (b-d) co-exist in a single case in the archaeological record.
It is important to mention here that the organic traces usually are very small, covering just few square millimetres to centimetres as a localised preservation in association with metal objects.

2. Case studies – organic remains in graves from prehistory until the early medieval Period

Selected case studies from inhumation graves (buried persons) from prehistory to early medieval period illustrate their potential for analysis and interpretation.

2.1. Textiles

Usually, textile fragments attached on metal elements in graves are limited in size and often the original colouring is lost especially during the proess of mineralisation. Nevertheless, there are some analytical tools that enable us to gain data from such small fragments. Textile analysis (e.g., Bender Jørgensen & Grömer 2012; Walton & Eastwood 1988) embraces macro- and microscopic analysis of thread quality and weave type. Sometimes even textile patterns can be detected. This especially applies to original organic material preserved. Aspects such as thread quality and weave can also be identified from pseudomorphs and casts. The raw material from which the textiles have been made can be analysed by means of Scanning Electron Microscopy, as the high magnification helps to identify characteristics of the fibers. The best results for fibre identification can be done on organic preserved material, sometimes on mineralised and cast material this is not possible.

Textiles are important features among prehistoric and early medieval graves. In grave contexts, they serve different purposes. These include the garments a person was buried with as well as shrouds, wrappings of objects (see Gleba 2014), garments that served as burial gifts, or textile furnishing of the grave including wall hangings and floor covers.

For the identification of the function of a specific textile fragment in a grave, different sources also have to be analysed. The evidence of textile attached to certain objects in the grave together with the position of the dress-fasteners and other artefacts within the burial are important evidence. Contemporary pictorial sources can be informative e.g. of the kinds of garments in a grave – even if the single items are quite small.

These concepts can be demonstrated by a Roman example from Zwentendorf in Lower Austria. At Zwentendorf (Grömer 2014, fig. 71), a Roman cemetery was found with about 100 burials dated to the 4th century AD. From grave 96 (an adult male) mineralised textiles were identified on various items in the grave, and can be used for a reconstruction of the garments of the deceased (Fig. 3). A brooch (cross-bow fibula) was found in the chest area with a medium-fine wool textile that was folded (Fig. 3a-b). He also had a finger ring with small fragments of a textile in basket weave attached on it (Fig. 3c). The most impressive items in his grave are the bronze elements of a Roman military belt indicating that he was probably a soldier. On the bronze belt buckles (Fig. 3d) textile fragments of a linen weave were identified, found both on the position between belt and body as well as on the face side of the belt.

From contemporary depictions, for example from the 4th century AD diptych stored at the cathedral of Monza, showing general Stilicho and his family (Croom 2002, fig. 8) we see the typical "civilian" garments of roman soldiers (Fig. 3e): a knee-length tunic and a cloak, held by a fibula. Comparing the archaeological evidence of the textile items and the depiction, we can reconstruct the qualities and raw materials of different garments in grave 96 from Zwentendorf: The textile directly on the belt buckle must be a fragment of the garment that was belted – that match that of a tunic. Although we just have few square-centimetres, we know what raw material (in this case: linen) and what quality the tunic had. The linen textile on the finger ring (Fig. 3c) can also be detected as part of the tunic, in this case, the long sleeve – as it is also known from the Stilicho diptych. The coarser woolen textile on the fibula (Fig. 3a-b) also can be identified as a functional item, the garment held by the fibula in the chest area – which is the cloak.

2.2. Leather and fur

Along with textiles, leather and fur can also be detected in prehistoric to early medieval graves. Usually they are associated with metal belt items. Similar to the textile remains, they are very small, not extending past the metal carrier element to which they are attached.
At the Avar cemetery at Nuštar in Croatia, dated bet-

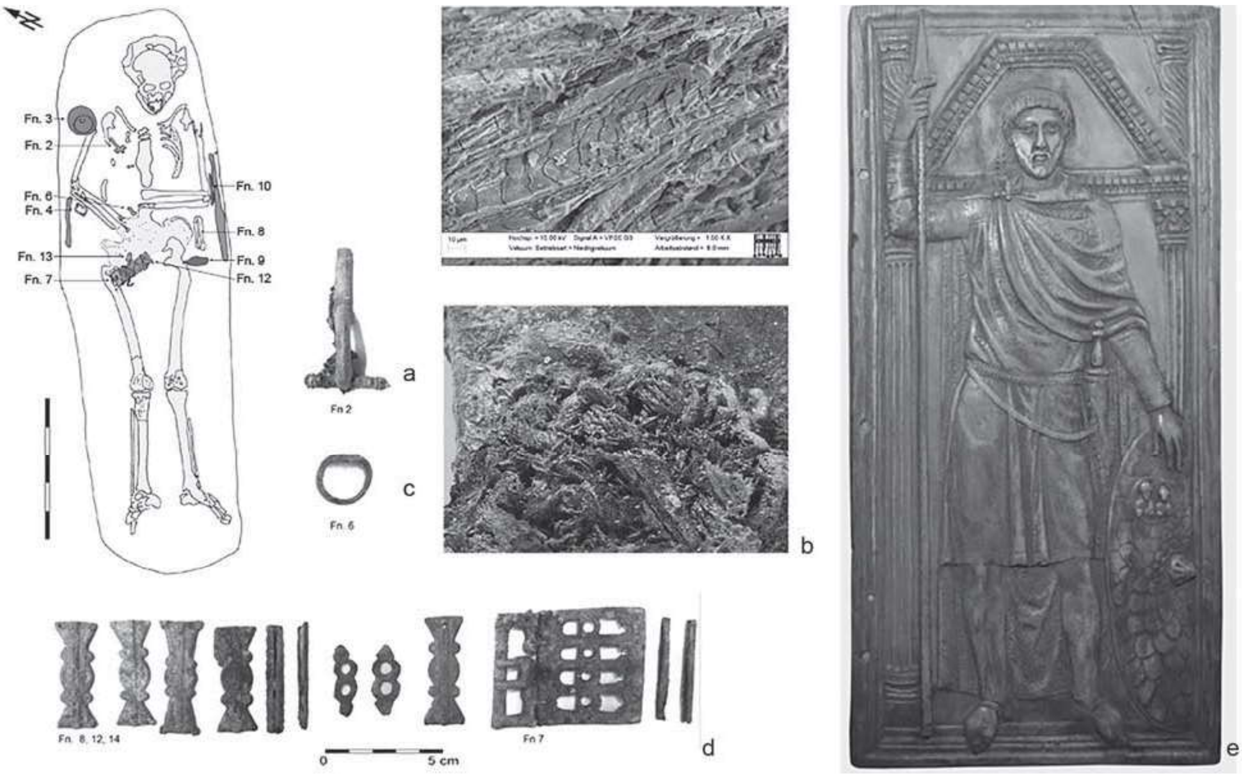

Fig. 3. Zwentendorf, grave 96 with relevant bronze dress fasteners (a fibula, c finger ring, d belt), b microphotos of textiles and wool fibres. e: diptych of Stilicho, late 4th century AD (© BDA/AS; image diptych courtesy of H.R. Goette).

ween 750-800 AD, along with textiles, pieces of mineralised, partly still organic leather have also been found corroded on a belt buckle from grave 46 of an adult male (Fig. 4a). Additionally, some decoration in form of triangular imprints could be identified. The leather fragment was on the inner side of the buckle, next to the body in the pelvic area. Due to its being *in-situ* (still in the place as it was laid down when the person was buried), the function of the leather piece is obvious: it belonged to the belt, which was closed by the buckle. The decoration, and the fact that belts played an important role regarding social status, indicate that the belt was worn to be seen (Grömer & Rapan Papeša 2015: 51-83).

In rare cases, other garments made of leather or fur, have also been identified due to minute excavation and restoration work. For example, in grave 5 from Unterhaching near Munich in Germany (480-520/ 530 AD), a woman was buried and next to her fingers, remains of mineralised fur were found, belonging to a carnivore of the family Mustelidae (e.g. weasels, badgers, otters). The finding has been interpreted as part of sleeves or gloves (Nowak-Böck & von Looz 2013: 173-180).

2.3. Human skin and human hair

Beside textile fragments, leather and fur, other organic matter can be preserved attached to metal elements in graves, for example human skin. It can be found especially on jewelry that is very close to the skin, like bracelets, but also on the inner side of finger rings. Due to its fine and sophisticated structure, skin usually is found on copper alloy items that enable a stable and durable corrosion film protecting the structure. Such, the corrosion surface is casting the texture of the original skin. On the skin casts, dermatoglyphic properties and other specific features can sometimes be observed in detail. Thus, Peška et al. (2006, fig. 7, pp. 17, 39-41) presented skin imprints from the early Bronze Age cemetery Hulìn in Czech Republic. In three graves, finger rings were found that show clear traces of epidermal ridge imprints in the corrosion products.

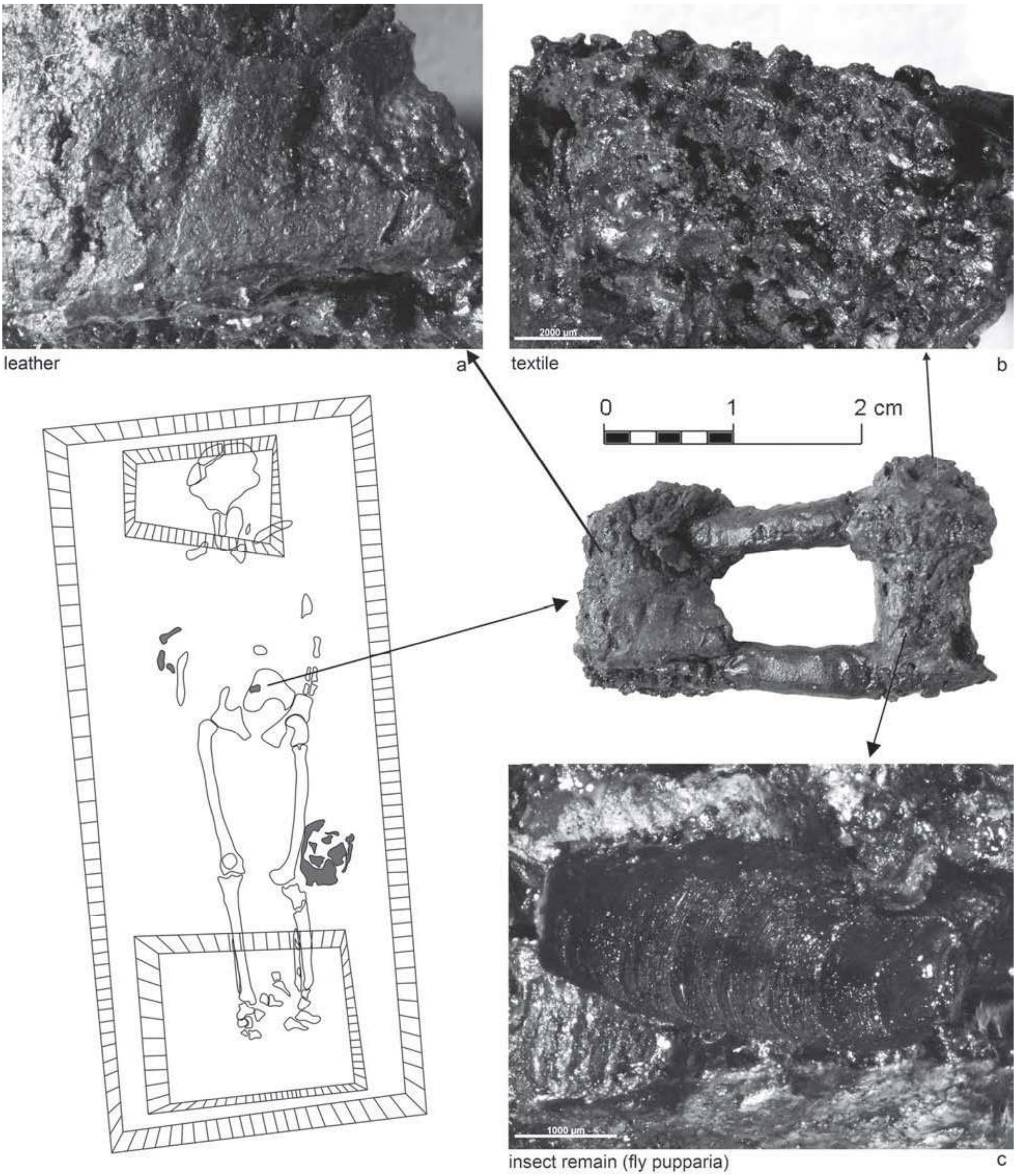

Fig. 4. Nuštar, Croatia: Organic matter attached to a belt buckle from grave 46, 8th century AD. a: leather, b: textile, c: insect remain (after Grömer & Rapan Papeša 2015).

In our work, we have identified skin imprints in a Roman Period grave that was found in Mauer an der Url in Lower Austria (Pollak 1988, 162, plate 2; Grömer 2014, plate 21). The grave contained a skeleton of a woman with a bracelet on her arm. On the inner side of the bracelet in the corrosion layer, casts of human skin

Fig. 5. Mauer an der Url, bracelet from grave 6 with skin imprints, 4th century AD (photo: K. Grömer).

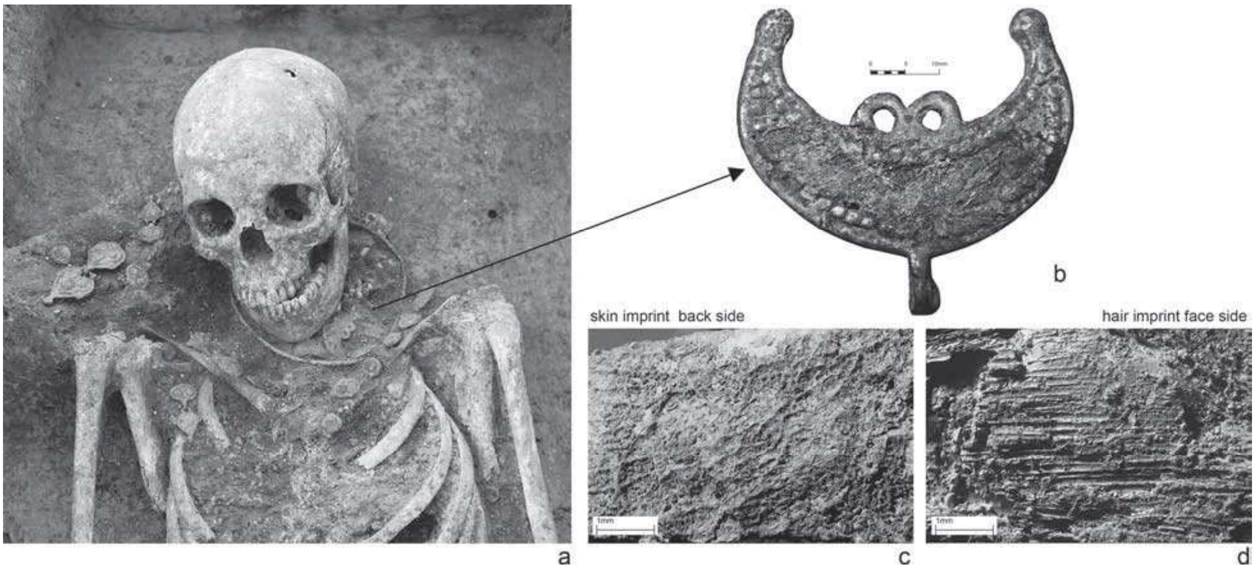

Fig. 6. Gattendorf, pendant from grave 113 (a-b) with impressions of skin (c) and human hair (d), 10th century AD (microphotos: K. Grömer, © courtesy of Cultural Heritage Agency Austria (BDA)).

were visible (Fig. 5) – clearly belonging to the skin of the wrist of the deceased.

The early medieval graves from Gattendorf (Krenn & Mittermann 2010: 453) also provide us with some skin and hair remains from two graves (gr. 95 and 113), dated to the 9th – 10th century AD. In grave 65, a young woman was buried with a pendant worn in the neck area (Fig. 6a). On one side of the pendant (Fig. 6b-c) the impression of skin in the corrosion layer was found, and on the other side casts of human hair from the girl (Fig. 6d). It covered the pendant after the girl was laid down in the grave.

2.4. Insect remains

While other organic remains described above can also be detected macroscopically, entomological remains in many cases can only be identified by microscopic analysis. Insect remains are of importance for various reasons. On the one hand, they indicate parasites that affect living persons such as human body lice. On the other hand, insects are also responsible for the decomposition processes.

In the early medieval cemetery of Thunau near Gars in Lower Austria (Grömer et al. 2017) parasites were found in two graves. Interestingly, they derive from clothing remains in burials of high ranking people, within the fortified hilltop settlement, which sheds a new light on hygiene and health conditions of a society. From grave 76, 0.2-0.25 mm small mites preserved as 3D mineralised remains were found in the clothing of a young man with precious garments made of silk samitum and decorated wool and linen cloth. Mites that parasitize humans or animals can cause damage to the skin and allergic reactions such as asthma and they can also pass on pathogens. On textile fragments in grave 46, mineralised casts of nits of human body lice were found. They are c. 0.7-1 mm in size and of oval shape. These parasites feed on human blood and can be found in clothing in close proximity to the body.

For further discussions, remains of insects, which often are an active part in the decomposition process are of specific interest. From the previously mentioned Avar cemetery Nuštar in Croatia (Grömer & Rapan Papeša 2015: 73), in grave 46 remains of a fly larva (*Diptera pupa*) body were identified on textile fragments from the pelvis area (Fig. 4c). This could be one of the fly species (e.g. blow flies, flesh flies or coffin flies) that prefer a moist corpse for their offspring (larvae or "maggots") to feed on. Similar discoveries derive from the early medieval Avar cemetery Frohsdorf in Lower Austria (Scharrer-Liška & Grassberger 2010). In this case, the authors tried to draw interpretative models concerning grave taphonomy and possible burial rites using the copious entomological remains in form of fly puparia (some of them parasitized by a wasp) and fragments of adult flies.

Peška et al. (2006, figs. 32-33, 53-56) report in their study of organic remains from early Bronze Age sites in the Czech Republic some insect corpse residuals or casts of the surface of insects or the pupparia of larvae in corrosion films. In addition to ovoid structures of puparia, that are recorded quite regularly, they also report an adult insect form with fully developed wings, classified as from the order *Diptera* and the cast of a dorsal body of an adult beetle (order *Coleoptera*) at the sites Hulìn and Holubice, dating between 2200-1800 BC.

2.5. Multiple organic layers: wood, textile and leather

For analysing more complex finds with different layers of organic matter, the methodology of micro-stratigraphy has been employed (Hägg 1989: 431-433). Microstratigraphy records the strata of organic remains e.g. textiles, wood, leather on metal objects and the correlation between each other. We have employed this method in a study of the Roman graveyard Mautern-Burggartengasse in Lower Austria (Grömer 2014: 150-152) from which we know of various knifes associated with organic layers. The most impressive comes from grave 83 (Fig. 7), which served as burial gift for an adult male and is dated to the 5th century AD. The wood of the knife handle can clearly be recognized, as well as the wood and leather on the knife blade. In this case, the wood and leather still preserves as organic remains; i.e. even the cell structure of the wood and the fibre structure of the leather are visible. Directly on the blade there is a layer of mineralised textile remain and another one attached to the leather. On this knife we have an example for different kinds of organic preservation on one artefact – organic material and pseudomorphs.

Following the microstratigraphy, a cross-section through this evidence can be described as following: outside is a textile layer, followed by leather, wood and directly attached to the iron blade textile on both blade sides, again wood, leather and textile outside. This evidence can be interpreted as follows: The wood and leather on the knife blade belong to a wooden sheath of the knife which was lined with a textile inside and leather outside. The textile outside the leather sheath could be a textile lining of the sheath, or the object was just wrapped when it was laid down in the grave.

3. Case study: re-opened graves

In this study we deal with challenging situations like re-opened graves. In re-opened graves usually bones are disarticulated, bones and burial goods sometimes even dislocated from the grave. In contrast to this, *in-situ* contexts would be the primary situation as the corpse and the grave goods have been placed in the grave when the person was buried. Generally, organic finds from graves with contexts that are not *in-situ* are usu-

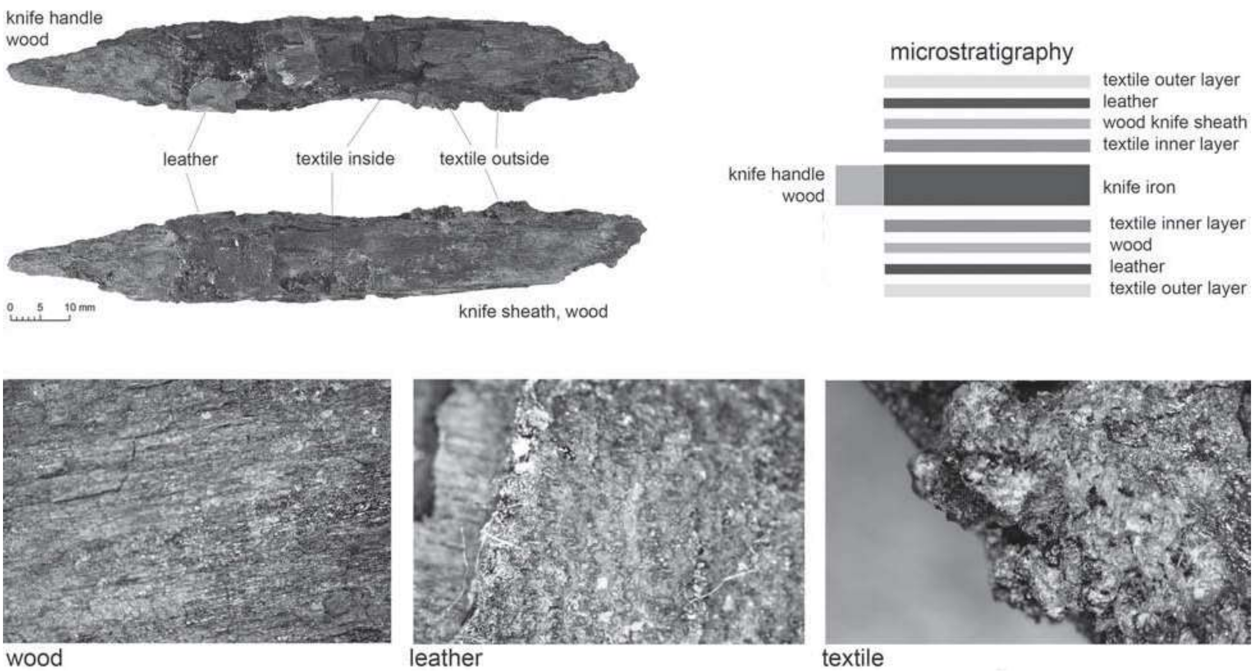

Fig. 7. Mautern Burggartengasse, grave 83. Micro-stratigraphy of wood, textile and leather on an iron knife blade, 5th century AD (after GRÖMER 2014, plate 24).

ally excluded from further interpretation due to the fact that important information, especially the positioning in the grave, the relation to the body of the deceased are missing. To meet this challenge, forensic studies on their taphonomy (see e.g. GARLAND & JANAWAY 1989; İŞCAN & STEYN 2013) have been taken into account. Two data sets are of importance here: first, about what happens between the moment when the dead body had been buried in the earth and the excavation hundreds or thousands of years later; secondly, the time-frame for the decomposition stages and variables affecting the decay rate. Both of them allow us to understand the mechanisms behind the archaeological evidence.

3.1. Re-opened early medieval graves in Salzburg

A burial from the early medieval cemetery Untereching near Salzburg, dated to the 7th century AD (HÖGLINGER 2014), serves as an example. From grave 2, the burial of an adult man, we know of a strap-end of a belt with a well preserved micro-stratigraphy (GRÖMER & RUDELICS 2014: 58-60, figs. 49-50): organic and partly mineralised layers of textiles, leather and even plant remains which point to straw. In this case the object was not found in an *in-situ* position as it was laid down in the grave at the moment the man was buried. The archaeological evidence shows disarticulated and dislocated human bones and artefacts, among them the strap-end. From historical records we know that the grave was re-opened somewhere during the 19th century AD.

At St. Martin im Lungau, Salzburg, Austria (HÖGLINGER & HAMPEL 2013) a brooch together with some human bones were completely dislocated from the original burial place. In this case, an early medieval item was found in a disturbed context from the early modern period. Based on the typological date of the brooch, the original burial dates to the 9th to 10th century. About 300 years later, the same place again was used as burial ground (and has been used as such continuously until today). The brooch displayed an interesting micro-stratigraphy: Directly on the back side of the brooch (Fig. 8a-b), 3D mineralised remains of a fine textile were found (Fig. 8c), partly in layers and with remains of a sewing thread. Above that, a pseudomorph of human skin (Fig. 8d) could be identified. Fibulae from the 9th century AD are always found in the chest area of female graves, as we know from *in-situ* contexts from other graveyards (e.g. EICHERT 2010: 163). Also pictorial sources from the early medieval period, the most important for us is the Stuttgart psalter, a richly

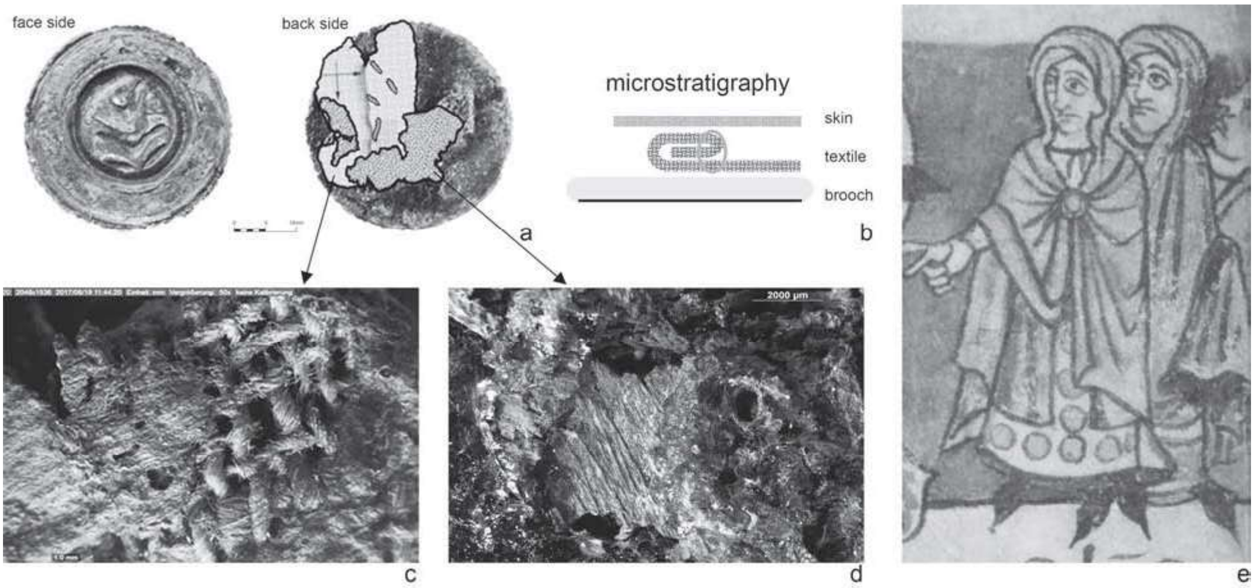

Fig. 8. St. Martin im Lungau, Austria: brooch (a), microstratigraphy on the back side of the brooch (b) layers of textile (c) and skin (d); comparison with Stuttgart Psalter, 9th century AD (e) (images brooch and microphotos: A. Rudelics; Psalter: Cod. bibl.fol.23, 94v, gemeinfrei, © Württembergische Landesbibliothek Stuttgart).

illuminated manuscript of the 9th century (Stuttgarter Bilderpsalter, Cod. bibl.fol.23)[1)], show women with cloaks held by such a brooch in the chest area (Fig. 8e).

3.2. Application of the forensic data to prehistoric and early medieval burials

As pointed out above, organic matter in inhumation graves usually decays in at most 10 years, thus the stage of complete skeletonization is reached relatively soon. As we saw, the noxious substances of metal corrosion can stop the decay of organic material associated with the body such as skin, leather and textiles (e.g. Chen et al. 1998; Peška et al. 2006: 41-42). It is a localised preservation in association with metal objects, usually not larger than a few square millimeters till centimeters. In the case of re-opened graves like from Unterehing or St. Martin it is now of interest to ask for a more detailed timing of the preservation of organic materials in proximity to metal objects.

For a more detailed timing, evidence for human skin is of importance, as the outer skin of the body disappears during the advanced decay stage (İşcan & Steyn 2013, tab. 2.3) – if there was no condition present that slowed down the process of decomposition. Artefacts with casts of skin usually consist of copper alloys like bronze; bronze very quickly forms a corrosion layer, preserving such information in a durable state. In the archaeological record skin structures can be recovered as far back as from the early Bronze Age 2000 BC at sites like Hulin, and more frequently from the Roman and early medieval period, for example from Mauer an der Url and Gattendorf.

Furthermore, the presence of insect remains is of interest, especially those from the Avar cemeteries in Nuštar and Frohsdorf, where 3D mineralised insect remains have been detected. We know that those insects appear during certain stages of the decay process. When the active insects themselves leave the body, their puparia are left behind. Without immediate preservation, the keratin substance of the puparia would then also disappear (decompose) some months to years later under the influence of bacteria and fungi. That means, when we find mineralised puparia in those

[1)] Kept at the Württembergische Landesbibliothek Stuttgart, Stuttgart Psalter, e.g. Cod. bibl.fol.23, 93v, 94v, 98r. http://digital.wlb-stuttgart.de/sammlungen/sammlungsliste/werksansicht (accessed: 27th Dec. 2017) graves, it hints to a stop of decay on a specific area next to a metal item within the active decay stage between 1 and 18 months post mortem (Fig. 1), depending on temperature outside the grave. Selected mineralisation replaced the organics of the puparia whilst the decay of the human carcass continued.

This archaeological evidence in comparison with the forensic data might be interpreted as following: the preservation of perishable material like textiles, skin, leather, insects in proximity to metals might be set in the time-frame of at least two years after death.

This is of interest in cases, where we know that graves have been re-opened hundreds of years after the burial, like our case studies Untereching and St. Martin.

Following the forensic data we can deduce that the microstratigraphy of organic layers from grave 2 at Untereching must reflect the original position of metal object, textiles, leather and straw in the grave, because the preservation of this happened in the years directly after the burial. From analogies we know that such strap ends are usually next to the feet and even from this disturbed context we know about the quality of the clothes worn around the feet, the leather used for the strap and we know that the coffin was padded with straw.

Also the microstratigraphy on the fibula from St. Martin (human skin and textile) can be interpreted as reflecting the primary *in situ* position. We can interpret the textile as part of a garment, maybe a mantle. We therefore know what kinds of textile qualities and raw materials have been used as cloak at the end of early medieval Period – in this case linen tabby textile of moderate quality.

4. Conclusion

From excavations of prehistoric to early medieval inhumation graves in Central Europe, organic material like textiles, leather, skin, insects or wood can be observed in corrosion products of metal artefacts. These remains are, however, usually rather small. For an accurate interpretation of these minute pieces, different analytical methods have to be employed, material and technical analysis of each item, but also the investigation of micro-stratigraphy – the layering of different organic materials and their metal carrier material. This has then to be interpreted in relation to the positioning in the grave, especially the placement in relation to the buried body and other burial gifts. Modern excavation methods with block-lifting of complete graves and minute detailed research on the blocks in the laboratory with micro-excavation allow greater information regarding organic finds (e.g. Nowak-Böck & Voss 2015). The evidence from the graves, coupled with contemporary written and pictorial sources, can be used to understand the original function of organic material, as items of clothing, shrouds, wrappings, coffins, wooden handles, and leather sheets.

For analysis of re-opened graves, which are usually thought to be not suitable for further interpretation because of their disturbed *in-situ* context, forensic studies on the timing of decomposition processes allow new insights into the possibilities of interpretation. Here, especially studies from archaeological material with mineralized entomological remains on metal objects are interesting, because insects are active during specific phases of the body's decomposition process. They help us to understand the critical period for the formation of corrosion-preserved organic pseudomorphs, which seem to be prevalent within the first 1.5 years.

In cases of re-opened graves, where we do not find *in-situ* positions, forensic data gives hints for a further discussion on the interpretation of specific finds, as demonstrated by early medieval examples from Salzburg (Fig. 8). Here we argue, that if the microstratigraphic layers of organic matter (e.g. on a belt buckle or fibula) are formed in the years after the person was buried, the microstratigraphy on the artefact can then serve as a fixed dataset. Thus, even if the original context is disturbed due to activities hundreds of years later, and the objects in the grave are distorted from their original position, the microstratigraphy of organic matter on the objects remain unchanged and reflect the original *in-situ* positions.

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3. Textile Techniques and Experimental Archaeology

3.1. Technical data and experiments on corded ware

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Technical data and experiments on corded ware

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ABSTRACT

Studies of the typical late Neolithic Corded Ware beakers are usually undertaken from a morphological point of view, and describe the shape and decoration of the vessel. Interesting details can, however, also be identified via the technical description of the twisted cord impressions. In this paper, a clear methodology of such a technical analysis is presented. This analysis points out different quality standards of both the vessels and their patterning. The cord impressions have also been correlated with organic finds of cords from the same period. With the help of experimental archaeology, facts were investigated which elucidate the possible raw material used for the cord impressions, the quality of the clay, and the surface condition of the beakers.

1. The Corded Ware Culture in the lower Traisen Valley, Austria

In the first half of the third millennium BC, the Corded Ware Culture was distributed across wide areas of Central and Northern Europe (Fig. 1). The term 'Corded Ware' is related to the typical decoration of cord impressions, usually found on the necks of beakers. In Austria, finds of this culture have been known since the 1930s (Stroh, 1940). Ruttkay identified a close relationship between these artefacts and those belonging to the Moravian Corded Ware Culture (Ruttkay, 1981).

The Traisen is a river that springs in the Alps, and, running to the north, it reaches the Danube near Traismauer, approximately 40 km west of Vienna. Although this north-south oriented valley is very fertile, the lower terraces have a history of being used for gravel extraction, resulting in a number of rescue excavations. The settlements and graves that these excavations have uncovered span the Early Neolithic through to medieval times, and have made the Traisen Valley one of the best-known archaeological areas in Austria (e.g. Neugebauer et al., 2000). About 160 graves of the Corded Ware Culture have been excavated (Neugebauer and Neugebauer, 1992 Neugebauer-Maresch and Neugebauer, 2001). No settlement areas dating from this period have yet been found.

In the context of the project "The Endneolithic in the Traisen Valley", finds from about 160 graves of the Corded Ware Culture (and about 25 graves of the Bell Beaker Culture) were investigated (Kern, in preparation). Grave goods made of stone, bone and antler were found. Most of the graves also contained ceramic vessels (beakers, jugs, bowls, cups, large and small amphorae, and jars). Twelve beakers are decorated with cord impressions (Fig. 2).

2. Technical description of Corded Ware patterns

While the patterning and shaping of Corded Ware vessels has been a part of many morphological, typological and chronological studies, technical data about the cord impressions is usually neglected. To date, only Corded Ware in western Switzerland has been analysed in technical detail, by Giligny and Michel (1995). Descriptions of cord impressions were published by Gibson and Woods (1990: 128 f.) and Gibson (2002). In the latter publication, experiments with whipped cord are mentioned (Gibson, 2002: 59). Only a few articles address the technical analyses of decorations with impression and experiments (Liddle, 1929; Neugebauer, 1976a,b; Berman and Hutcheson, 2000; Drenth and Prummel, 2006); thus far, only the impressed decorations on the late Neolithic Bell Beakers have been a focus for broader research concerning technique (e.g. Prieto Martinez and Salanova, 2009).

2.1. Methods

The methodology we have adopted for the technical analysis of the cord impressions from the Traisen Valley (the sites of Franzhausen

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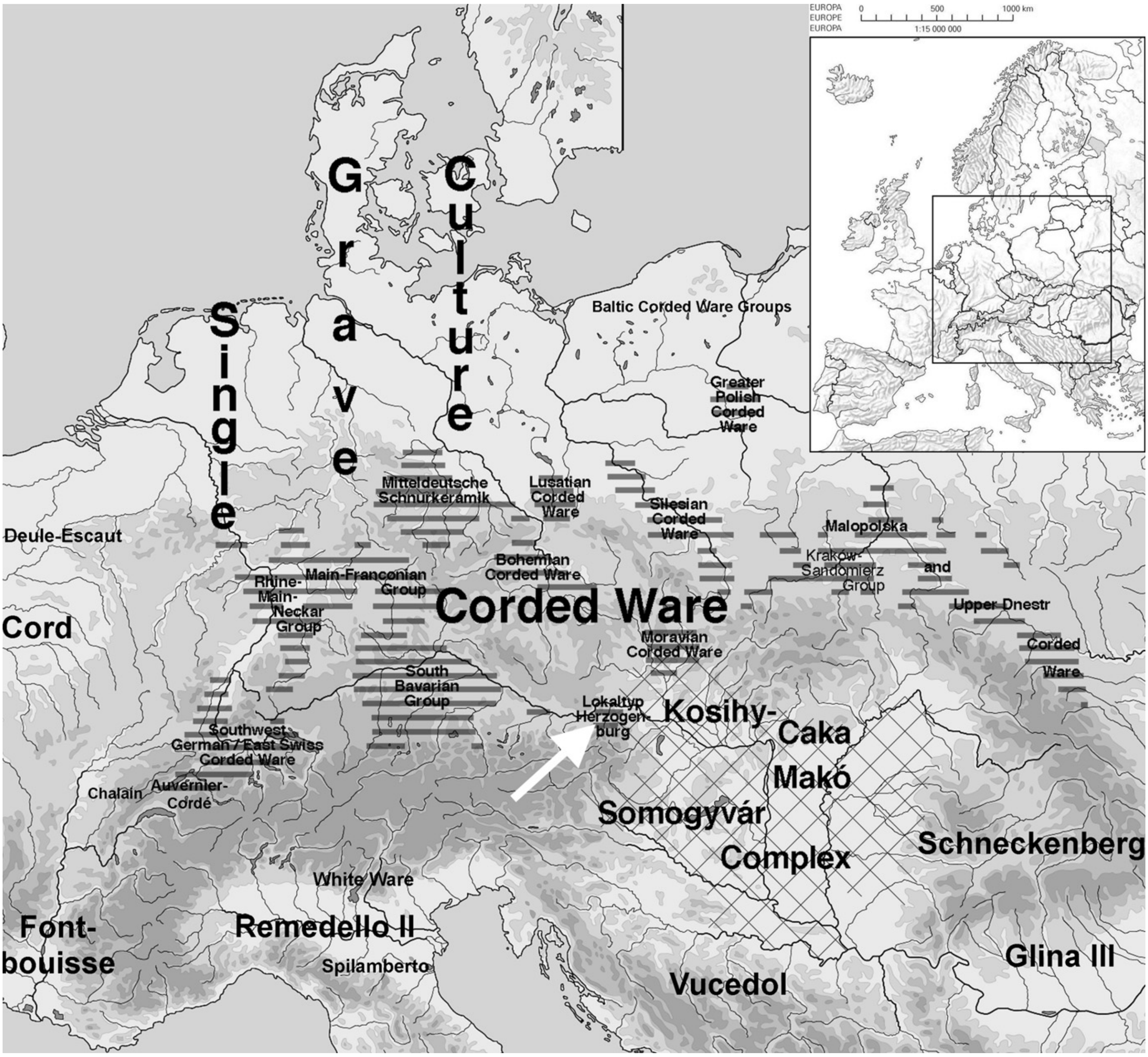

Fig. 1. Distribution of Corded Ware Culture and the Franzhausen and Gemeinlebarn archaeological sites (white arrow) (after Heyd, 2007).

and Gemeinlebarn) embraces a clearly defined and standardised description of the technical data (see also Fig. 3):

a) *twist direction of the impression (S- or Z-turn)*: the twist direction seen on the impressions is a reversed image of the twist direction of the cord.
b) *twist angle*: describes the intensity of the twist (loose or tight), as defined by Emery (1966: 11), where a loose yarn has a twist angle of 10°; a medium yarn is defined by values between 10 and 15°, while a tight yarn has a 25–40° twist angle.
c) *width of impression*: this feature defines the actually measurable width seen on the pot. On each pot, up to 5 measurements were taken at different points. If a margin of deviation was registered, the minimum and maximum size was counted.
d) *width of cord*: this is an estimated figure, depending on the depth of the impression. If the impression is about 50% of the cord diameter, we know that the width of the impression matches the width of the cord used. In cases where the cord was less deeply impressed, the width of the cord is calculated from the width and the curve of the impression. In all these measurements, we assume that the cord had a circular diameter.
e) *depth of impression*: the depth of impression indicates what percentage of the cord diameter was pressed into the clay.
f) *number of twists within 2 cm*: the number of twists is counted in combination with the thread diameter, to separate very fine and coarse cords. The number of twists also relates to the twist angle. A high number of twists is usually coupled with a tight twist angle, while a low number of twists on a yarn of similar diameter as the first one is related to a very loosely twisted yarn.

There is a terminological problem concerning the cords that must be recorded as such: in the Central European prehistory, the terms 'thread', 'cord' and 'rope' are clearly defined and distinguished by diameter (Rast-Eicher, 1997: 305, 313). A thread is considered to be up to 2 mm in diameter, a cord between 2 and 8 mm. If the sample has a diameter of more than 8 mm, it is referred

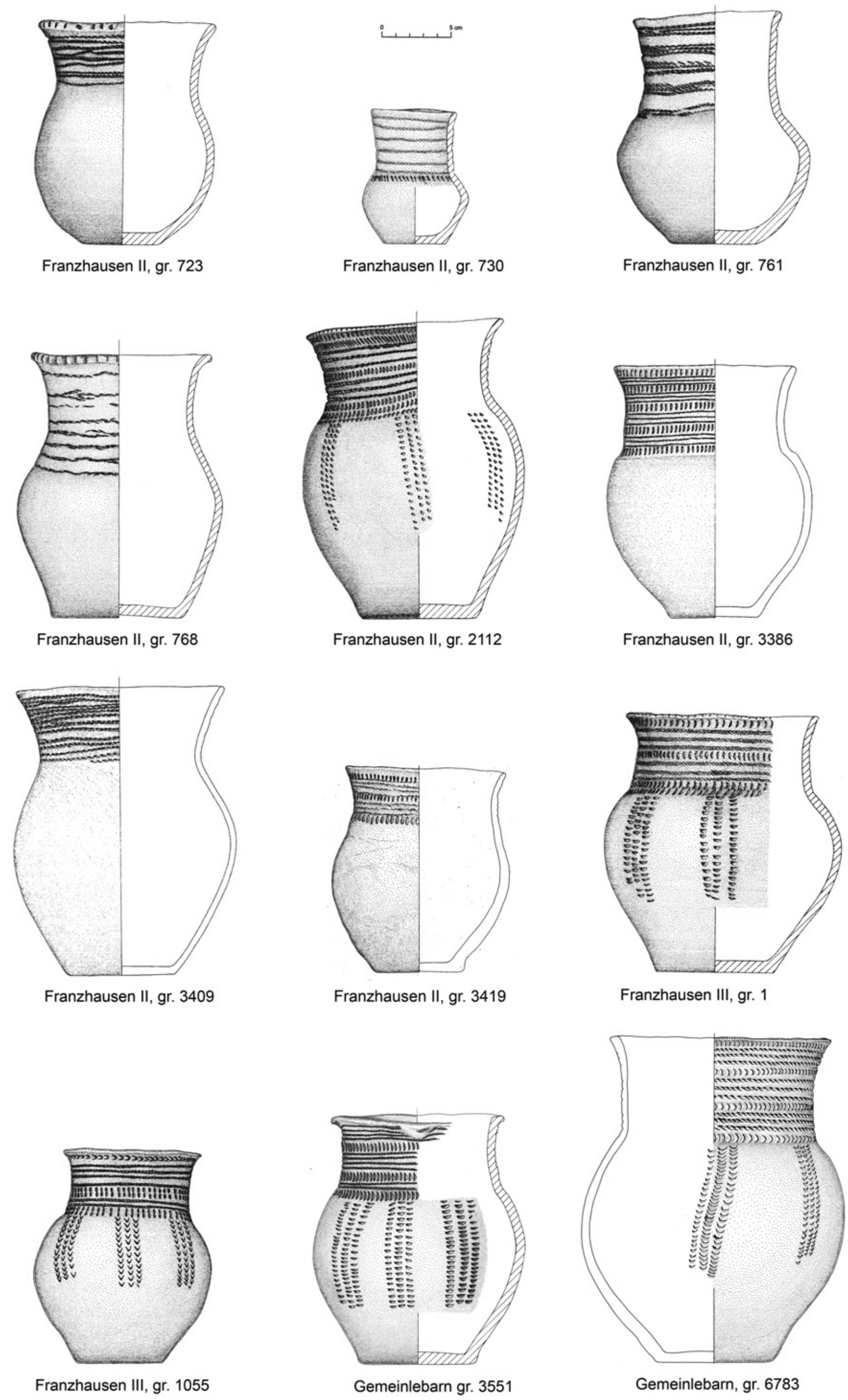

Fig. 2. Traisen Valley: Corded Ware beakers (drawing: M. Imam).

to as 'rope'. Some of the impressions on 'Corded Ware' are less than 2 mm in diameter. Nevertheless, we decided to employ the term 'cord' for all the impressions, in keeping with the name of the cultural group, 'Corded Ware'.

2.2. Catalogue of recorded vessels and data (Table 1 and Fig. 4)

Franzhausen II, grave 723: pattern: irregularly placed horizontal cord rows on the neck of the vessel. Cord impressions of fine tightly twisted cords (Z-twist), impressions irregular in depth.

Franzhausen II, grave 730: rows of horizontal cord impressions with 0.7–1 cm distance between one another on the neck of the vessel. Cord impressions of coarse cords, tightly Z-twisted, impressions 20% of the thread diameter.

Franzhausen II, grave 761: pattern: 4 horizontal bands of 3 rows of cord impressions next to each other on the neck of the vessel. Cord impressions of coarse cords (Z-twist), executed carefully and evenly.

Franzhausen II, grave 768: irregularly and with less care placed horizontal rows of cord impressions with 0.7–1 cm distance between one another on the neck of the vessel. Cord impressions

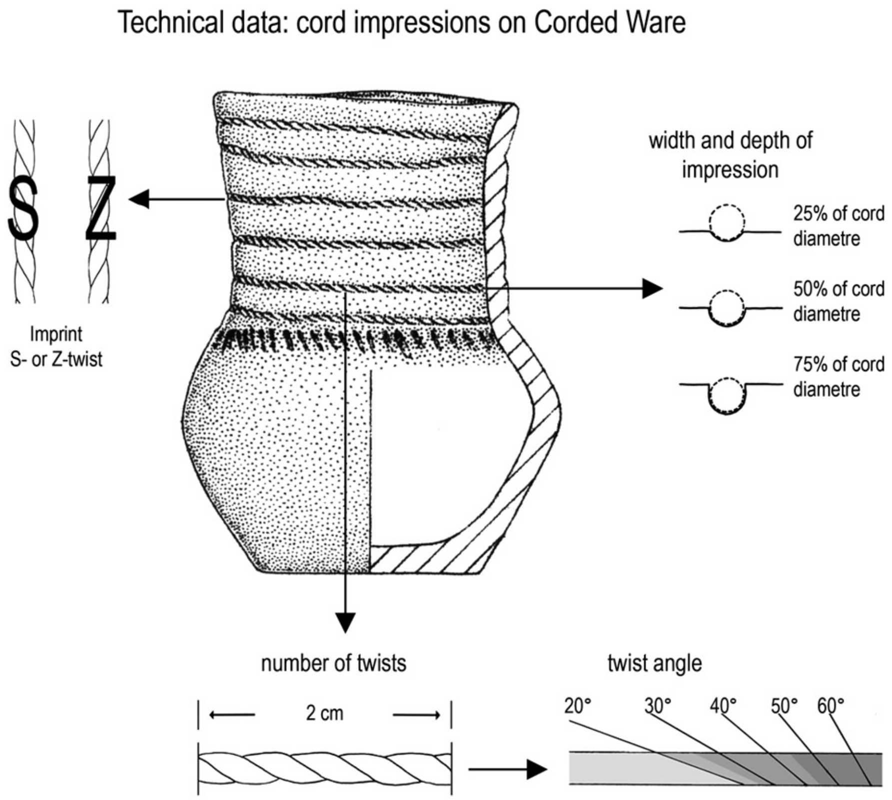

Fig. 3. Technical data recorded from cord impressions on Corded Ware beakers (drawing: K. Grömer).

of coarse irregularly twisted cords (Z-twist), impressions irregular in depth.

Franzhausen II, grave 2112: alternately, 3 horizontal close rows of cord impressions and rows of notch-like imprints on the neck of the vessel. Cords loosely Z-twisted, coarse and carefully deep impressed.

Franzhausen II, grave 3386: pattern: 4 horizontal bands of 3 rows of cord impressions next to each other; intermediate rows of notch-like imprints on the neck of the vessel. Cord impressions of fine loose cords (Z-twist), executed carefully and evenly.

Franzhausen II, grave 3409: densely placed horizontal cord rows on the neck of the vessel. Cord impressions: carefully executed tight Z-twisted cords, impressions uniform and even.

Franzhausen II, grave 3419: pattern: 3 rows of notch-like imprints intermediate irregularly placed horizontal bands of 3 cord rows on the neck of the vessel. Cord impressions of fine tightly twisted cords (Z-twist), impressions irregular in depth.

Franzhausen III, grave 1: alternately, 3 horizontal rows of cord impressions and one row of notch-like imprints on the neck of the vessel. Coarse cords, tightly Z-twisted, carefully deep impressed

Franzhausen III, grave 1055: pattern: 4 carefully placed horizontal rows of cords below the rim; below, 2 rows of oblong imprints and 2 more rows of cord impressions on the neck of the vessel. Cord impressions: fine cords, carefully Z-twisted, impressions uniform.

Table 1
Corded Ware from Traisen Valley: recorded technical data.

Site/grave	Twist direction imprint	Twist angle (plied yarn)°	Width imprint mm	Width cord mm	Depth imprint %	Number of twists 2 cm
Franzhausen II, gr. 723	Z	40–50	2	2–2.5	25–75	6–8
Franzhausen II, gr. 730	Z	40–50	2	2.5	25–30	6–7
Franzhausen II, gr. 761	Z	30–40	2	2	50	4
Franzhausen II, gr. 768	Z	20°	1.5–3	2–3	25–50	4
Franzhausen II, gr. 2112	Z	30	1.5–2	2	40	5
Franzhausen II, gr. 3386	Z	20–30	0.7–1	1	25	8–9
Franzhausen II, gr. 3409	Z	40	2	2	35	5
Franzhausen II, 3419	Z	30°	1–1.5	1.5	30–50	7–8
Franzhausen III, gr. 1	Z	40–50	2	2–2.5	50	5
Franzhausen III, gr. 1055	Z	40–50	1.5	1.5	50	6–7
Gemeinlebarn gr. 3351	Z	40–50	1.5–2	2	50–75	6
Gemeinlebarn gr. 6783	Z	30–40	3	3	50	4–5

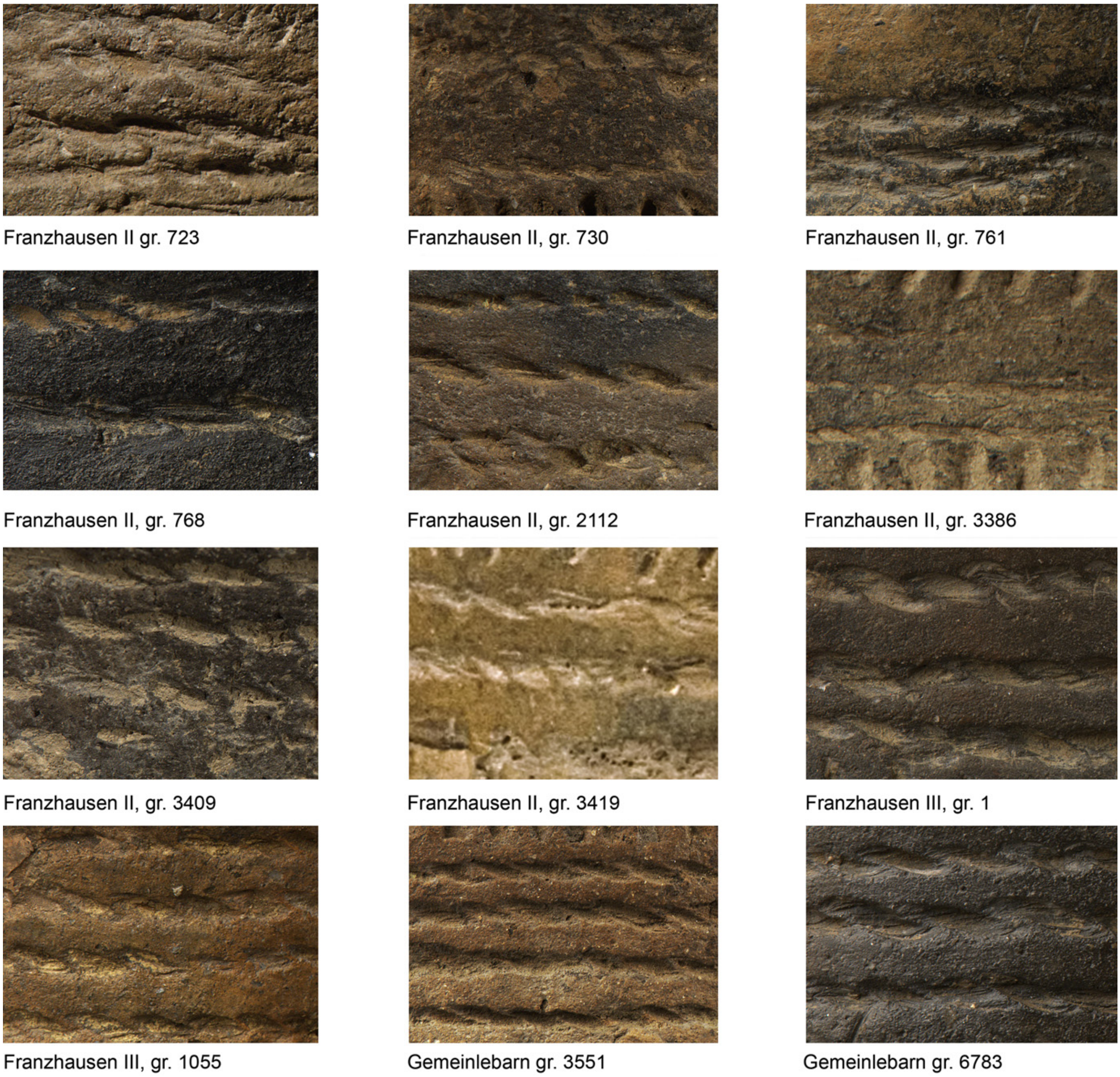

Fig. 4. Overview of cord impressions from the Franzhausen and Gemeinlebarn archaeological sites. The width of each image is 2 cm (photos: A. Rausch, ANWORA).

Gemeinlebarn grave 3551: alternately, 4 or 2 horizontal rows of cord impressions and notch-like imprints on the neck of the vessel. Cords tightly Z-twisted, carefully deep impressed.

Gemeinlebarn grave 6783: alternately, 3 horizontal rows of cord impressions and notch-like imprints on the neck of the vessel. Very coarse cords, Z-twisted, carefully deep impressed.

The impressions are Z-twisted, and therefore the original cords have to be S-plied. The cord impressions stretch once around the entire vessel, and sometimes the meeting points can be recognised by overlaps (Franzhausen II, gr. 2112, Fig. 4). There are no indications of the use of different cords in the decoration of a single vessel.

It is known that pots shrink as a result of drying and firing; thus, the cord impressions on the vessels would therefore be slightly thinner than the original cords. Our general conclusions are not affected by this slight difference.

3. Experimental archaeology: making cord impression with various raw materials

Experiments were designed to provide a better understanding of the Corded Ware impressions. The aim was to undertake a series of tests using different raw materials and then to compare the experimental impressions with those from the original beakers. The analysis was carried out by optical microscopy (Microscope: Wild M3Z, magnification $\times 10-\times 40$). Additionally, the microstructure of the experimental impressions was analysed with a Scanning Electron Microscope (LEO EVO 60) at the Vienna Institute for Archaeological Science (VIAS) (Fig. 8).

3.1. Questions and modus operandi

The principles and methodology of experimental archaeology have been discussed in many publications (e.g. Coles, 1973; Reynolds, 1999; Lammers-Keijsers, 2005). All of these authors state that it is important to define a clear hypothesis with respect to a specific archaeological problem, a modus operandi, and to compare the results of the experiment with the archaeological data.

1) The first question concentrated on the quality of the clay. This is important as the original Corded Ware beakers from the Traisen Valley suggest that different qualities of clay may affect the quality of the impression.
2) The second question regarded the establishment of the condition of the clay at the time the impressions were made. This included its wetness and other treatments, such as burnishing.
3) Finally, the most important question for the present study concerned the raw material that was used for the production of the cords, which formed the impressions on the Corded Ware vessels.

To address the first question, small clay tablets (with a diameter between 5 and 7 cm) were made using clay of varying quality (fine, medium fine, coarse, highly tempered). Fifteen tablets of each clay quality were produced using local deposits from Lower Austria (Laa an der Thaya, Maiersch and Gars/Thunau). In order to address the second question, impressions were made on the clay surface under different conditions. First, the patterning was carried out directly in the fresh clay; for the next series, the surface of the clay was dried; and for the third series, the clay tablets were slightly burnished in a not fully dried condition – as can be observed on the original pots. Different cord materials were impressed in all the tablets of different clay quality, with the surface treatments as described (Fig. 5).

Different raw materials were selected for the test cords in order to address our final question. Each of the five raw material groups of lime-bast (*tilia*), grass (*graminae*), flax (*linum usitatissimum*), sheep wool, and hair (horse hair from the tail and human hair) was accessible to the people in the first half of the third millennium BC. Analyses of plant material from circum-alpine lakeside settlements, especially from Switzerland, have produced a clear picture of various textile products, such as cordage, mats, basketry or woven fabrics (Schibler et al., 1997: chapters II, IV and V; Rast-Eicher, 1997: 310 ff.). In the Late Neolithic, oak-bast and lime-bast were preferred as cordage materials. The use of reed begins in the Horgen Culture and becomes very frequent in the Corded Ware Culture, while in this period flax is used infrequently.

Each step of the tests undertaken for this research was documented by digital photography and additional written records detailing the handling, working rhythm, and problems encountered, as well as the ideas that arose in the process. The clay tablets were marked so that clay quality, the surface condition and the cord raw material were all clearly identifiable. All parts of the experiment (cords and clay tablets) are now housed at the Museum of Natural History in Vienna for further investigation and as reference material for future comparisons.

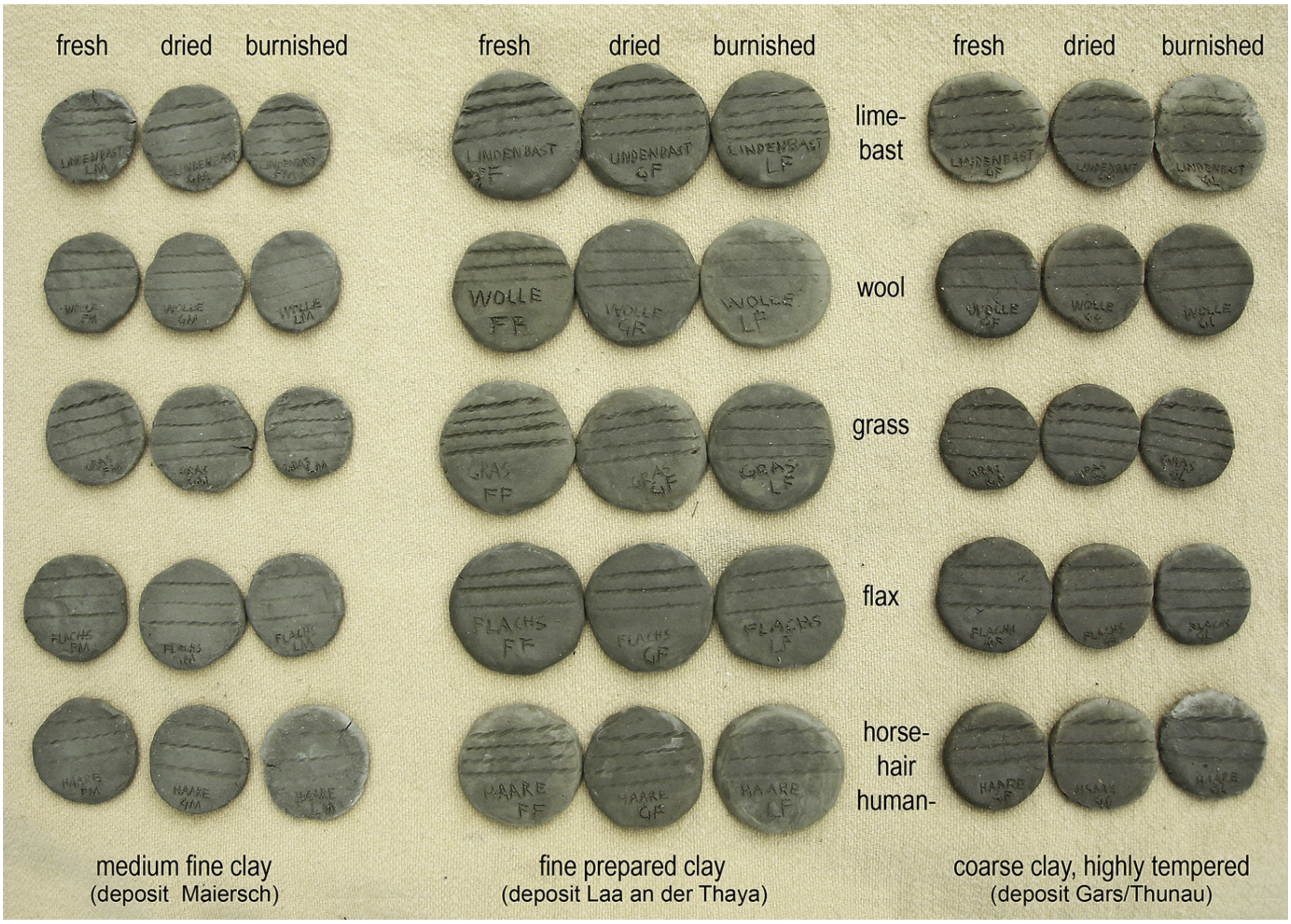

Fig. 5. Experimental Archaeology: clay plates of different quality and surface treatment with cord impressions.

3.2. Results of the experiments

3.2.1. Clay quality

It was assumed that the quality of the impression depends on the quality of the clay, its condition and surface treatment. The experimental impressions are as visible on fine as on coarse clay. While the beakers from the Traisen Valley are sometimes made of very finely prepared clay, the more normal material is medium fine clay with some inclusions; however, sometimes even coarse clay with a lot of inclusions was used for cord impressed beakers. The finer the clay, the more clearly visible is the microstructure of smoother cords, such as those made from flax. Surprisingly, strong and stiff cords, such as grass and bast cords display their microstructure equally well on both fine and coarse clay.

3.2.2. Surface condition

The best results can be obtained when pressing the cords directly into the fresh (wet) clay. Slightly smoothed surfaces on partially dried clay do not affect the impression very much, but, as might be expected, a dried surface makes the patterning difficult. For the cord impressions to work on dried surfaces, a great deal of pressure is necessary. This can be carried out on the flat tablets used for our experiments, but pressing the cords on vessels at the leather-hard stage would cause deformation or breakage. Additionally, the cords cannot be pressed very deeply into the clay. If we compare this with the data from the original beakers, we can be sure that the impressions were made on fresh or smoothed surfaces.

3.2.3. Cords of different raw material

Some interesting observations regarding the qualities of raw materials came to light during the manufacture of the different cord types used for the impressions. As previously noted, the prepared cords (Fig. 6) are about 2 mm in diameter, which is comparable to the impressions on the original vessels. The shrinkage of the clay does not affect the results very much, because it is in the range of the variability of the original cord impressions.

Lime bast and flax are very elastic, soft and smooth, so it is very easy to twist them and make a cord with different twist angles and different numbers of twists per centimetre (as we know from the original impressions).

Fig. 6. Drilling a cord from lime-bast (photo: P. Grömer-Mrazek).

While working with grass, it was noticed that fresh grass is as soft as lime bast, but because of the variable thickness of the leaves, it is not easy to make a completely even cord of the sort obtained from flax, which has more even fibres. Also, a cord made of fresh grass tends to disintegrate within a few days, as the grass dries out. The experimental use of dried grass for cordage indicated that it is a very stiff and hard material, making it impossible to ply a cord with a dense number of twists or a high twist angle.

It was interesting to note that there is a difference in terms of cordage between horse hair from the horse's tail and human scalp hair. The former has thick fibres and is a stiff material, comparable to dried grass but without the associated problems. Human hair is smoother, and cords of different twist angles can be easily made of it. Both human and horse hair result in cords with a very fine microstructure, caused by the fine even fibres.

Wool is very soft and smooth, so it is easy to produce cords in any required thickness out of this material.

The process of making the actual impressions with cords of the different raw materials (Fig. 7) brought more interesting features to light. Woollen cords are useless for Corded Ware impressions. Wool is too soft, the impressions are diffuse and do not even show the characteristic 'structure' of a cord. As pointed out above, bast and grass cords are made of single elements (fibres) of inconsistent thickness. Therefore, impressions of bast and grass are characterised by an irregular microstructure. Impressions made of hair and flax have an evenly fine microstructure, those of flax being even finer than those of horse hair (Fig. 8).

If we compare the impressions derived from the experiments with the data from the original beakers, we usually see a slightly irregular microstructure on the latter impressions. It seems as if the original impressions were executed with cords made with a raw material, which was not very finely prepared – such as bast or grass cords (Fig. 8). However, even though we identified clear analogies between the experimental and the original impressions (for example, the impression from Gemeinlebarn 6783 corresponds to the experimental grass impression in Fig. 7), it remains possible that fibres of other plants, which we did not test (such as hemp, as speculated by Sherratt, 1995: 31) could result in the same kind of traces.

The beakers from Graves 723 and 3386 at Franzhausen II are two exceptions. The impressions show a very fine microstructure, corresponding to a cord made of finer raw material – perhaps flax; however, so far we have not identified a sharp fine microstructure as in the cords made of human or horse hair.

4. Cord impressions on Corded Ware beakers from the Traisen Valley

Analysis of the technical data pertaining to Corded Ware impressions showed that the influence of the fabric on the decoration is not high. Impressions are seen as clearly on fine as on coarse clay. Most of the beakers show traces of burnishing. This was probably done after impressing the decoration on a fresh or smoothed surface.

Two principal cord types were used for the impression; both consist of S-plied cords, which result in a Z-plied impression on the vessel. Cords with a coarse microstructure (most probably bast or grass) and a diameter of about 2–2.5 mm were preferred. A very coarse example is known from a good quality beaker at Gemeinlebarn, Grave 6783. It is 3 mm in diameter and has only 2 twists per centimetre. Very fine cords were also used to make finer patterns (e.g. Franzhausen, Graves 3386 and 1055). Usually their microstructure is fine and even, and presumably a flax cord was used.

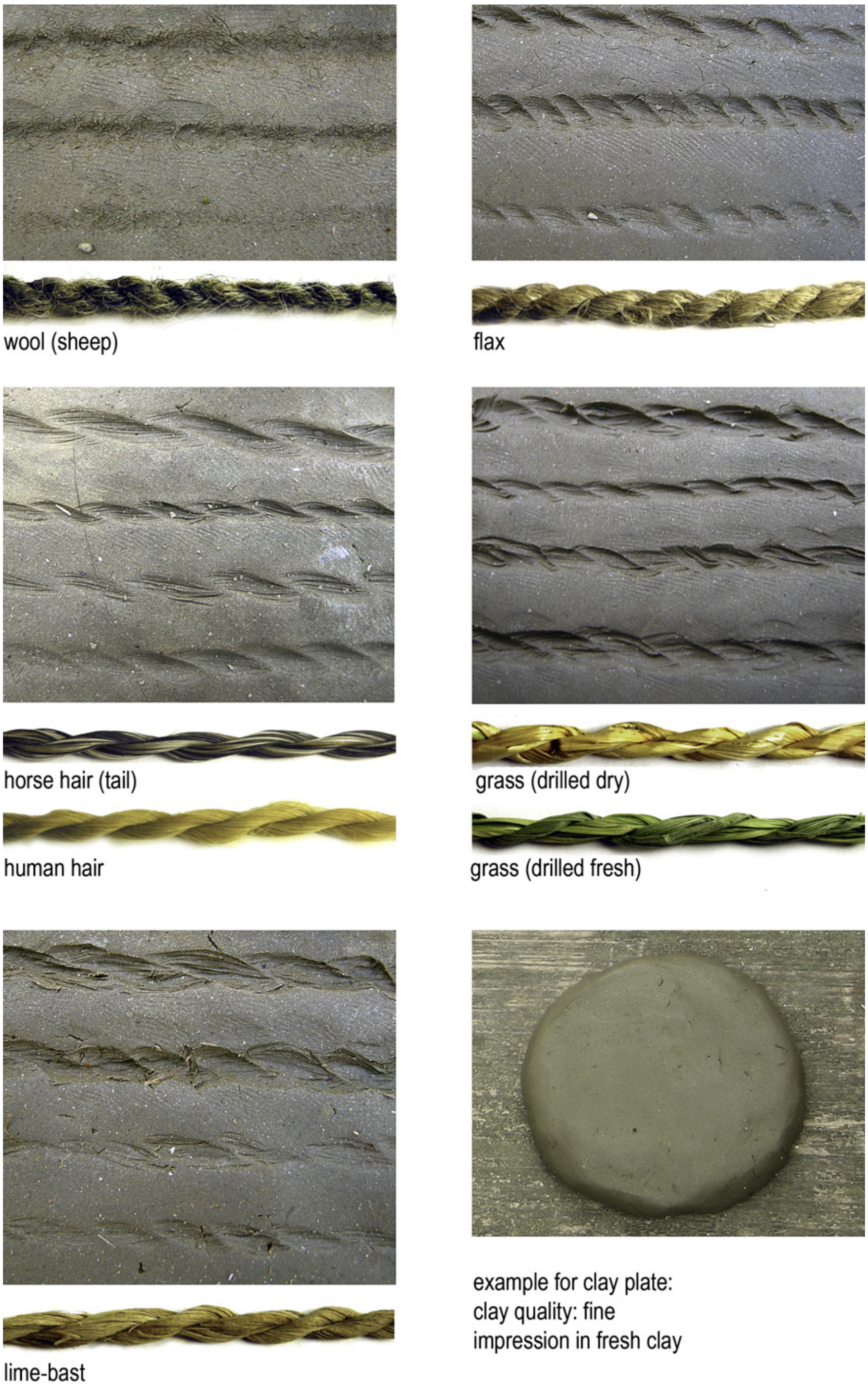

Fig. 7. Experimental Archaeology: Cord impressions on fresh clay, made with wool, flax, hair, grass and bast cords (© K. Grömer).

Such cord impressions are just 0.7–1.5 mm thick, they have a high number of twists per centimetre (4–5), and a high twist angle of about 50°, which strengthens the stability and stiffness of the cord.

The depth of impression varies. Usually the cord impressions are very clear, with impression about 50% deep, indicating that the full diameter of the cord can be seen and the structure of the cord is clearly visible. Sometimes the impressions are irregular.

It is interesting to note that irregular impressions correspond to irregularly executed patterns and coarser beakers (e.g. Franzhausen II, Graves 761 and 768). For example, the cord from the beaker Franzhausen II, Grave 768, has a great variety of twists per 2 cm (between 2 and 7), illustrating the irregularity of the twist.

5. Technical decisions and social implications

The analysis of technical data derived from Corded Ware from the AustrianTraisen Valley has shown that we can clearly identify two different categories of quality in relation to the beakers and their patterning. On the one hand, some of the artefacts are carefully made beakers with even patterning; the cords used for the impression are carefully twisted and the impressions are done with constant deep pressure so that the structure of the cord is clearly visible. Meanwhile, there are other examples of coarser, irregularly shaped beakers, decorated with irregular rows of cord impressions. Even the cords used are irregularly twisted. Perhaps differences between

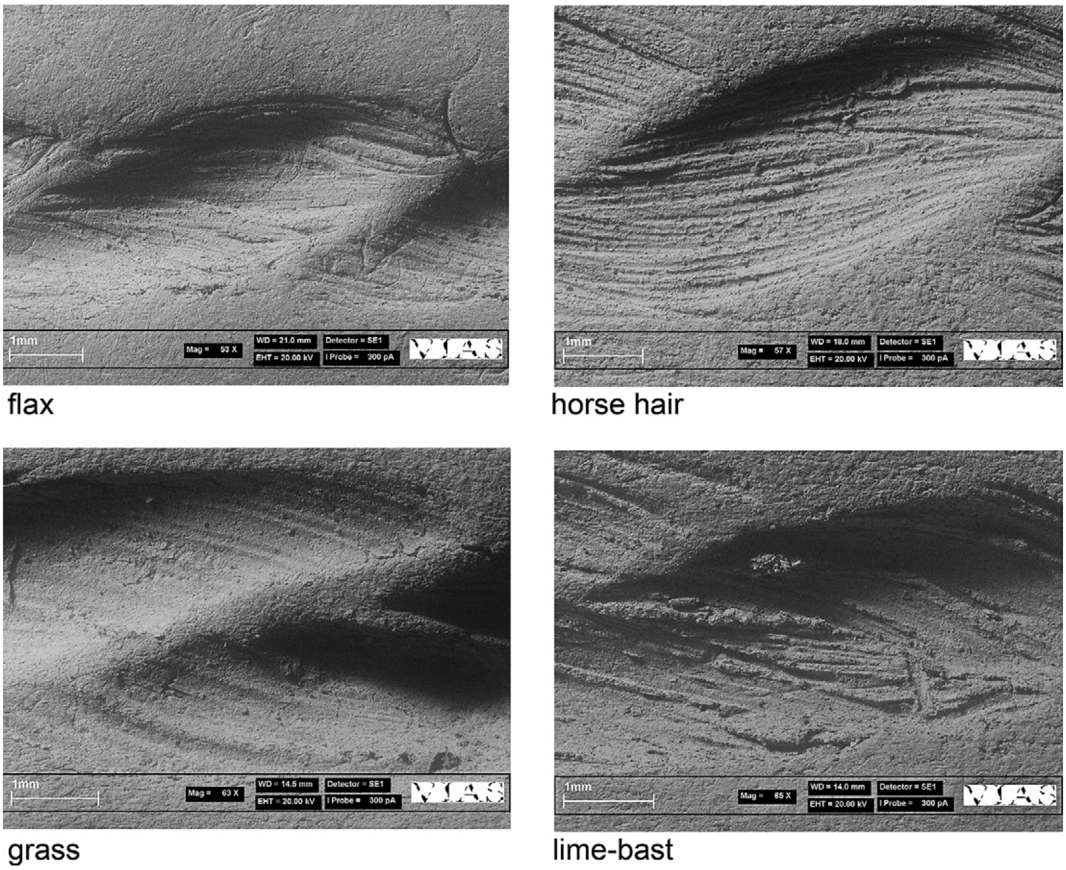

Fig. 8. Microstructure of cord impressions made with flax, hair, grass and bast cords (SEM photos, M. Kucera, VIAS – Vienna Institute for Archaeological Science).

good quality beakers with regular impressions and somewhat sloppy, coarse pots with irregular shaping and patterning are indicative of the work of 'masters' and 'apprentices'.

Another noticeable feature is that all of the cord impressions derive from S-plied cords, which cause Z-plied impressions. As pointed out by Antoinette Rast-Eicher (1997: 310 ff.), more than 80% of the organic cords found at Swiss lacustrine settlements from the Corded Ware Culture are also S-plied. According to this aspect, the author inferred that, for a right-handed person, S-plying is 'ergonomically' easier than working the cord in the *Z*-direction. The percentage of S- and Z-plied cords may therefore correspond to the percentage of right- and left-handed persons within the Corded Ware society.

The analysis of Corded Ware in the same area (Switzerland) (Giligny and Michel, 1995: Fig. 4) has shown that the majority of impressions are caused by using S-plied cords (Z-plied impression). Our Traisen Valley data are comparable with these results.

6. Conclusion

In the present paper, archaeological experiments have been used to improve archaeological knowledge concerning the possible raw materials employed to manufacture the cords used for pottery decoration and the way in which these impressions were actually made. As a result of these experiments, we can exclude the use of woollen cords for the impressions. Bast-fibre and grass seem to have been used for the majority of the decorations. Some cord impressions show a very fine microstructure that is analogous with that of the experimental impressions made with flax.

The impressions were made on a fresh or possibly smoothed surface. The quality of the clay does not significantly affect the quality of the impressions. A correlation between irregular cord impressions and less carefully made vessels was observed.

Acknowledgements

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3.2. Efficiency and technique – Experiments with original spindle whorls

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Efficiency and technique – Experiments with original spindle whorls

Karina Grömer

Abstract

In order to be able to understand better the general context of textile production in European prehistory, it is necessary to get to grips with spindle whorls – the commonest textile-related artefacts found on archaeological sites. Tests were made to establish the efficiency of various spindle whorl forms from all horizons of prehistory (Neolithic to Iron Age); measurements were taken of spindle whorl twist frequency and twist duration, together with the yarn strength achieved with the spindles. This all offers a new perspective on the rare finds of textile remains.

Um den Gesamtkontext der textilen Produktion in der Urgeschichte besser verstehen zu können, ist es nötig, sich vor allem auch mit den im archäologischen Fundgut am häufigsten vorkommenden Artefakten, den Spinnwirteln, auseinanderzusetzen. Dabei wird die Leistungsfähigkeit verschiedener Spinnwirtelformen aus allen Abschnitten der Prähistorie in Form von Messungen zur Drehfrequenz und Drehdauer eruiert, sowie auch die mit den einzelnen Spindeln erzielbaren Fadenstärken, was wiederum einen ergänzenden Blickwinkel auf die eher spärlich gefundenen Textilreste gibt.

Introduction

Textile techniques are a field hard to explore since all organic material usually decays: the tools used to produce textiles not the textiles themselves are preserved. Generally, in Central Europe we just have artefacts of stone, antler, bone or pottery. In the course of our textile research we deal with basic technique, the questions concerning spinning, the production of threads by the use of a hand-operated spindle.

The aim of this research was to assess the mechanism of prehistoric spindles, of which we only find the whorls (usually made of clay) on conventional prehistoric sites in Central Europe. It was important to evaluate the characteristics and technical facts of different spindle whorls to make statements about the mode of operation. It was tried to obtain basic data on the question of efficiency and the technique of prehistoric spindle whorls. For that it was very important to test the original artefacts (only examples in adequate condition could be used).

The experiments were carried out with whorls originating from sites in Upper and Lower Austria, dating from the Neolithic to the Roman Period (about 3.500 BC to 400 AD). The whorls were selected according to weight and shape, but above all used only items which would survive the handling undamaged. Even minor damage could affect the behaviour of a piece; for its weight or shape might change more or less, which could influence the turning properties.

Within this experiments the typical big whorls from the late Neolithic Jevišovice Culture from Meidling/Kleiner Anzingerberg and Krems-Hundsteig were tested. From the Early Iron Age we have very small, variously shaped and richly decorated whorls; for the experiments we used examples from Malleiten/Bad Fischau (Early Iron Age, HaC) and Hallstatt (Early Iron Age, HaC and HaD). The originals from a later period, from Mannersdorf (Late Iron Age, LtB) and Halbturn (Late Roman Period, 2.-5. cent. AD)[1], which were tested, were similar (Fig. 1).

Different techniques of spinning

In prehistoric times the hand-operated spindle consisted of a wooden stick and a whorl as flywheel, usually made of clay[2].

In the process of spinning the fibres were twisted to achieve a thread of a specific thickness. The spindle has to be rotated, the woollen or flax fibres were drafted and immediately twisted to a thread. It is possible to hold a pick of fleece in one hand and to spin the thread directly "out of the hand". For carrying a large quantum of wool or for spinning flax a distaff is needed, which is a long stick: The phytogenetic material or extended fibres have to be fixed

1 Thanks for making the original whorls available to: Institute for Prehistory, Vienna (Malleiten), Dr. Alexandra Krenn Leeb (Meidling), ASINOE (Krems/Hundsteig), Museum of Natural History (Hallstatt), Peter Ramsl (Mannersdorf), Nives Doneus (Halbturn)

2 More detailed see Grömer 2003.

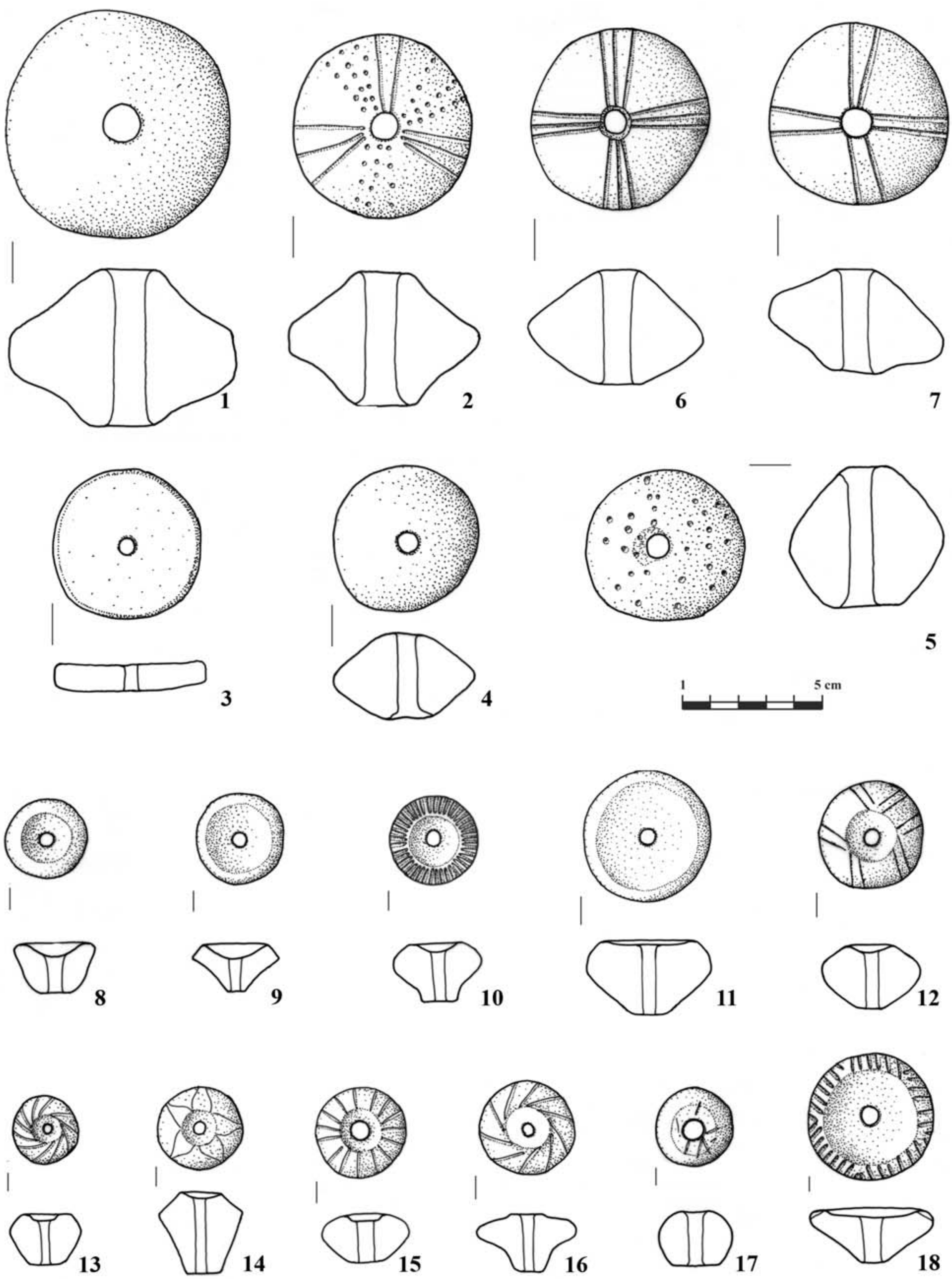

Fig. 1: Prehistoric spindle whorls used for the experiments: 1-5: Krems/Hundssteig. – 6-8: Meidling/Kleiner Anzingerberg. – 9-12: Malleiten/Bad Fischau. – 13-16: Hallstatt. – 17: Mannersdorf a. Leithagebirge. – 18: Halbturn (The numbers correspond with Fig. 7) (© K. Grömer).

on and worked with both hands. If the thread is long enough, it can be wound around the spindle- stick before continuing to spin.
There are two different basic techniques (with a lot of variations of each) applied to spin threads with a hand-operated spindle. The first is the use of the spindle „free hanging" on the lenghtening thread (Fig. 2); the second is to let the spindle run on the ground or in a vessel (Fig. 3).
The advantage of the second technique is that gravity has no influence on the spinning process. But with this technique the spinner has to stay on one place, while the use of the spindle „free hanging" makes it possible to spin while sitting, standing, walking or even while riding on muleback. In addition to producing single yarns a spindle can also be used to ply two or more threads together.

The Experiments

For all experiments the original whorls were attached to standarised wooden sticks of 27-29 cm length, with a weight of 3-5 g. For the smaller whorls thinner rods of 3 g, for the bigger ones sticks of 5 g were used (Fig. 4).
It has to be mentioned that the results of all experiments are influenced by my personal manual skills (I have about 10 years spinning experience); results achieved by another

Fig. 2: Spinning with a „free hanging" hand-operated spindle (© K. Grömer).

Fig. 3: Spinning with a hand-operated spindle, running in a vessel (© K. Grömer).

person even under similar conditions and circumstances might be different, but in general we would expect the same results.

Relation between the weight of the whorls and the thread thickness

To examine the question of a relationship between the weight of the whorls and the thickness of the threads that can be achieved, we tested two quite different types of spindle whorls (Fig. 5). We used the original artefacts from Hallstatt (weights of the whorls between 8-20 g, Early Iron Age) and from Meidling (weights of the whorls between 120-140 g). Such extremely big whorls are typical for the late Neolithic Jevišovice Culture (in Moravia and Lower Austria) and for the Chamer Culture (in Upper Austria and Soutern Germany, around 3.000 BC). Those big whorls here are seen as artefacts for spinning, but it has to be mentioned that they are even heavy enough bo be used for weaving.

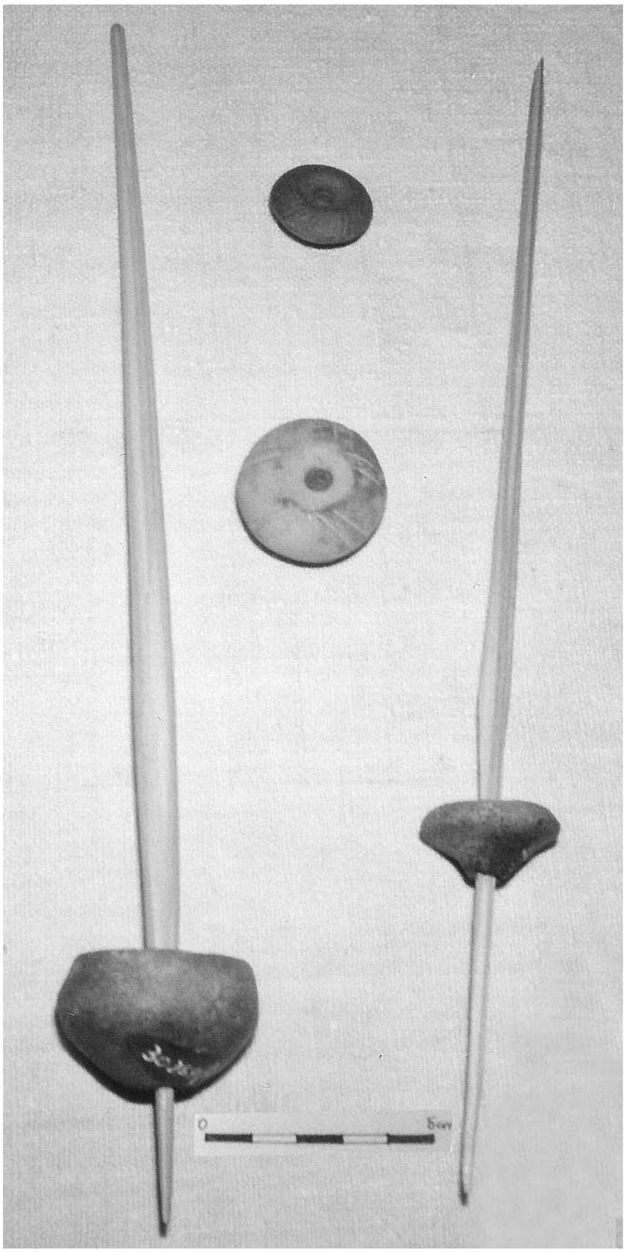

Fig. 4: Spindle whorls from Malleiten, Iron Age, prepared for the experiments (© K. Grömer).

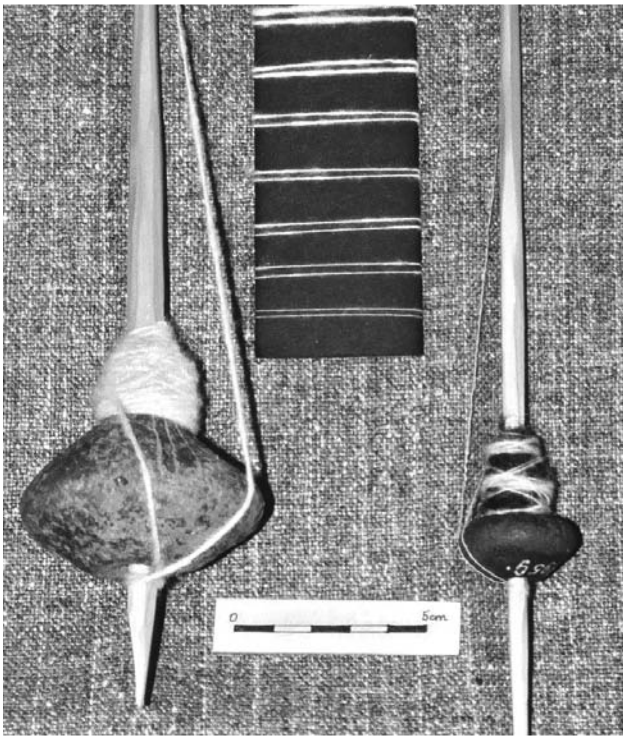

Fig. 5: Comparison between an averaged thread spun with a heavy Neolithic whorl from Meidling (133 g) and with a light Iron Age whorl from Hallstatt (12 g) (© K. Grömer).

Flax and mainly carded woollen fleece was used for the tests, two of the main materials used in European Prehistory for producing textiles. The spindles with the original whorls were used both free hanging and running on the ground to find out the differences between those two spinning techniques.

As a result of our experiments (Fig. 6) generally we can state that heavier whorls go better with thick woollen threads (for wool at between 0.7-2 mm and even more) or flax, but only if the technique of letting the spindle hang free is adopted.

When the spindle is used running on the ground (or in a bowl) fine threads of 0.3 mm diameter can also be spun with heavy whorls (more than 100 g); for gravity does not affect the spinning process or break the thread. The best results using very heavy spindles were achieved in producing threads of 0.8 to 1.5 mm. They go very well, quick and easy, without a lot of concentration (which is needed in spinning very fine yarns that they do not break). The work even can be done walking.

A very light spindle with a weight of 10-20 g cannot be used for threads at more than 1.5 mm diameter or flax, what ever technique is employed. Because the thread is so thick, the spindle quickly stops and tries to turn backwards, so the thread cannot be twisted correctly. By running in a bowl the whorl is additionally slowes down, which has a negative effect on the efficiency. By means, trying hard it is possible to spin thick woollen threads or flax with very light spindles, but that was surely not the intended function of this tool. With a small spindle not enough inertial power can be produced to spin thick or stiff fibres. The best results we achieved were with woollen threads between 0.2 and 0.7 mm thick. It is no problem to produce very thin threads of 0.2 mm thickness, such as can be found at the prehistoric salt-mines at Hallstatt.

A common result of the testing of the two different types of spindle whorls (Fig. 6) is that the often published view[3], that heavy whorls are useful for the production of thick woollen threads and flax, and light whorls are good for

3 For example see Rast Eicher 1997: 304. Dunning 1992: 43 f. Schade Lindig and Schmitt 2003: 12 f.

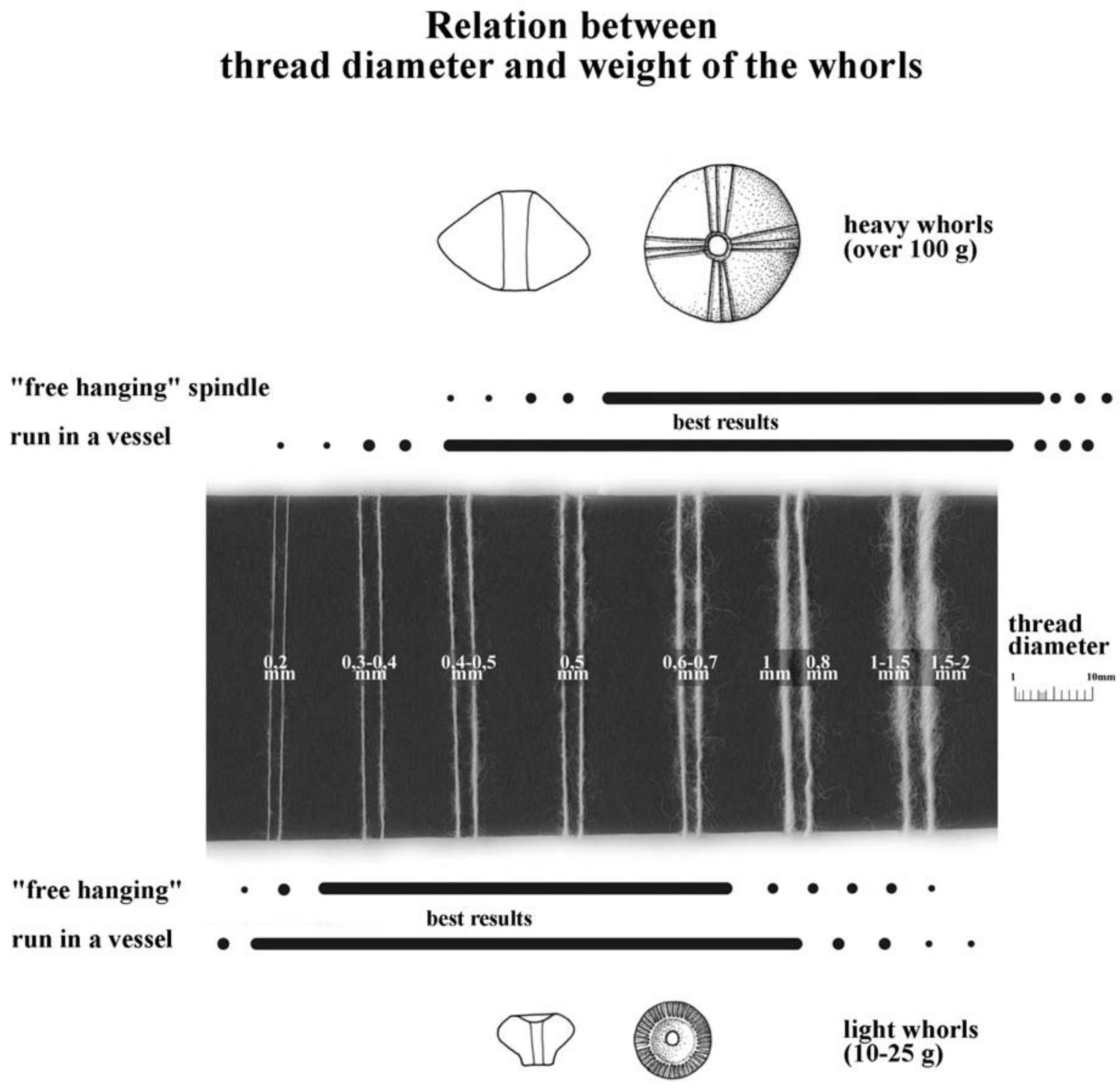

Fig. 6: Relation between thread diameter and weight of the whorls. Differences between extremely light and extremely heavy whorls and differences between using the spindle free hanging or run in a vessel. The experiment was made in spinning wool (© K. Grömer).

spinning thin woollen threads can be verified. It became evident that whorls between these two extremes brought results between the minimum and maximum achieved. In my experience whorls with a weight around 40 g are practical for nearly every thread thickness which was used in European prehistory.

Comparing the thread thickness of yarns found at Late Neolithic and Hallstatt Period sites, these results fit very well with archaeological finds. For the Hallstatt Period very small whorls with 10-15 g weight are very often; the biggest are about 40 g. Even the woven farbics of that age frequently show fine yarns of 0.2-0.5 mm thickness. Ones thicker than 1 mm are rarely evidenced[4]. The rare yarns from Neolithic sites (most of them from lake dwellings in Switzerland) are usually around 0.6-1.2 mm and of plant fibre. The Swiss Neolithic whorls are usually heavier than the Hallstatt Age ones, about 20-100 g[5].

Frequency of turns and time-measurement of operation

The aim of the experiments was to find out differences in the efficiency of spindle whorls from the Neolithic to the

4 See Grömer, The Textiles from the prehistoric salt mines in Hallstatt, in this volume.

5 For example the late neolithic settlement Arbon Bleiche 3: Leuzinger 2002: 119, Fig. 151 and 123, Fig. 160.

No.	Site	Date	Material	Diameter	Thickness	Weight	Frequ. 1	Frequ. 2	Time
1	**Krems**/Hundssteig, Nr. 523	Late Neolithic	darkbrown clay	7,9 cm	5,1 cm	259 g	59	73	63 sec
2	**Krems**/Hundssteig, Nr. 561	Late Neolithic	brownish clay	6,4 cm	4,8 cm	147 g	78	94	57 sec
3	**Krems**/Hundssteig, Nr.168	Late Neolithic	reddish clay	5,3 cm	0,9 cm	39,5 g	140	171	37 sec
4	**Krems**/Hundssteig, Nr. 548/1	Late Neolithic	redbrown clay	5,4 cm	3,1 cm	78 g	122	136	45 sec
5	**Krems**/Hundssteig, Nr. 548/2	Late Neolithic	darkgrey clay	5,7 cm	5,1 cm	124 g	90	109	54 sec
6	**Meidling**/Kl. Anzingerberg, FNr. 3787	Late Neolithic	darkbrown clay	6,1 cm	4,1 cm	133 g	81	105	58 sec
7	**Meidling**/Kl. Anzingerberg, FNr 842	Late Neolithic	greybrown clay	6,7 cm	3,9 cm	141 g	79	99	55 sec
8	**Meidling**/Kl. Anzingerberg, FNr 122	Neolithic?	reddish clay	3,2 cm	1,9 cm	19 g	162	209	28 sec
9	**Malleiten**/Bad Fischau, Nr. 30269/19	Ha C	hellbrown clay	3,8 cm	2,3 cm	24 g	156	200	29 sec
10	**Malleiten**/Bad Fischau, Nr. 30269/3	Ha C	greybrown clay	2,7 cm	1,3 cm	8 g	160	223	17 sec
11	**Malleiten**/Bad Fischau, Nr. 30269/43	Ha C	greybrown clay	4,5 cm	2,6 cm	42 g	145	175	38 sec
12	**Malleiten**/Bad Fischau, Nr. 30269/33	Ha C	grey clay	3,3 cm	1,7 cm	9 g	154	220	18 sec
13	**Hallstatt**, Grave 380, Nr. 24.827	Ha C	redbrown clay	2,4 cm	1,8 cm	8 g	154	225	15 sec
14	**Hallstatt**, Grave 58, Nr. 23.831	Ha C	darkbrown clay	2,8 cm	2,7 cm	14 g	150	202	18 sec
15	**Hallstatt**, Grave 87, Nr. 23.959/1	Ha D	greybrown clay	3,1 cm	1,6 cm	12 g	161	220	21 sec
16	**Hallstatt**, Grave 87, Nr. 23.959/2	Ha D	black clay	3,4 cm	2 cm	12 g	155	218	19 sec
17	**Mannersdorf** a. Leithagebirge, Gr. 95	LT B	grey clay	2,9 cm	2 cm	20 g	161	208	34 sec
18	**Halbturn**, Grave 20	2.-5. cent. AD	grey clay	4,2 cm	1,7 cm	30 g	145	185	36 sec

Fig. 7: Experiments on the frequency of turns and time of operation: Work with free hanging spindle. (time: operation time, in seconds. Frequ. 1: Frequency of turns in 6 seconds, 1 single turn. Frequ. 2: Frequency of turns in 6 seconds, repeated turns. Ha C+D: Early Iron Age, Hallstatt Period. Lt B: Late Iron Age, Latène Period). The numbers correspond with Fig. 1 (© K. Grömer)

Iron Age and Late Roman Period. The differences are evident from the shape and particularly the weight of the spindle whorls.

To evaluate work with a free hanging spindle of different prehistoric eras, the duration of operation (how long does the spindle turn, in seconds) and the frequency of turns (number of twists in 6 seconds) are examined[6].

It is very important for the spinning process that the spindle rotates for as long as possible after it has been set in motion; for each movement of the hand means an additional effort. With a high frequency of turns the developing thread can be very quickly twisted to get the desired number of turns.

In our experiments (Fig. 8) on the number of turns the spindles were used free hanging. Two differently coloured threads were twist together, thus making it easier to count the turns. For the turning frequence experiments the spindle was hanging free; the turns were counted in standardized intervals of 6 sec. Two different points were tested, the number of twists in a) one single turn and b) repeated turns within the 6 seconds. For every whorl of each test 5 measurements were taken and the averaged result is shown in table Fig. 7. A high frequence is positive also because the thread can be spun very fast in the desired number of turns (Fig. 8). The whorls with a weight between 124 to 147 g turned after being set in motion 78 to 90 times in 6 seconds. The lightest spindles weighing 10-20 g completed between 140 and 170 turns. Repeated motion of the light spindles within the 6 seconds shows axial rotations of 220-175 turns.

The influence of the weight on the efficiency (light whorls generally have a higher number of rotation than heavier ones) changes in the course of conventional spinning due to the weight of the spun thread wrapped around the spindle. The air resistance of the bundle of newly spun threads also works as an energy-absorber and slows down light spindles.

The shape of whorls has great effect on the spinning-process: discoid pieces turn faster than spherical ones; for their centre of gravity is further away from the axis.

Measuring the duration of turning after settinng in motion we saw that light spindles turn much for a shorter time

6 Compare with Bohnsack 1985: 57 ff.

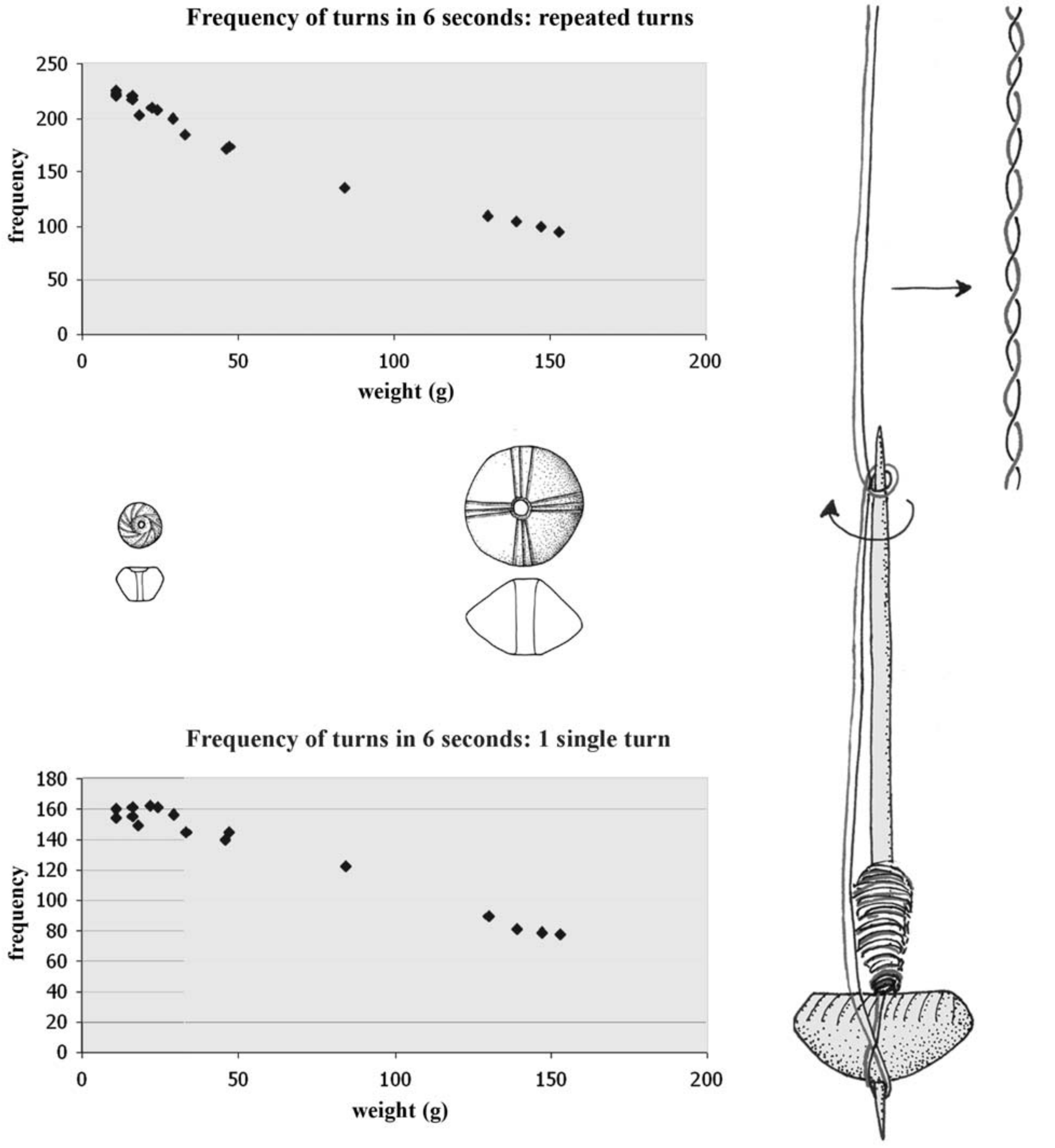

Fig. 8: Frequency of turns: Number of twists in 6 seconds, difference between repeated turns (above) and one single turn (below) within that time. Differences between light and heavy whorls (© K. Grömer).

than more massive examples. Heavy whorls weighing 124 to 147 g turned up to one minute, while light pieces of 10-15 g turned only 15-20 seconds. Each whorl was fitted with a spindle, hung on a 2 m thread and given one twist. To get an objective result, 3 tests were carried out with each spindle whorl and the results were averaged.

For the measurement of the rotating time the spindle was hung on a 2 m long thread and turned once. The aim was to find out for how long one spindle turns (in seconds) until it stops and begins to turn backwards. In this experiment three measurements were taken from each whorl and the averaged time is shown in table Fig. 7.

Results

Taken as a whole the experiments inducate that the weight of the spindle whorl and therefore its efficiency, the number of turns once the spindle has been set in motion and the rotating time have a direct influence in the purpose of the spindles (and whorls).

The great speed with which larger spindles twist the thread, together with their lesser weight, is an advantage in the production of fine wool yarns, since fine yarns (perhaps 0.2-0.4 mm thick), assuming a comperable lenght and twist angle, require many more rotations than yarn of (say) 1.5 mm diameter. The disadvantage of very light spindles, that they have to be reset in motion more often, is somewhat reduced to the great number of turns in each sequence.
For the production of very thick wool threads (over 1.5 mm) it is important that the spindle should have great mass and be very long and harmonious twining, which guarantees an even rotation sequence. It is of minor consequence that heavy whorls show a smaller number of turns; for thick yarns of a length that can be achieved in a single operation the spindle does not have to be set in motion so often to stabilise the thread.

Leistung und Technik – Experimente zum Spinnen mit Originalspinnwirtel

Der gesamte Bereich der Textilen Techniken ist im archäologischen Fundmaterial aufgrund der Vergänglichkeit organischer Materialien meist nur indirekt, in Form der für die Herstellung verwendeten Geräte erhalten. Diese bestehen oft aus Materialien wie Stein, Knochen oder Ton und konnten daher in unseren Breiten im Boden überdauern. Die hier behandelte Fragestellung bezieht sich auf das Spinnen, der Bildung von Fäden mittels Handspindel. Um die Wirkungsweise prähistorischer Spindeln – im archäologischen Fundmaterial großteils nur als tönerne Spinnwirtel fassbar – bewerten zu können, ist es nötig, sich mit den Eigenschaften verschiedener Spinnwirtel und damit den unterschiedlichen technischen Gegebenheiten auseinanderzusetzen.
Es wurde versucht, den verschiedenen Aussagen zu Leistung und Technik der Spindeln in der Urgeschichte eine Datenbasis zu geben. Um möglichst authentische Ergebnisse zu erhalten, war es unbedingt notwendig, die prähistorischen Wirteln selbst zu testen, vorausgesetzt der Zustand der Artefakte erlaubte dies. Verwendet wurden für die verschiedenen Experimente Originalspinnwirtel aus Ober- und Niederösterreich vom Neolithikum bis zur römischen Kaiserzeit (Fig. 1).

Das Spinnen in verschiedenen Techniken

In der Urgeschichte wurde mit der Handspindel gesponnen, die aus einem hölzernen Stab und einer meist tönernen, als Schwunggewicht dienenden Spinnwirtel besteht.

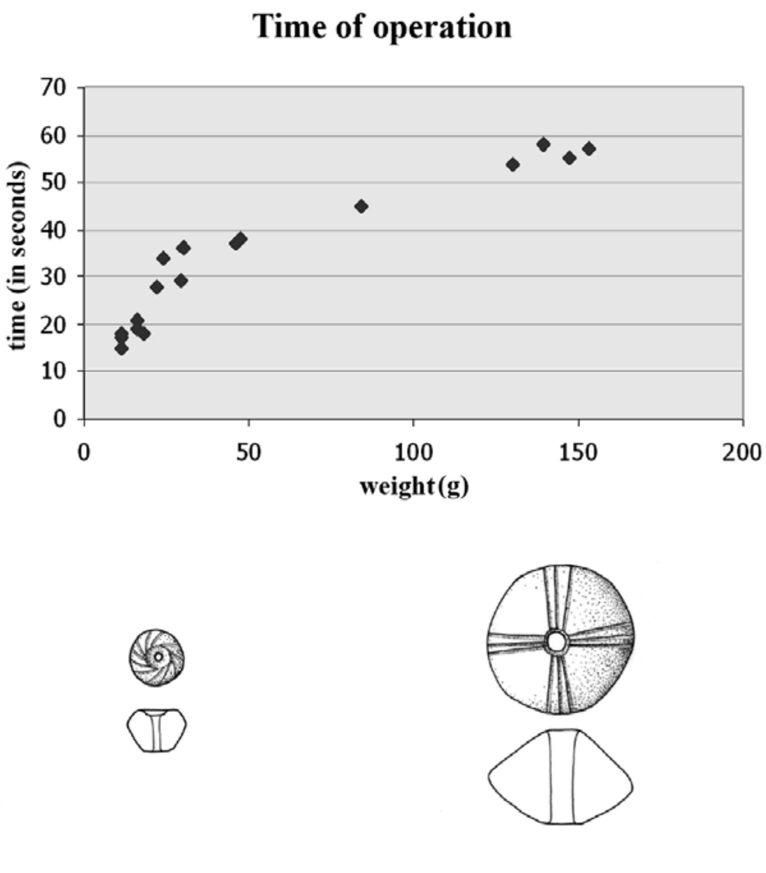

Fig. 9: Duration of operation of light and heavy whorls (© K. Grömer).

Beim Spinnen werden einzelne Fasern miteinander zu einem beliebig dicken Faden verdrillt. Das Wollvlies, bzw. das Flachsbündel (Bast etc.) wird gleichmäßig zu einem dünnen Band verzogen, die Spindel wird in Drehung versetzt und durch diese Drehung verzwirbelt sich das Fasermaterial sofort zu einem Faden. Bei Schafwolle kann das Vlies in der Hand gehalten und sozusagen „aus der Hand gesponnen" werden. Beim Verspinnen von Flachs oder anderen pflanzlichen bzw. langfaserigen Materialien muss ein Hilfsmittel, der Spinnrocken, verwendet werden, von dem mit beiden Händen die Fasern verzogen werden.
Es sind beim Spinnen mit der Handspindel zwei unterschiedliche Grundtechniken mit zahlreichen Abwandlungen möglich. Zum einen wird die Spindel „hängend" verwendet, sodass die Spindel an dem gerade entstehenden Faden in der Luft hängt (Fig. 2). Andererseits ist es auch möglich, die Spindel in einer Schale (Fig. 3) oder auch auf dem Boden laufen zu lassen, sodass die Schwerkraft nicht auf sie einwirkt. Es können mit der Spindel auch zwei oder mehrere Fäden miteinander verzwirnt werden.

Die Experimente

Spinnwirtelgewicht in Relation zur Fadenstärke

Bei der Frage, welcher Zusammenhang zwischen dem Gewicht einer Spinnwirtel und möglichen erzielbaren Fadenstärken beim Verspinnen von Wollvlies und Flachs besteht, wurden Originalspinnwirtel aus Meidling/Kleiner Anzingerberg (Spätneolithikum, mit Gewichten zwischen 120-140 g), sowie aus Hallstatt (ältere Eisenzeit, mit Gewichten von 8-20 g) getestet.
Allgemein kann als Ergebnis (Fig. 6) festgehalten werden, dass sich schwere Spinnwirtel eher für dickere Wollfäden und für Flachs eignen, wobei einschränkend hinzugefügt werden muss, dass dies nur bei der Spinntechnik gilt, bei der die Spindel frei hängend verwendet wird.
Wird die Spindel am Boden (in einer Schale) laufend verwendet, so ist mit einer schweren Spindel über 100 g auch bei Wolle eine sehr feine Fadenstärke von 0,3 mm herstellbar, da die Schwerkraft nicht auf den Faden einwirkt.
Eine sehr leichte Spindel mit ca. 10-20 g ist hingegen nicht in der Lage, zu dicke Wollfäden (ab 1,5 mm Stärke) oder Flachs zu verarbeiten, unabhängig von der Spinntechnik. Im Gegenteil, wird sie am Boden laufend verwendet, so wird sie noch zusätzlich gebremst, was die Effizienz noch mehr beeinträchtigt.

Drehfrequenz und Laufzeit

Ziel ist es, etwaige Unterschiede bei Spinnwirtel unterschiedlicher Zeitstellung festzustellen, die sich auf die Leistungsfähigkeit der Spinnwirtel auswirken. Diese Unterscheide liegen vor allem im Gewicht, aber auch in der Form der Spinnwirtel. Um die Spinnarbeit mit der frei hängenden Spindel unterschiedlicher Zeitstufen richtig einschätzen zu können, wurde die Laufzeit (Drehdauer: Zeit bis zum Stillstand der Spindel bei einmaligem Andrehen) und Frequenz der Spindel (Umdrehungszahl pro Zeiteinheit, hier 6 sec.) untersucht.
Wesentlich ist für die Produktivität beim Spinnprozess, dass sich die Spindel möglichst lange dreht, da man die Spindel dann nicht so oft andrehen muss – jeweils ein zusätzlicher Handgriff beim Spinnen. Eine sehr hohe Spinnfrequenz ist jedoch auch von Vorteil, da der entstehende Faden schnell mit den gewünschten Drehungen versehen werden kann.
Die Stücke mit einem Gewicht von 124 bis 147 g drehten sich in 6 sec. bei einmaligem Andrehen 90-78 mal (Fig. 7-8). Die leichtesten Spindeln zwischen 10-20 g konnten vergleichsweise mit einer doppelten Drehfrequenz von 140-170 Umdrehungen aufwarten. Dieser Einfluss des Gewichtes auf die Leistungsfähigkeit (die leichteren Spindeln haben eine höhere Drehfrequenz als schwere Spindeln) ändert sich bei einer im herkömmlichen Spinnablauf zunehmenden Bewicklung. Die Bewicklung wirkt sich bei den leichten Spindeln durch den vermehrten Luftwiderstand als Schwungdämpfer aus.
Bei der Messung der Laufzeit oder Drehdauer der Spindeln bei einmaligem Andrehen verhält es sich nun genau umgekehrt: leichtere Spindeln haben eine weitaus kürzere Laufzeit als schwerere (Fig. 7 und 9). So laufen die schweren Spindeln mit 124-147 g Gewicht fast 1 Minute lang, während die mit um 10-15 g sehr leichten Exemplare teilweise nur 15-20 sec. laufen.

Ergebnisse

Gesamt gesehen hat das Gewicht der Spinnwirtel und damit die Leistungsfähigkeit, die Drehfrequenz und die Laufzeit einen direkten Einfluss auf den Verwendungszweck der Spindeln (und Wirtel) unter der Voraussetzung, dass sie frei hängend verwendet wurden.
Die große Geschwindigkeit, mit der leichte Spindeln den Faden drehen bei gleichzeitigem geringem Gewicht ist etwa für die Herstellung von dünnen Wollfäden von Vorteil, da dünne Fäden (etwa 0,2-0,4 mm dicke) bei vergleichbarer Länge und gleichem Drehwinkel viel mehr Umdrehungen benötigen als etwa 1,5 mm dicke. Der Nachteil bei sehr leichten Spindeln, dass öfter angedreht werden muss, ist durch die große Drehfrequenz etwas gemindert.
Es ist für die Herstellung von sehr dicken Wollfäden (ab 1,5 mm) wichtig, dass die Spindel eine große Masse und Trägheit besitzt, die einen langen gleichmäßigen Lauf garantiert. Dass schwere Wirtel eine geringere Drehfrequenz aufweisen, stört wenig, da für dicke Fäden in einer in einem Arbeitsgang verziehbaren Fadenlänge nicht so viele Umdrehungen nötig sind, um den Faden zu stabilisieren.

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Curriculum vitae

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3.3. Late Neolithic weaving tools from Melk-Spielberg in Austria: experiments with crescent-shaped weights

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(peer-reviewed)

11

Late Neolithic weaving tools from Melk-Spielberg in Austria: experiments with crescent-shaped weights

Karina Grömer

Archaeological background

At Melk-Spielberg in Austria, a Late Neolithic fortified settlement was discovered.[1] A pit of the Baalberge Group (southern Funnel Beaker culture) contained three loom weights of a very distinct shape, differing from the well-known egg- or cylinder-shaped loom weights of the Late Neolithic in Central Europe. Those crescent-shaped weights were the basis for a series of experiments intended to examine their functionality.

Central Europe in the Late Neolithic period

The Neolithic in Central Europe covers the period from *c.* 5600 to 2300 BC.[2] A warm and humid climate had generally been predominant since the beginning of the Neolithic, but from *c.* 3800 BC, the Late Neolithic onwards, the climate began to change to a slightly cooler transitional period. This seems to be a significant turning point, not only according to climate, but also technologically and socio-economically.

In the millennia before the Late Neolithic period, cultures were purely agriculturally focused; social and economic changes then occurred. Different social groups are archaeologically identifiable in the cemeteries, *e.g.* specific tools and weapons suggest that warriors and craftsmen emerged as new social groups. This period saw the beginnings of copper metallurgy, for that time being mainly used for jewellery, later tools were also made of this metal, and gold was also employed. In this era, the new sought-after raw material meant an economic and cultural boom in regions with copper and gold deposits, especially the Carpathian region. The Alpine areas, too, were now settled. The four-wheeled cart made its first appearance in Central Europe, evidenced by finds of wooden wheels from Switzerland and Slovenia and zoological evidence for domestic horses.[3]

Human mobility increased through the use of wagons and horses; for millennia, it had only been possible to travel on foot or by water. The wheel and carts were also important for the development of agriculture, enlarging the areas that could be worked. The principle of the rotating axis was already familiar from the use of spindles in the Neolithic.

In contrast to the extensive and relatively homogeneous Early Neolithic Linear Pottery culture, the Late Neolithic in Europe saw a breakdown into many different and successive regional cultural groups that maintained contacts to neighbouring areas. For textile research, the cultures of the lakes around the Alps are of particular interest, since organic materials and, therefore, textiles have been preserved in the wetlands. These include the Pfyn (3900–3500 BC) and Horgen (3500–2800 BC) cultures that occurred in what is now Switzerland during the Late Neolithic; the Funnel Beaker culture (Baalberge group; 3800–3400 BC), and the Cham and Jevišovice cultures (3400–2800 BC) in what is today Austria.[4] There are more cultural groups in the area, but those are the main ones we are referring to here. Of particular interest also is the Iceman Ötzi,[5] a mummy found in 1991 near an old mountain pass in the Ötztal Alps with clothing and equipment, which has survived *c.* 5300 years in the ice of the glacier.

Textiles and tools in the 4th and 3rd millennia BC

As far as we know, the textile technology of the first Stone Age farmers in Central Europe was based on bast fibres, such as lime-bast, flax, *etc*. According to sparse finds, only in the Late Neolithic are we able to trace the first wool textiles. At the end of the 4th millennium BC, a larger sheep emerged in Central Europe, and in the 3rd millennium BC the slaughtering pattern altered and more animals survived to an older age, which can be interpreted as change from use of these animals for milk and meat to their exploitation as a source of wool. The 3rd millennium BC was the time when wool emerged as raw material for textiles in Europe in general.[6]

Basic spinning and weaving techniques had already been developed, but in Central Europe textile products made in basketry techniques, matting, cordage and twining techniques were more common than spun and loom-woven items. This can be recognised from the lakeside settlements during the 4th and 3rd millennium BC, which present excellent conditions for the preservation of organic finds. Late Neolithic lake dwellings from Switzerland, south Germany, northern Italy and Austria have yielded large woven fabrics, bands and twined fabrics.[7] At least from the beginning of the Bronze Age onwards, woven textiles begin to dominate the textile and 'cloth culture'.[8]

Textile tools recorded for the period (*c.* 3500–3000 BC) show great variation (Fig. 11.1). There is, for example, differentiation in size and weights of spindle whorls in the Central European Jevišovice culture (in eastern Austria, Czech Republic) and Chamer culture (in western Austria and southern Germany), where very large and heavy items predominated,[9] while in the Swiss lakeside dwellings smaller examples were found. We also know of spools, loom weights or bone artefacts from recently excavated sites Krems-Hundssteig, Melk-Spielberg, Melk-Wachtberg and Meidling-Kleiner Anzingerberg,[10] Austria.

The evidence of the oldest find of a warp-weighted loom *in situ* in Austria is important for our understanding of the development in textile crafts in this area. The find from Krems-Hundssteig consists of 35 egg-shaped loom weights found lying in a line of 1.2 m length in a house within the fortified settlement (^{14}C date *c.* 3150 BC).[11]

Crescent-shaped loom weights

In this contribution, we focus on determining the possible functions of the crescent-shaped weights, exemplified by the three examples from the site Melk-Spielberg (Baalberge Group of the Funnel Beaker culture).[12] They are 16–18 cm long and 6 cm thick. The weight of the complete items was about 450 g. The distance between the holes of the weights was about 12 cm. The original finds seem to be unfired or lightly fired (Fig. 11.1).

Examples of crescent-shaped weights have also been found in the area around the Alps, in Hungary, northern Italy, Austria, Czech Republic and southern Germany, and in western Iberia, all in Late Neolithic contexts.[13] Unfortunately, they are usually found as single items within settlements, thrown away in settlement pits like broken pots and other settlement waste. At the site Lagozza di Besnate in northern Italy,[14] several crescent-shaped weights were found in settlement pits, always together with spindle whorls. This type of loom weight is common in the Lagozza culture (*c.* 3800–3600 BC), and it is thought that this is the origin of the spread of crescent-shaped weights to Central Europe (together with early copper technology).[15] One of the most interesting contexts of these weights is known from Melchendorf in Germany:[16] two crescent-shaped weights, 20 cm long, were found in a pit, together with the body of a 40-year-old man. The finds are contemporary with the items from Melk-Spielberg and have a similar shape, length and weight. The loom weights served as grave goods, but it is not known if the two weights form a functional tool-set or if they were meant as a part of a bigger group of objects.

From Spain, in the settlement El Malagón (Prov. Granada), in a context dating to the end of the Late Neolithic/beginning of the Copper Age (*c.* 3000 BC),[17] a larger number of crescent-shaped weights were excavated within a house (hut F). More than 30 items were deposited densely packed together – maybe indicating the former use on a loom. The Spanish weights are slender and 26 cm long, and their form, shape and weight differ from those from Central Europe. The crescent-shaped loom weights from Late Neolithic and Chalcolithic contexts in southern Portugal are discussed in this volume by C. Costeira and R. Mataloto.

Further to the east, in Sardinia, Bulgaria, Albania, Greece and Turkey,[18] crescent-shaped loom weights are well known in the Early and Middle Bronze Age contexts, of the mid- and end of the 3rd millennium BC and early 2nd millennium. At the site Demircihüyük in Turkey,[19] a total of 74 crescent-shaped weights were excavated from various archaeological contexts. Most of the weights were found in the settlement layers dated to *c.* 2000 to 1800 BC, but they were also found in a grave of a child – maybe as a grave gift. The shape, size and weights differ a bit, but all are smaller than those known from Central Europe. The weights are between 100 and 250 g (averaging about 150 g), the distance between the holes is about 7 and 13 cm. Some of the crescent weights from Anatolia have decoration like seal impressions or other types of marks.[20]

Methodology

The exact function of these unfired or lightly fired artefacts is reconstructed in different ways. For our experiments, we presume that the objects were used as weights and we applied different experimental variants: the crescent-shaped weights were used for band weaving, on a warp-weighted loom and in twining techniques. For the design of the experiments, analogies from ethnographic sources were also employed. We tested the possible uses of tools, even if the evidence for a specific technique comes from a region and period far beyond.

Variants of experiments

Three different loom set-ups were tested in use with these crescent-shaped weights. The first was a simple band loom

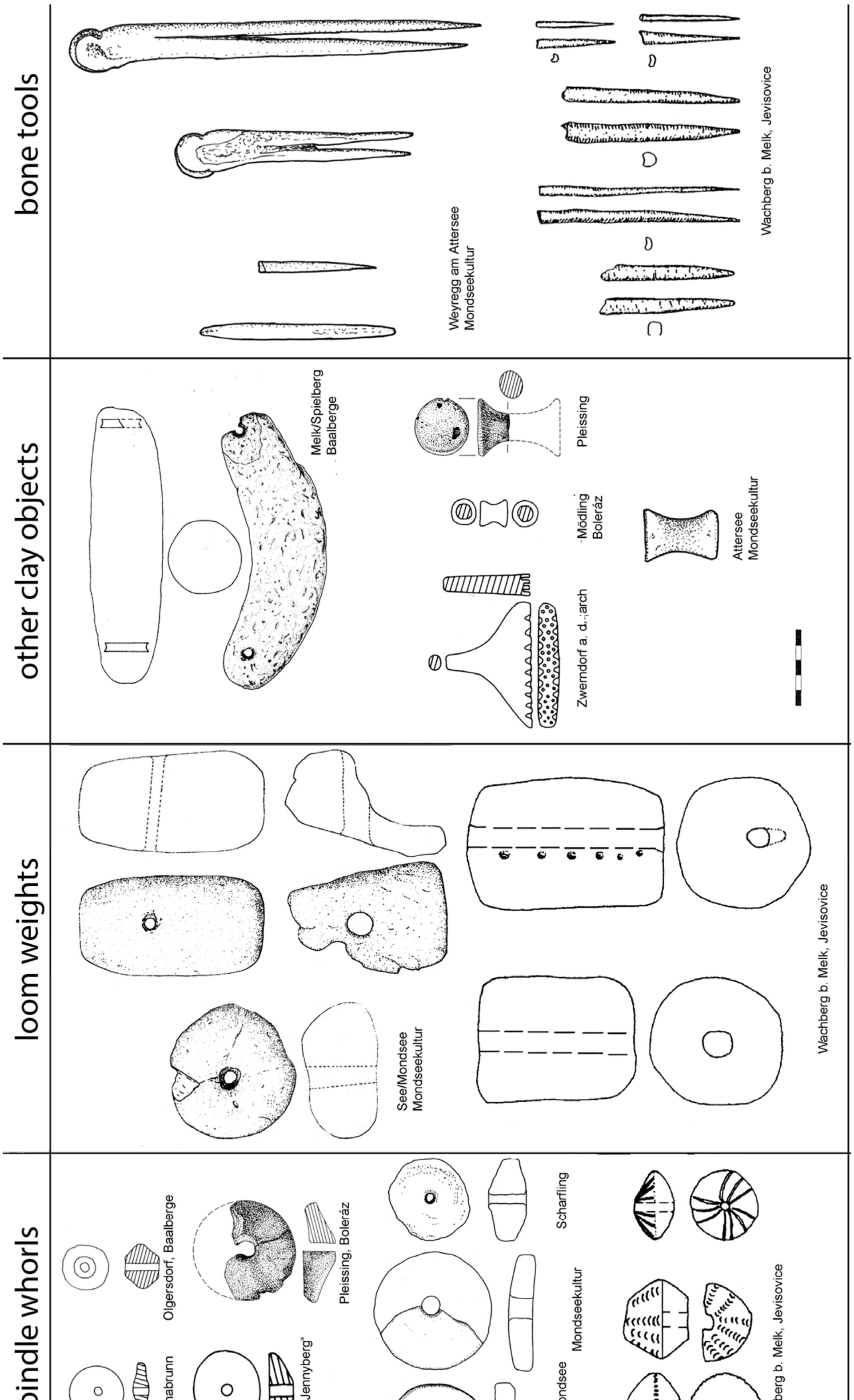

Fig. 11.1 Textile tools from Austria of the 4th millennium BC (drawing: K. Grömer, after Grömer 2006, Fig. 5).

with two weights. The next was a warp-weighted loom with over 10 weights, and the last was a twining frame with crescent weights tightening vertical active elements ('warp twining').

The original finds from Melk-Spielberg seem to have been unfired or lightly fired. For the experiments, weights of clay and some of clay mixed with sand were produced. It was also tested whether the preparation of the weights (fired or unfired) had any effect on the use-wear.

Reconstructed tools

The crescent weights were prepared in the same shape and mass as the original artefacts from Melk-Spielberg. The reconstructed objects were crescent-shaped, 16–18 cm long and 5–6 cm thick. Their weight was 400–500 g. The distance between the holes of the weights was about 11–12 cm. They were made by Ludwig Albustin in the open-air museum Asparn an der Zaya in Austria, and used in all the variants of experiments.

Additionally, for some of the twining experiments at Lejre in Denmark (with flax and lime-bast) smaller crescent-shaped weights were used as well. They were produced in the Lejre pottery workshop, as reconstructions of finds from Turkey (*c.* 2000–1200 BC), for experiments carried out by Agnete Wisti Lassen.[21] They are smaller, 250 g in weight, 12 cm long, 2.5 cm thick. The distance between the holes is 9 cm.

Documentation

Each part of the experiments was documented by photography (a snapshot of the materials used, the hand movements during preparation and beginning, the weaving, *etc*.). A form was used for the written documentation, and this recorded data concerning duration, participation, information about equipment used, individual production steps and procedure, a graphic record of the use-wear on the loom weights, observations and results.

The main aim of the experiments was to compare the use-wear on the original weights with the traces resulting from the different experiments. Therefore, different weaving and twining activities were tested for several hours, until the first traces of use (*e.g.* resulting from weights rubbing or clapping on each other) appeared. Usually that happened first on the unfired weights. The use-wear was documented on a sheet. To see the rubbing effect of the threads inserted in the holes more easily, blue pigment was added to the threads. It highlighted the movements of the threads within the holes. By obtaining a picture of use-wear marks resulting from a specific use of crescent weights in different experiments, it is possible that the function of the artefacts might be clearer.

Crescent-shaped weights and the band-loom

There is some archaeological evidence for the use and production of wider bands in the Late Neolithic. Woven bands with 7–15 cm width were found (for example) at the lake dwellings of Zürich-Utoquai, Feldmeilen 'Vorderfeld' or Muntelier 'Platzbünden' (second half of the 4th millennium BC).[22] Those fabrics are usually tabbies made with plied yarn and about 8–12 threads per cm.

Experimental set-up (Fig. 11.2)

The experiment was inspired by the work and publication of Annemarie Feldtkeller.[23] The aim was to test the function of the weights for band-weaving. Few materials and equipment were used for the experiment: two reconstructed weights from Melk, linen yarn, one wooden stick for heddling. The woven fabric was, in accordance to the original finds, tabby (slightly ribbed variety with 12 warp and 6 weft threads per cm) and 9 cm wide.

The individual steps of the procedure were warping, attaching the two warp-layers (back and front row of the tabby warp) on separated crescent weights, preparing the heddles, crocheting of the space-keeper, tightening the warp with the weights again – and weaving.

Observations (handling and produced fabric)

The whole band-loom set up with two crescent-shaped weights can be used very easily for weaving. The shed for the weft thread can be opened very well, the two layers of the threads (back and front layer of the warp for tabby) are separated clearly.

The fabric was a 9 cm wide band, but a problem with the spacing of warp threads was observed. The warp threads for each layer were divided into two groups that were fastened to the two holes of the crescent weights. The tension on the threads differed a little bit according to their position. The weave, therefore, did not appear well balanced. The band shows a 'gap' in the centre and denser parts on the edges. Maybe this effect could be corrected with more practice using these tools.

The special function of the weights in a band loom is that they provide the two warp layers separated from each other. Band weaving with such a tool is very practicable. It is possible to weave bands such as were found in the Late Neolithic Swiss lake dwellings.

Crescent-shaped weights and the warp-weighted loom

In the Mediterranean region, objects of this special shape are found more often and they are significantly lighter and smaller than the Central European ones. They usually are interpreted as weights for a warp-weighted loom. In several experiments, replicas of those weights have been used on a simple loom with one shaft to produce tabby.[24] There were also attempts to employ two rows of crescent-shaped weights for twill weaving on a more complex loom with four shafts.[25]

However, in Central Europe, the crescent-shaped weights have usually been found as single items, far less than the

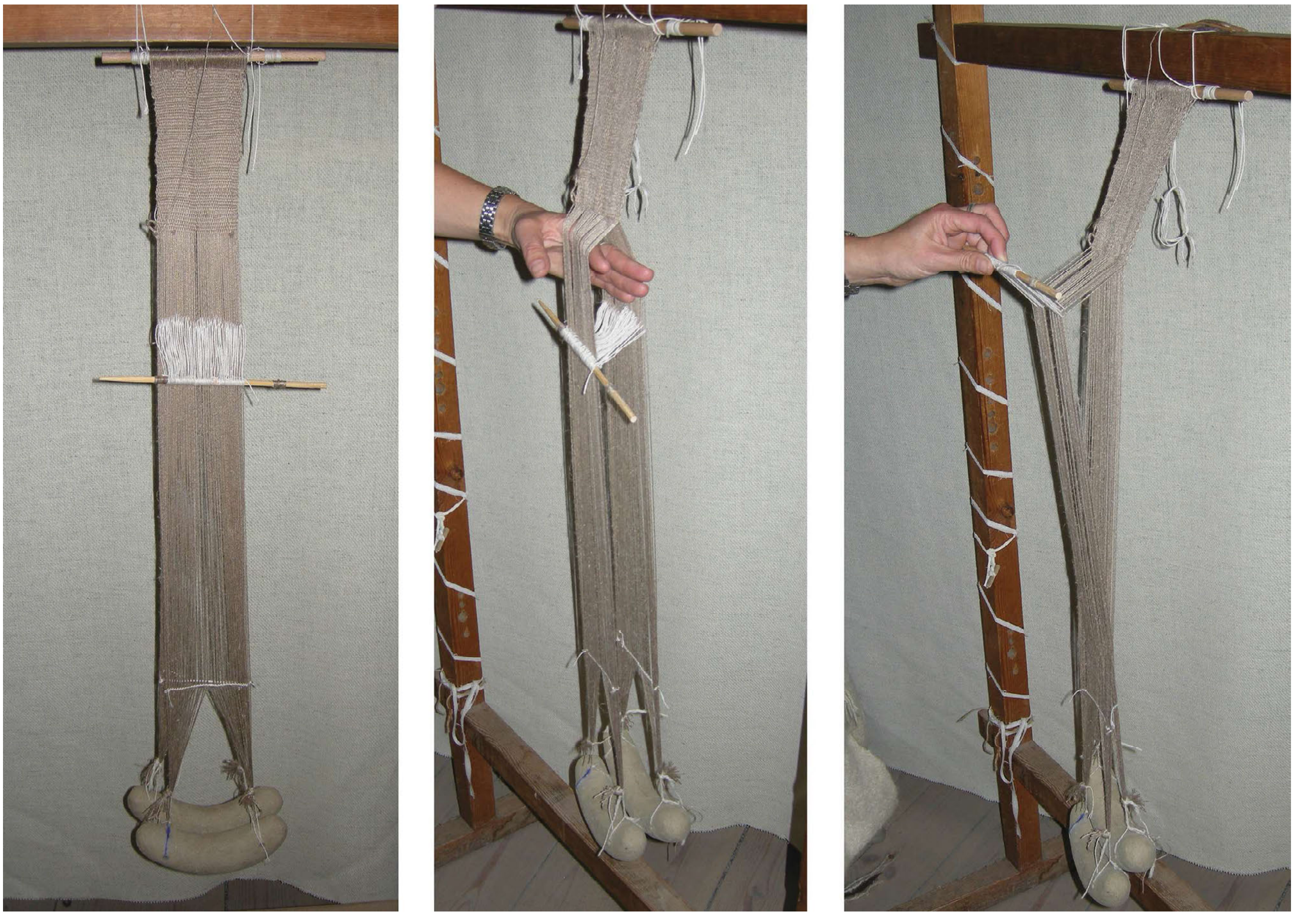

Fig. 11.2 Crescent-shaped loom weights used on a band loom (photos: K. Grömer).

numbers required for a loom set-up for twill or tabby. From the 4th and 3rd millennium BC, in Central Europe several larger fabrics woven on a warp-weighted loom have been preserved. All of them are tabbies, sometimes with starting borders, such as the one found at Wangen or Allensbach,[26] all dating to the Late Neolithic, between 3600–3000 BC. Of interest are woven textiles of the Funnel Beaker culture in Central Europe, such as from Rmíz in the Czech Republic (3600–3200 BC).[27] It is a flax tabby with 13 threads per cm. From the Jevišovice culture, we know a tabby fabric from Náměšt na Hané (Czech Republic).[28]

Experimental set-up (Fig. 11.3)

There is no archaeological evidence in the Late Neolithic in Central Europe of a woven twill textile. One of the earliest depictions of a warp-weighted loom is known from Val Camonica in Italy,[29] dated to the Bronze Age. There, a single shaft can be identified together with the loom weights. Therefore it was decided to use the crescent weights on a simple loom with one shaft.

The equipment for this experiment were 11 loom weights (reconstructions from Melk, alternating one fired and one unfired weight), linen yarn for the warp and weft (0.7 mm plied yarn), a long weaving sword and a loom with one heddle rod and one shed rod. For warping, a ground warping frame was used, for weaving the repp starting border – a rigid heddle.

The individual steps of the procedure are warping and making a repp starting border, setting up the loom. For tensioning the warp threads with the crescent weights, the loom weights were arranged in one row – always one hole of the weight for the front warp layer, the other hole on the back warp layer. The next step was knitting the heddles, crocheting of the space-keeper, tensioning the warp with the weights – and weaving.

For the weaving experiment, 11 crescent weights were used. Considering the results of experiments done by the Lejre team and the CTR,[30] we estimated that 25 g tension per thread would be optimal. Since the crescents weigh 500 g, we arranged 20 threads (10 for the front and 10 for the back warp layer) to be attached to each weight. In that way a tabby fabric of 24 cm width was produced with a thread count 12 threads per cm in the warp and 8 threads per cm in the weft.

Observations (handling and produced fabric)

The crescents functioned very well when used as loom weights. A nice, well-balanced fabric can be woven with

tabby: natural shed

tabby: counter shed

Fig. 11.3 Crescent-shaped loom weights used on a warp-weighted loom (photos: K. Grömer).

them. The heddle rod can be moved very easily for opening and closing the shed for the weft.

For this experiment a shed rod was used, so the warp bundles and the weights were fixed at their place. On the Early Bronze Age depiction of a loom at Val Camonica, the bottom line could be a hint of the use of such a shed rod.

During weaving, the crescent loom weights are in a ‘swinging’ movement, the ends of the crescent weights tilt up and down. Without a shed rod, the loom weights also move sideward and strongly back and forth. With this movement, weaving is not easy and it is not possible to get a clear shed.

The experiments demonstrated clearly that it is possible to use these weights on a warp-weighted loom, especially in combination with a shed rod. The fabric produced with the loom is comparable with original finds.

Crescent-shaped weights for twining

Twining is an established Neolithic technique, employed to produce various two- and three-dimensional objects. The basic principle is to twine (wind) a flexible, active element around a passive flexible or stiff element to create a fabric. As we learn from archaeological and ethnographic sources,[31] various materials can be used, flexible taw material such as bast fibre, lime-bast, grass, willow, *etc*., or even stiff material like straw, twigs, *etc*. The techniques to create those objects are also various. The simplest is to manipulate the materials just by hand, maybe by the help of a stick or pin beater. For more complex or huge items, such as large mats, there is ethnographic evidence for the use of a frame, *e.g.* from Korea.[32] For a twining frame, there are two possibilities of handling: the vertical elements can be fixed, and the horizontal elements can be used for twining weft, or the other way round for warp twining. The latter is of interest for our experiments, and we used the crescent-shaped weights as active moving vertical elements for twining.

In Late Neolithic Central Europe, various twining techniques were used to produce two- and three-dimensional objects. The most important finds belonged to the Iceman Ötzi, *e.g.* the knife sheet and the mat.[33] Sometimes the twined objects are as fine as woven textiles, but some are coarser. Some of the flat twinings (*Kettenstoffe*), such as the ones from Wetzikon-Robenhausen or Hornstaad,[34] as well as narrow twined ‘bands’ like from Wangen, are of interest here, since they could have been produced on a twining frame.[35]

Experimental set-up

The equipment for the twining-experiments was 8–12 weights, reproductions from Melk, fired and unfired, for Test 1, and Anatolian weights from the Lejre pottery workshop for Tests 2 and 3, a weaving sword and a simple frame to put the vertical elements on. Three series of experiments were made: one twining with flax for the warp twines and bast for the ‘weft’, and two experiments with twisted lime-bast for the warp twines (Fig. 11.4). One of these was done with low twisted lime bast-stripes for the ‘weft’, the other with plied lime-bast.

First, the vertical active elements were fixed on the loom and the weights: one thread ran from one hole of the crescent weight, over the beam of the loom and back to the other hole of the weight. It was found to be absolutely necessary that all weights were in a row next to each other. For twining, the weights had to be turned (Fig. 11.4.3) and the ‘weft’ was passed through the shed.

Observations (handling and produced fabric)

Test 1: twining with flax and lime-bast. The functionality of the weights (handling while turning) was tested in this experiment. It was observed that the horizontal elements had to be very thick to get a dense fabric. The weight on the twined vertically tensioned threads pulls them so strongly downwards that a space appeared between the horizontal rows of thread.

On this first experiment, the rows of the active elements were placed at a distance of 1.2–1.5 cm from each other, as we know from the fabric from Hornstaad. For a large twined fabric (*e.g.* made with 20–30 weights – one for each twined row) this distance is acceptable.

Test 2: twining with lime-bast and wide twisted bast (inspired by the fabric of Hornstaad) (Fig. 11.4.1–2). The second experiment was testing a set up with twisted (not plied or twined) lime-bast as known from Hornstaad. In this experiment we used eight loom weights, placed at a distance of 1.2–1.5 cm. Twining with that set-up was very easy, it was possible to reach a similar product to the Hornstaad twining, but the weft-density was not that satisfying.

Test 3: twining with lime-bast and plied lime-bast threads (inspired by the fabric of Wangen). For the next experiment we used eight crescent weights, but placed very dense to get a warp-faced band (Fig. 11.4.4). We aimed to reproduce a band made with single lime-bast as the active element and plied lime-bast as the passive element. Such a band was found in Wangen.[36] From this piece it is clear that it was ‘warp-twined’, because both side borders survived.

The band from Wangen could be reproduced very easily and quickly, with the density of the active and passive parts equal to the original finds.

Results

In general, the functionality of the crescent weights for ‘warp-twining’ is very good – the vertical threads are the active elements and the horizontal threads are the passive ones. The active threads can be moved very easily and quickly. After they are turned, they are fixed in their position, held in place in a row. They do not turn back. The threads in the holes of the weights create a nice shed because of the

Fig. 11.4 Crescent-shaped loom weights used for twining (photos: K. Grömer).

distance of the holes. The passive elements can be easily threaded through the shed.

The experiments demonstrate that it is possible to carry out 'warp-twining' on such a frame with the help of crescent-shaped weights. The use-wear also fits this activity very well. But, on the other hand, some technical details on the fabrics (density, twist of threads) show that the twined fabrics of the Late Neolithic in Central Europe presumably were also produced without any tool, just by hand.

Use-wear

During work and after finishing each experiment, the use-wear on the crescent-shaped loom weights (Fig. 11.5) was documented in detail. Using the weights on the band-weaving implement, some specific types of abrasion were documented: there are linear traces of a pulling movement from the upturned holes (in the direction of the weave). Another type of use-wear reflects rubbing on the larger sides of the tools resulting from the movement during opening and closing the shed.

While using the crescents as loom weights, the traces are different to those appearing with the use for a band loom. There is minor rubbing on the larger parts of the weights, in areas where the weights touch each other. But there is characteristic use-wear on the holes of the crescent weights. The typical traces are V-shaped, caused by the movement of

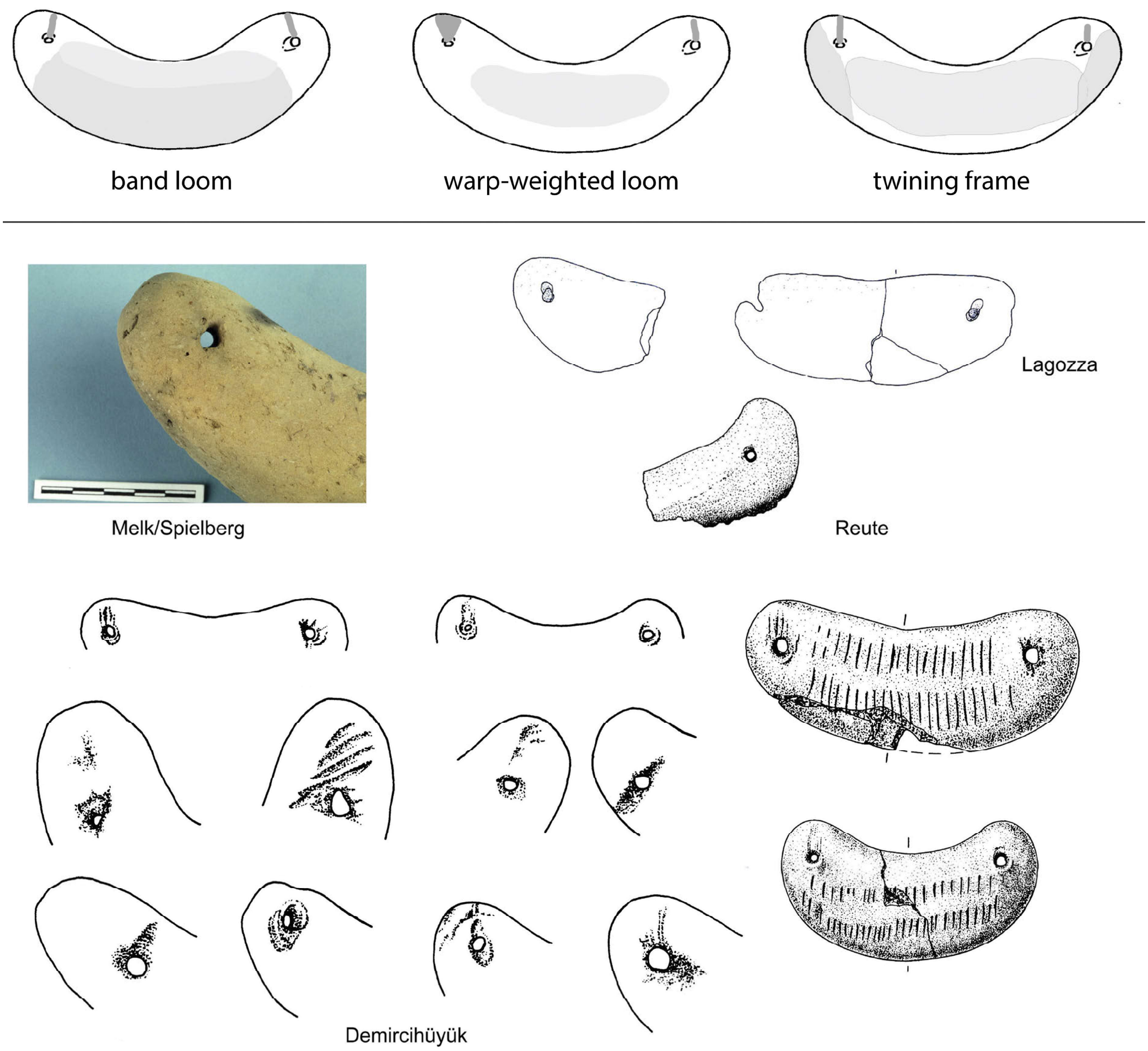

Fig. 11.5 Use-wear on the reconstructed tools in comparison with original finds (graphic: K. Grömer, after Krenn-Leeb 2002).

the weights tilting up and down. Sometimes linear vestiges of a pulling movement from the holes upwards were also recognised on the original finds.

For twining, use-wear is seen in clear linear traces of a pulling movement from the holes in direction to the fabric. Beside that, abrasion on the larger sides and on the edges of the tools appears, because the tools were always hitting each other while turning the weights.

The observations made during the different activities can be compared with original finds from Melk-Spielberg,[37] but also from Lagozza[38] or Demircihüyük.[39] The originals show linear use-wear on the holes, the typical V-shaped traces of use as loom weights cannot be recognised according to the publications. Therefore, the best interpretation is the use of crescents for band weaving and twining. The work on the warp-weighted loom causes slightly different use-wear, because of the 'swinging' movement of the weights. Use-wear on the large sides of the weights is usually not recorded on the original finds. Interestingly, abrasion of the edges is documented on the Lagozza tools. This is typical for the use on a twining frame.

Conclusion

As indicated by the three variants of our experiments, crescent-shaped weights known from the Late Neolithic cultures around the Alps (*c.* 3800–2800 BC) can be used for different textile techniques such as band weaving, weaving a large textile on a loom or twining on a frame. Using these tools, it is possible to construct fabrics similar to ones found on Late Neolithic sites, especially bands and large fabrics in tabby, as well as the structures of twined textiles.

The first experiment was to test crescent-shaped weights on a band-loom, based on the experiments and publication of Annemarie Feldtkeller. It is possible to weave bands like the ones found in the Late Neolithic Swiss lake dwellings, and the use-wear on the crescent weights is comparable to the original weights.

The second experiment dealt with the warp-weighted loom and crescent loom weights, following the common interpretation of that type of tools in the Mediterranean region. The experiments showed clearly that it is possible to use those weights on a warp-weighted loom, especially in combination with a shed rod. The use-wear on the weights is somehow different to the original finds because of the swinging movement of the weights.

Lastly, the crescent loom weights were tested whether they could have functioned in twining. In the Central European Neolithic, various twining techniques were used to produce two- and three-dimensional objects. Some of the flat twinings could have been produced on a twining frame. The experiments show that it is possible to do 'warp-twining' on such a loom with the help of crescent-shaped weights. The use-wear (linear traces from the holes and rubbings on the edges), seen on the experimentally used weights, are comparable to those of the original finds. Some technical details on the fabrics (density, twist of threads) show, however, that the twined fabrics of the Late Neolithic in Central Europe presumably were produced without any tool, just by hand.

Following these experiments, some educated guesses can be made about the function of the crescent-shaped weights. Whatever it was, they must have been involved in the manufacture of some specific kind of textile, as loom weights of that shape are not at all common in the Late Neolithic in Central Europe. From the dates that are available so far, it seems as if one of the origins of those tools might be South-East Europe, for example the earliest dates for finds occur in places like Sălcuţa in Romania, Kamik in Albania or Šuplevec in Serbia, sites dating to the later 5th and early 4th millennia BC. Then the tools spread to the Lagozza culture in northern Italy (3800–3600 BC). The slightly later Melk-Spielberg examples are probably to be understood as products of a specific weaving or twining technique stemming from these areas. In western Europe (Spain, El Malagon *c.* 3000 BC, Portugal, São Pedro) and in Anatolia (early 3rd millennium BC) crescent loom weights also appear. We do not know that the function of the loom weights was the same during that long period and in all regions, or if the textile types, produced by the use of those tools, changed.

Notes

1 Krenn-Leeb 2002. The experiments were part of a research project on the textile technology of the Late Neolithic Jevišovice culture (*c.* 3000 BC) in Austria (cooperation with Alexandra Krenn-Leeb, University Vienna). The experiments were carried out in August 2007 with a grant HAF 03/07 offered by the Lejre Archaeological-Experimental Centre (now Sagnlandet Lejre – Lands of Legends) in Denmark. Further experiments were also done within the framework of the lecture 'Experimental Archaeology' by the University Vienna in the open-air museum Asparn an der Zaya, Austria, in July 2008. We have to thank for help the following persons (alphabetical order): Ludwig and Vera Albustin, Anne Batzer, Ida Demant and Anne Reichert.
2 For a general overview, see Cunliffe 1998; Kristiansen 2000.
3 Discussion in Becker *et al.* 2016, 104–105.
4 In detail about the cultural groups, Urban 2000, 106–138.
5 Spindler 1995; Egg and Goedecker-Ciolek 2009.
6 Bender Jørgensen and Rast-Eicher 2015.
7 Rast-Eicher 1995; 2005; Bazzanella *et al.* 2003; Grömer 2006, figs. 9, 11, 16; Médard 2010; Rast-Eicher and Dietrich 2015.
8 Harris 2012.
9 Grömer 2006, fig. 5.
10 Pieler 2001, 504; Grömer 2005, figs. 1.1–7; Krenn-Leeb 2010.
11 Pieler 2001, 503–506, fig. 59.
12 Krenn-Leeb 2002, 302, figs. 21–26, pl. 5.
13 For collection of comparative finds, see Krenn-Leeb 2002, 302–306; Costeira and Mataloto in this volume.
14 Cornaggia Castiglioni 1964; Borrello 1984, 39, table 54; Odone 1997, 128.
15 Krenn-Leeb 2002, 310.
16 Bahn 1989.
17 Arribas *et al.* 1978, fig. 13, tables X, XV.
18 Borrello 1984, 39; Krenn-Leeb 2002, 307–308; Lassen 2013, fig. 5.4; Melis 2014.
19 Kull 1988, 200–201, fig. 190, see also catalogue.
20 See also Alp 1968; Weingarten 1990; Lassen 2013, 80.
21 Lassen 2013, 81–84; 2015. The smaller size and weight of reconstructions of Anatolian weights did not have a significant effect on the intended test of their usability with lime-bast. The basic mechanisms of turning the weights did not differ much in comparison to the Melk-Spielberg weights reconstructions.
22 Wininger 1995, fig. 51; Médard 2010, 202.
23 Feldtkeller 2003, 16–19, fig. 15.
24 Cornaggia Castiglioni 1964. See also later experiments: Bazzanella *et al.* 2003, fig. p. 105.
25 Lassen 2013, fig. 5.6; Ulanowska this volume.
26 Feldtkeller and Schlichtherle 1987, 79.
27 Baldia 2004, 69–70.
28 Smíd 1990, 67–69.
29 See Anati 1994, 158–159.
30 *Cf.* Lassen 2015, 132.
31 Seiler-Baldinger 1994; Rast-Eicher 1995; 2015; Médard 2010.
32 Hirschberg and Janata 1986, fig. 70.
33 Egg and Goedecker-Ciolek 2009, 88 (knife sheet) and 124 (mat or cloak).
34 Schlichtherle 1990.
35 Reinhard 1992, 51–53; Wininger 1995, 178, fig. 32; Médard 2010, 167, 180.
36 Courtesy of Annemarie Feldtkeller, who provided us with photos and graphics of this band.
37 Krenn-Leeb 2002, fig. 25.
38 Borrello 1984, pl. 54.
39 Kull 1988, 201–202, fig. 195.

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4. TEXTILE TECHNIQUES AND DESIGN THROUGH THE AGES

4.1. Vom Spinnen und Weben, Flechten und Zwirnen. Hinweise zur neolithischen Textiltechnik an österreichischen Fundstellen.

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(reviewed by editorial board)

Vom Spinnen und Weben, Flechten und Zwirnen

Hinweise zur neolithischen Textiltechnik an österreichischen Fundstellen

Karina Grömer

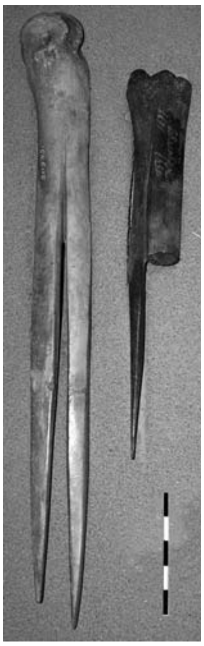
Für Elisabeth Ruttkay

Zu den Textiltechniken gehören nicht nur Spinnen und Weben, es zählen alle Arbeitsschritte dazu, von der Aufbereitung des Rohmateriales, der Fadenherstellung, über verschiedene flächenbildende Techniken wie Weben, Flechten, Zwirnbindung, bis hin zum Nähen und Verzieren fertiger Stoffe[1]. Zu den Endprodukten textilen Handwerks sind neben Kleiderstoffen, Gürteln und Mützen auch Matten, Körbe, Siebe und Taschen etc. zu zählen.

So sollen im Folgenden die einzelnen Textiltechniken nacheinander auf ihre archäologischen Hinterlassenschaften hin untersucht werden, um eine überblicksmäßige Zusammenschau der neolithischen Textiltechnologie anhand ihres Niederschlages an österreichischen Fundplätzen geben zu können.

Rohmaterialaufbereitung

Abb. 1: Weyregg am Attersee: Hechelzinken aus der Mondseekultur (Photo: K. Grömer).



Im Neolithikum verwendete man für das textile Handwerk großteils pflanzliche Materialien; so wurden Gräser (*graminae*) und Schilf vor allem für Geflechte benützt, etwa für Matten. Baumbaste, v. a. Linde (*tilia*), Eiche (*quercus*), auch Weide (*salix*) wurden nicht nur für Flechtereien oder Zwirnbindung, sondern auch für Stoffe verwendet – sie sind in den schweizer Feuchtbodensiedlungen, die den größten Bestand an Textilfunden im mitteleuropäischen Neolithikum aufweisen, als Rohmaterial für textiles Handwerk sogar häufiger nachgewiesen als Flachs. Auch die textilen Reste aus der Pfahlbaustation See/Mondsee (Mondseekultur) sind ausschließlich aus Baumbasten gefertigt, hauptsächlich aus Lindenbast, einige auch aus Eichenbast, einmal konnte auch Eschenbast identifiziert werden[2].

Der Flachs (*linum usitatissimum*) taucht als Kulturpflanze in Mitteleuropa bereits ab der Bandkeramik auf. In Österreich ist die Flachspflanze in Schletz (Linearbandkeramik), Kamegg (Lengyel), aus dem Mondsee, Station See[3] und in der Pfahlbaustation Misling II am Attersee (beide Mondseekultur)[4] nachgewiesen. Durch das archäobotanischen Fundgut der Jevišovice-Siedlungen von Krems- Hundssteig und am Kleinen Anzingerberg bei Melk kann eine gezielte landwirtschaftliche Nutzung von Lein nachgewiesen werden[5]. Bei der ebenfalls in letzterer Siedlung gefundenen Nessel (*urtica dioica*) kann nicht erschlossen werden, ob sie für Textilien verwendet wurde. Die frühesten Nesselgewebe stammen aus Voltdofte auf Fünen und sind bronzezeitlich[6].

Durch größere archäobotanische Serien aus der Schweiz kann zumindest für diesen Raum gesagt werden, dass nach spärlichem Vorkommen in der Egolzwiler Kultur (entspricht bei uns altersmäßig dem Spät-/Epi-Lengyel) ab der spätneolithischen Pfyner Kultur (wie bei uns Altheim, Baalberg) die Bedeutung des Leins steigt, in der spätneolithischen Horgener Kultur (bei uns der Horizont Jevišovice-Cham) ihren Höhepunkt erreicht und ab der Schnurkeramik nur noch selten vorkommt[7].

Wichtiges Fasermaterial, besonders für Gewebe, sind Tierhaare, wobei in der europäischen Urgeschichte der Schafwolle eine besondere Bedeutung zukommt. Obwohl bereits in der Bandkeramik eine große Anzahl an Ovicapriden (Schaf/Ziege) vorhanden sind, in Österreich etwa in Neckenmarkt und Strögen[8], handelt es sich dabei wahrscheinlich hauptsächlich um Fleisch- und Milchlieferanten (Haarschaf), worauf auch das geringe Schlachtalter hinweist. Das Schaf taucht als Wolllieferant in Europa erst im Jungneolithikum auf. Das Wollschaf ist etwa 10 cm größer als das bandkeramische

1) Zur Textilsystematik und zu den Definitionen der einzelnen Techniken siehe Seiler-Baldinger 1991. – Für viele kritische Anmerkungen möchte ich Antoinette Rast-Eicher, Anne Reichert und Oliver Schmitsberger danken.

2) Holzer und Antl-Weiser 1995, 10. Das Material Fundstelle ist noch nicht zur Gänze publiziert. Ein im Rahmen des „Pfahlbauprojektes" unter Leitung von Dr. Elisabeth Ruttkay erstellter Katalog mit der Auflistung aller ca. 100 Textilreste aus See/Mondsee liegt seit 1996 von Dr. Veronika Holzer druckfertig vor und soll in den Mitteilungen der Prähistorische Kommission veröffentlicht werden. Mein herzlicher Dank ergeht an Dr. Veronika Holzer, Naturhistorisches Museum, für die vielen Informationen zu den Textilien aus See sowie für die Erlaubnis zur Publikation der Photos.

3) Freundlicher Hinweis Marianne Kohler-Schneider zu Schletz, Kamegg und See/Mondsee. – Kohler-Schneider 2005.

4) Offenberger 1981, 346 und 353.

5) Caneppele und Kohler-Schneider 2003, 54, Abb. 4. – Kohler-Schneider und Caneppele, in diesem Band

6) Späte Nordische Bronzezeit. Nach Hald 1950, 422-423.

7) Siehe Preuß 1998, 1/1, Abb. 19.

8) Lenneis 1995, 13.

Schaf, die neue Schafform wurde wahrscheinlich zur Zeit der Badener Kultur über das Karpatenbecken nach Mitteleuropa eingeführt[9]. Für die Schweiz wurde festgestellt, dass im Spätneolithikum, in der Horgener Kultur, nur ein kleiner Anteil des Haustierinventares vom Schaf gestellt wird. Dies lässt sich mit der Intensivierung des Flachsanbaues und der Flachsverarbeitung in der Horgener Kultur korrelieren, die durch makrobotanische Reste und häufige Flachshechelfunde in dieser Zeit belegt werden kann. Ab dem Endneolithikum steigen die Schafanteile wieder leicht an, eine Tendenz, die sich auch in der Bronzezeit fortführt[10]. Diese Entwicklung ist bei den Gewebefunden selbst ebenfalls zu sehen, wo nach den fast ausschließlichen Flachsgeweben der Steinzeit in der Bronzezeit Wollgewebe auftauchen, die dann ab der Mittelbronzezeit und besonders in der Hallstattzeit in Mitteleuropa dominieren. Der Umstand, dass bisher noch kein Wollgewebe an einer neolithischen Fundstelle bekannt ist, mag auch daran liegen, dass die Erhaltungsbedingungen für Wolle im Gegensatz zu Pflanzenfasern in den Feuchtbodensiedlungen sehr schlecht sind. Besonders in den basischen Ufersedimenten erhalten sich tierische Fasern nicht.

Für die Aufbereitung von Tierhaaren ist kein allzu großer Aufwand nötig. So können die Haare etwa von Schafen im Zuge des natürlichen Haarwechsels im Frühjahr einfach ausgerauft werden. Leichtes Reinigen von Hand, das Entfernen gröberer Schmutzteilchen, sowie das Auseinanderzupfen der Vliesteile reicht aus, um das Material verspinnen zu können. Für diese einfachen Tätigkeiten sind primär keinerlei Gerätschaften nötig, wodurch dieser Arbeitsschritt archäologisch auch nicht fassbar ist. Wahrscheinlich erst in der Eisenzeit wurde Wolle auch gekämmt[11].

Es ist weitaus schwieriger und (zeit-)aufwändiger, pflanzliche Materialien so weit vorzubereiten, damit sie weiterverarbeitbar, etwa spinnbar sind. Flachs wird mit der Hand ausgerauft, die Samenkörner durch Riffeln über Kämme entfernt, und schließlich längere Zeit am Feld ausgestreut der Witterung ausgesetzt oder in Wasser eingelegt („Röste"), um die Stängel etwas zu zersetzen. Beim Brechen werden die holzigen Anteile von den Bastfasern gelöst, die dann beim Hecheln ausgekämmt werden. Durch den letzten Arbeitsschritt werden die feinen parallelen spinnfähigen Flachsfasern vom sogenannten Werg getrennt.

Ähnliche Aufbereitung ist auch für Baumbaste notwendig. Der Bast, die faserige Schichte zwischen dem Holz und der äußeren Rinde, wird mit der Rinde abgezogen, gerottet und die Jahreslagen in Streifen aufgetrennt. Bast kann gröber belassen oder auch zum Verspinnen fein gehechelt werden. Andere Faserarten wie Gräser, Schilfstängel etc. wurden in rohem, frischem Zustand verarbeitet.

Archäologische Nachweise für das Hecheln bzw. Durchkämmen der langen Faserstränge des Flachses und der Baumbaste sind etwa in den spätneolithischen schweizer Seeufersiedlungen die verschiedensten Hechelzinken aus zusammengesetzten Knochenlamellen, gebündeltem Schwarzdorn, zweizinkig geschnitzten Rippen etc.[12]. Solche zweizinkigen Hechelgeräte verschiedener Länge (die vollständigen zwischen 16 und 26 cm Länge) gibt es in Österreich aus der Mondsee-Kultur von der Station See am Mondsee und Weyregg am Attersee (Abb. 1)[13]. Sie wurden meist aus Metatarsen gefertigt und sind tief gabelförmig eingeschnitten, ein Exemplar aus See besteht aus der Rippe eines größeren Tieres.

Dass trotz des höheren Arbeitsaufwandes und des komplexeren Vorganges in der Jungsteinzeit dennoch eher pflanzliche als tierische Fasern für die textile Produktion verwendet wurden, ist aus mesolithischer Tradition erklärbar. Für die Zeit vor der „Neolithischen Revolution", in deren Zuge auch das Spinnen und Weben in Europa auftaucht, war die Verwendung von Tierhaaren für die Herstellung von Schnüren oder flächigen Gebilden offenbar nicht in größerem Ausmaß üblich. Es wurde hauptsächlich Bast verwendet, Textilfunde gibt es aus vorneolithischer Zeit vor allem in Form von Körben, Netzen und Matten[14].

Fadenherstellung

Zur Herstellung von Fäden und Schnüren waren im Neolithikum verschiedene Techniken gebräuch-

9) Preuß 1998, 1/1, 82, 86-87. – Bökönyi 1974, 169 ff. – Schafbestände etwa von den Seeuferstationen im Salzkammergut zeigen eine andere Viehwirtschaft als zeitgleiche im Donauraum, wobei sich die Struktur der Mondseeviehwirtschaft eher von westlichen oder südlichen Ursprüngen ableiten lässt. Pucher und Engl 1997, 25, 98.

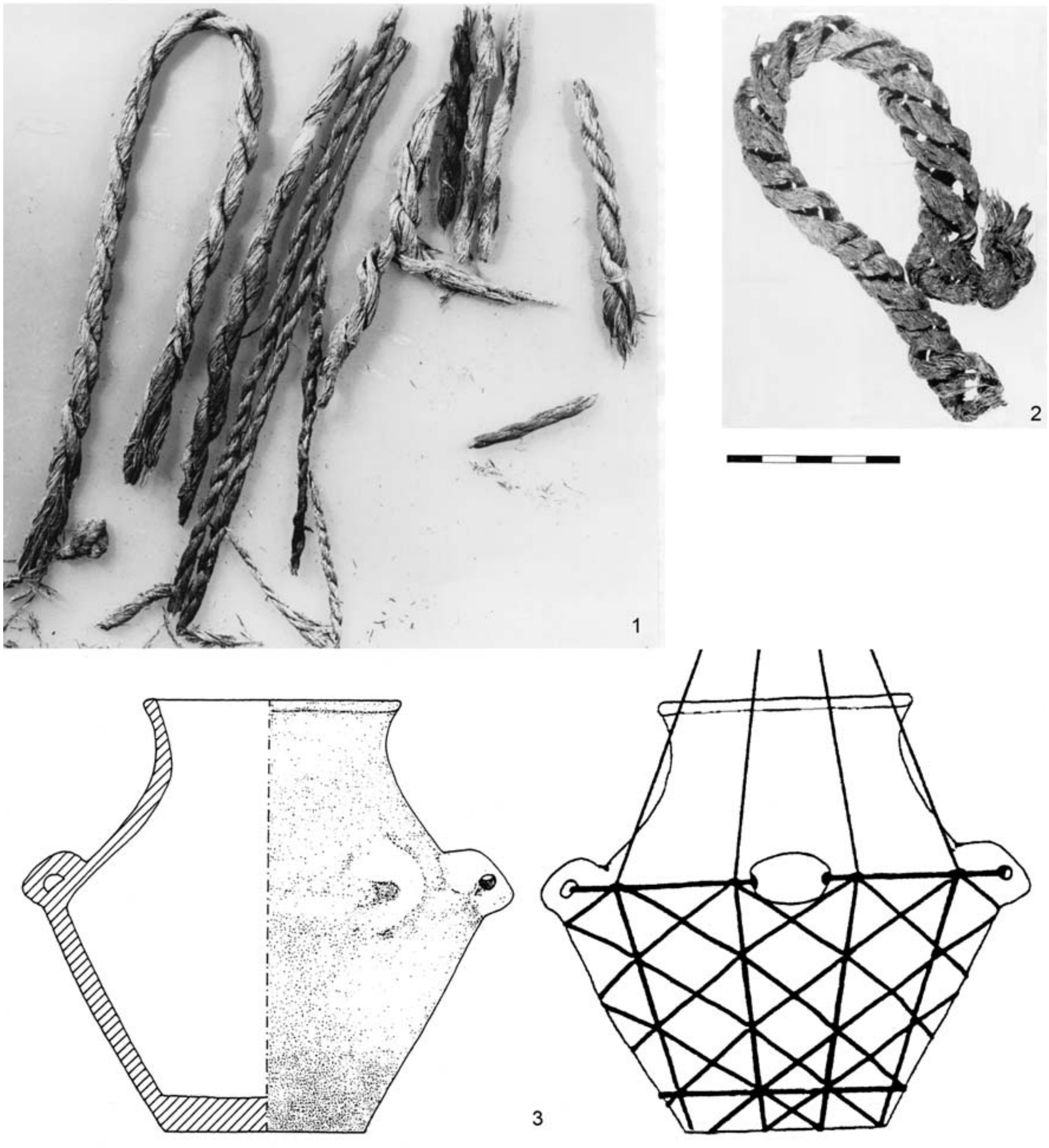
10) Schibler und Suter 1990, 91 ff.

11) Einige Textilien aus dem Salzbergwerk Hallstatt weisen Garne mit parallel liegenden Fasern auf, wie sie durch Verspinnen eines Kammzuges erreicht werden (Kammgarn). Vgl. Grömer 2005a, 37.

12) Vgl. Wininger 1995, 162, Abb. 41/1.

13) Willvonseder 1963–1968, 163, Taf. 11.

14) Rast-Eicher 2005, 118.



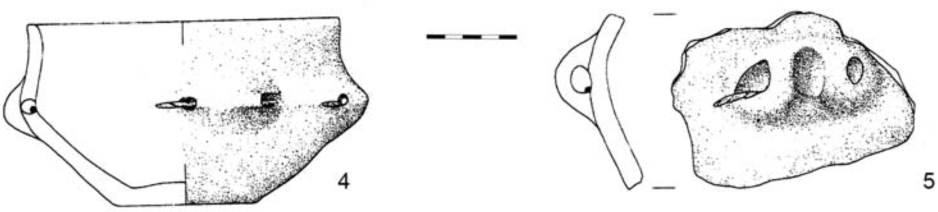


Abb. 2: See/Mondsee: 1 gedrillte Bastschnüre, 2-fach. – 2 Schnur aus drei Strängen. – 3-5 Gefäße mit Schnurösen der Mondseekultur (Photos: Prähist. Abteilung, Naturhist. Mus. Wien, Grafik nach Holzer und Antl-Weiser 1995, Abb. 4).

lich. Mit langfaserigem Material wie Bast oder auch mit Gräsern können endlose Schnüre durch einfaches **Verzwirnen** per Hand hergestellt werden. Dabei werden zwei Stränge abwechselnd gedreht (in S- oder Z-Richtung) und in Gegenrichtung überkreuzt und somit verzwirnt (Abb. 3). Diese dabei entstehenden meist dickeren Schnüre sind als universelles Bindematerial einsetzbar oder als Ausgangsprodukt für verschiedene andere Textiltechniken, etwa als Kettmaterial bei Zwirnbindung. Durch Zwirnen können jedoch auch sehr feine Fäden (Zwirne) entstehen, wie etwa das Kettmaterial für die spätneolithischen Siebe aus Hornstaad[15]. Gedrillte Schnüre aus großteils Linden- und Eichenbast finden sich in der Station See/Mondsee[16], es kommen sowohl S- als auch Z-gezwirnte vor; erstere sind am häufigsten, sie haben Schnurdicken von 4–14 mm (Abb. 2/1). Neben den aus zwei

15) Freundlicher Hinweis von Anne Reichert. Vgl. Reichert 2005.

16) Freundliche Mitteilung von Veronika Holzer, siehe Anm. 2. Unpublizierter Katalog Taf. 2/6 und 7/1.

Strängen gedrehten Schnüren finden sich solche, die aus drei Strängen zusammengezwirnt wurden (Abb. 2/2). Es haben sich auch einige Schnüre in Schnurösen von Keramik erhalten, wo sie als Aufhängevorrichtung dienten (Abb. 2/4–5), was die Bedeutung von Schnüren bei der Verwendung von Gefäßen verdeutlicht. Bei einem vollständig erhaltenen Gefäß mit Schnurresten in beiden Henkeln konnte beim Freilegen der Abdruck von in drei Reihen liegenden Resten von Schnurverbindungen in die Kulturschicht eingepresst dokumentiert werden, sodass die Aufhängung rekonstruierbar war (Abb. 2/3)[17].

Eine 3,5–4 mm starke Schnur (S-gezwirnt) aus Bast wurde an der Pfahlbaustation am Keutschacher See[18], Kanzianiberg-Lasinja-Gruppe des Epilengyelkomplexes entdeckt (Abb. 3b).

Eine indirekte Quelle für Fäden bieten die Schnurabdrücke auf Gefäßen, wie bei der nach dieser Verzierungsweise benannten Schnurkeramik.

Eine andere, aus dem Neolithikum bekannte Methode zur Bildung langer Schnüre, ist das **Flechten**, das abwechselnde Verkreuzen von drei oder mehr Strängen, wobei langfaseriges Material wie Bast oder Gräser bzw. bereits gesponnene Fäden verwendet werden. Geflochtene Schnüre wurden auch als Kettmaterial bei Zwirnbindung verwendet, sie sind jedoch im Verhältnis zu gezwirnten sehr selten.

Einer der raren Funde für geflochtene Schnüre in Österreich sind Schnurzopfabdrücke auf einer spätneolithischen Scherbe aus Roggendorf Ost, NÖ. (Abb. 4)[19].

Spinnen

Zum Spinnen eines Fadens sind als Werkzeug primär ein (hölzener) Stab von ca. 20–30 cm Länge und ein Schwunggewicht vonnöten, letzteres ist als tönerne Spinnwirtel im archäologischen Fundgut relativ häufig vertreten. Hier soll ein kurzer Überblick über neolithische Spinnwirtelformen in Österreich[20] gegeben werden (Abb. 5), der folgende

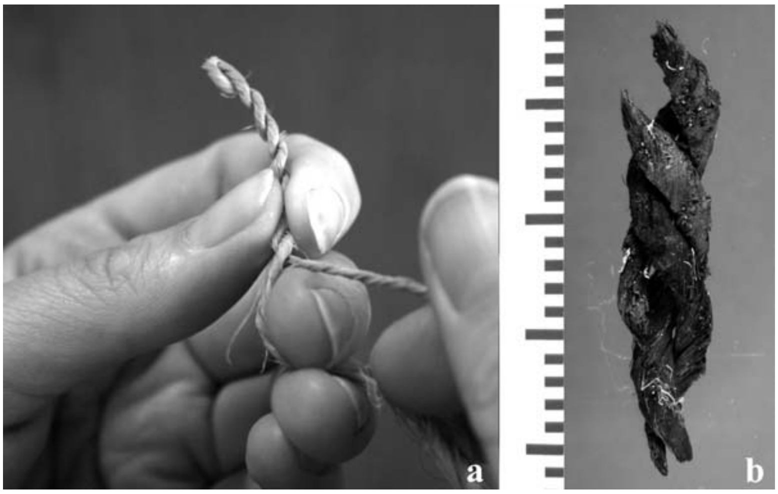
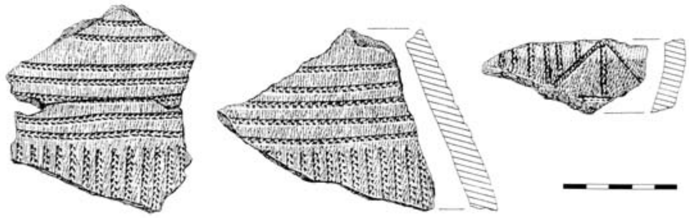


Abb. 3 (oben): Zwirnen: a Fasern werden verdrillt und zu einer Schnur gezwirnt. – b Schnurrest vom Keutschachersee (Photos: a M. Kuceram, b C. Dworsky).
Abb. 4 (unten): Roggendorf: Schnurzopfabdrücke auf spätneolithischer Keramik (nach Ruttkay und Harrer, Fundber. Österreich 39, 2000, 571–572)



Absatz versteht sich jedoch nicht als eine vollständige Spinnwirteltypologie der Jungsteinzeit.

In der Bandkeramik kennt man etwa aus zerbrochener Keramik rundlich zugeschliffene und durchbohrte Scherbenwirtel, wie jene aus Leonding oder Breiteneich. An letzterer Fundstelle oder in Poigen gibt es zudem kugelige bis doppelkonische Spinnwirtel. Diese Form kommt noch im Mittelneolithikum vor, so in der Lengyelbefestigung Falkenstein (MOG Ib), oder in Etzmannsdorf bei Straning (Mittelstufe, MOG IIa). Die lengyelzeitlichen Spinnwirtel sind eher klein mit Höhen und Durchmessern von ca. 3,5–4 cm. Aus Wolfsbach (Epilengyel, Spätstufe) ist ebenfalls ein kugeliger Spinnwirtel bekannt.

Im Jungneolithikum ist die Spinnwirtelform scheibenförmig oder flachkonisch anscheinend am gebräuchlichsten, wenn auch in den Münchshöfener Komplexen (Epilengyelhorizont) von Rutzing als

17) Holzer und Antl-Weiser 1995, 10–11, Abb. 4 und 5.
18) Siehe Cichocki und Dworsky, in diesem Band.
19) Freundlicher Hinweis für die Literatur von Oliver Schmitsberger. Vgl. bei E. Ruttkay und A. Harrer, Roggendorf. Fundber. Österr. 39, 2000, 573 und Abb. 293–295. Derart verzierte Scherben kommen in der jüngeren Trichterbecherkultur in Polen (Luboner Gruppe) mehrfach vor.
20) Referenzen zu den einzelnen Fundorten: **Leonding**: Grömer 2001, 97, Taf. 64/16 und 73/12. – **Breiteneich**: Fundber. Österreich 1980, 1984, 1987, 1990–1994 (freundl. Hinweise von Franz Pieler). – **Poigen**: Lenneis 1977, Taf. 10. – **Falkenstein**: Neugebauer-Maresch 1981, Taf. 56/2E. – **Etzmannsdorf** und **Wolfsbach**: Ruttkay 1978, Taf. X und XVI. – **Rutzing**: Kloiber, Kneidinger und Pertlwieser 1971, Taf. IX/5. – **Keutschacher See**: Samonig 2003, 80, Taf. 49/570–572. Ein neuerer Wirtelfund aus dem Keutschacher See ist scheibenförmig und trägt Verzierungen. Siehe Cichocki und Dworsky, in diesem Band. – **Mondseekultur**: Lochner 1997, Taf. 7/17, Taf. 61/7–8. – Baalberge und Boleráz: Ruttkay 1995, Abb. 9, 11, 16. – **Melk-Wachberg**: Schwammenhöfer 1990, 97 ff. – Kleiner Anzingerberg, Krems-Hundssteig und Pulgarn: noch nicht katalogmäßig vorgelegt; Zeichnung K. Grömer.

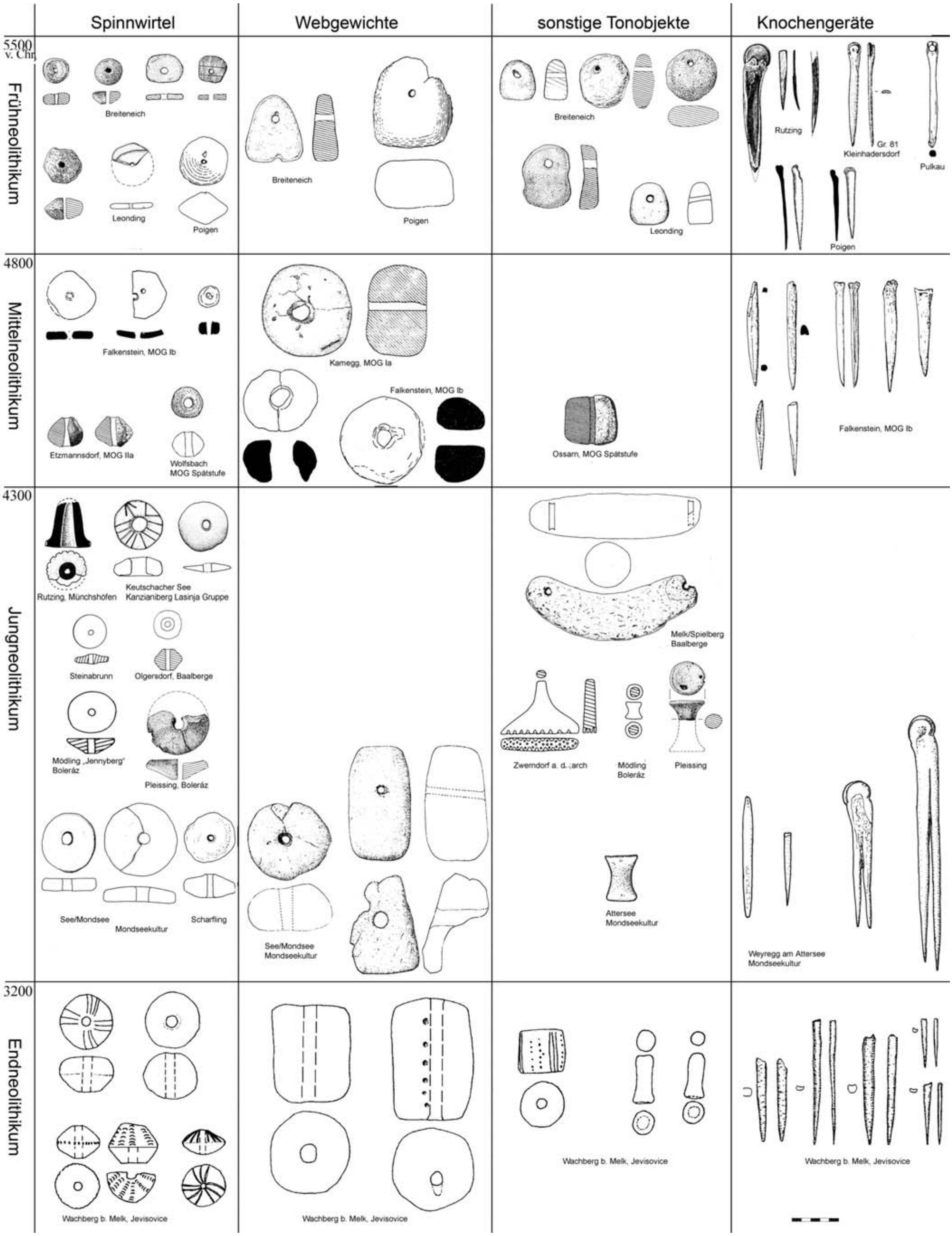


Abb. 5: Übersicht zu Textilgeräten aus Ton und Knochen des österreichischen Neolithikums (Auswahl) (Abbildungsnachweise siehe Anm. 20, 24, 29, 51 und 54).

Ausnahme ein glockenförmiger Wirtel bekannt ist. In der Kanzianiberg-Lasinja-Gruppe des jungneolithischen Epilengyelkomplexes gibt es am Keutschacher See scheibenförmige Wirtel mit Durchmesser um 5 cm, wobei auch Strichverzierungen und Eindrücke auftauchen. Die Spinnwirtel der Mondsee-Gruppe aus Scharfling und See sind ebenfalls scheibenförmig bis flachkonisch mit Durchmessern von 4–6 cm. Flachkonische bzw. schälchenförmige Spinnwirtel gehören in der Baalberger Gruppe, in Olgersdorf und Steinabrunn, der gemischten Gruppe mit Furchenstich, etwa in Wien 23, sowie in der Boleráz-Gruppe zum bekannten Inventar, in letzterer Gruppe kommen auch verzierte vor.

Besonders häufig sind Spinnwirtel im älteren Endneolithikum, in der Jevišovice-Kultur, so am Kleinen Anzingerberg, in Melk-Wachberg oder in Krems-Hundssteig und in der Chamer Gruppe, etwa in Steyregg-Pulgarn, wo teils große Spinnwirtelserien vorkommen. Der Formenreichtum der Spinnwirtel zu dieser Zeit ist enorm, er reicht von scheibenförmig, kugelig, doppelkonisch bis hin zu glockenförmig. Sie sind auch mit kulturspezifischen Ornamenten verziert, etwa Einstichen, Ritzlinien etc. Die Verzierung ist meist radial geformt, es sind auch Umbruchkerbungen vorhanden. Diese sog. „bombastischen“ Spinnwirtel der Chamer Gruppe und Jevišovice-Kultur erreichen auch bei den doppelkonischen Formen sehr große Durchmesser um 5–6 cm und Gewichte über 100 g.

In der Schnurkeramik und in der Glockenbecherkultur werden Spinnwirtel wieder seltener, wobei Spinnwirtel in den Gräbern dieser Zeit nicht beigegeben wurden und bisher nicht viele Siedlungen in Österreich bekannt sind.

Durch ihre Zweckform sind Spinnwirtel per se feinchronologisch schwer zu datieren, da die Grundformen kugelig, scheibenförmig und dann doppelkonisch in den unterschiedlichsten kulturellen Kontexten auftauchen. Ob die Verzierung auf den Spinnwirtel im Neolithikum symbolische Bedeutung haben, oder ob sie lediglich dem jeweils zeittypischen Verzierungsschema entsprechen, kann in diesem Rahmen nicht beantwortet werden.

Vorbild für das Spinnen mit der in der Urgeschichte üblichen Handspindel war das Drehen eines Fadens mit der Hand, ein Vorgang, der mittels Stäbchen und Schwunggewicht beschleunigt und vereinfacht wurde (ist das fertige Fadengut einmal auf die Spindel gewickelt, kann es sich nicht mehr aufdrehen). Durch den vom Gewicht des jeweiligen Spinnwirtels anbhängigen Schwung wird der Spindel ein gleichmäßiger, möglichst langer Lauf verliehen, um das Garn zu drehen und dadurch zu verfestigen.

Es gibt unterschiedliche Spinntechniken, die unter anderem auch mit dem zu verspinnenden Rohmaterial zusammenhängen (Abb. 6). Beim Verspinnen von Wolle wird das aufgelockerte Wollvlies in der linken Hand gehalten, während die rechte Hand die Spindel dreht und das Fasermaterial zu einem dünnen Strang verzieht. Sobald sich die durch die Bewegung der Spindel verursachte Drehung auf den losen Faserstrang überträgt, ist ein Faden entstanden. Der Arbeitsvorgang verläuft gleichmäßig und rhythmisch: Spindel drehen – Fasermaterial verziehen – Faden drehen lassen. Ist der Faden zu lange geworden, muss er auf den Spindelstab aufgewickelt werden. Nach abermaligem Befestigen des Fadens an der Spindel kann der Vorgang wieder beginnen.

Wie oben beschrieben, kann Wolle „aus der Hand“ gesponnen werden, während man das Material hält. Spinnt man hingegen langfaseriges pflanzliches Material, etwa Flachs, so ist es einfacher, das Spinngut auf einem Rocken, einem Stab, aufzuhängen. Nur so hat man beide Hände frei, um den Faden gut verziehen zu können (Abb. 6 links).

Auch Wolle kann man auf einem Rocken befestigen, besonders wenn man größere Mengen mit sich führen will oder man verspinnt sogenanntes „Vorgarn“[21]. Diese Technik ist ab der Eisenzeit und besonders im antiken Griechenland bekannt, dabei wird Wolle gekämmt und bereits in schmäleren Streifen vorbereitet auf einen Rocken gewickelt, um feineres und gleichmäßigeres Garn spinnen zu können. Ein Rocken ist archäologisch schwer nachzuweisen, da es sich bei der simpelsten Ausführung lediglich um einen Holzstab handelt.

Weitere verschiedene Spinntechniken beziehen sich auf die Handhabung der Spindel. So kann die Spindel verwendet

Abb. 6: Spinnen mit der Handspindel anlässlich eines Keltenfestes: links: Spinnen von Flachs mit Spinnrocken, Mitte: Spinnen von Wolle in der Tonschale, rechts: Spinnen mit „frei hängender“ Spindel (Photo: P. Grömer).

21) Dazu näher bei Grömer 2003, 468 f.

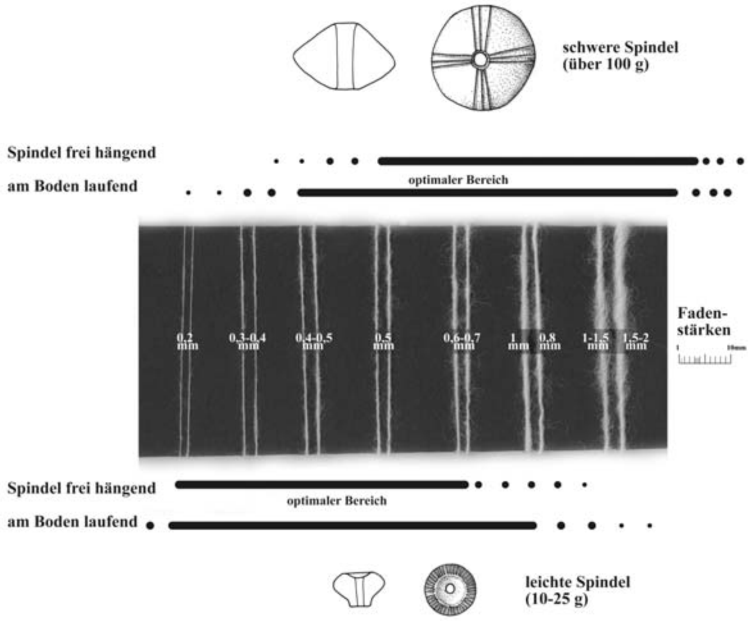


Abb. 7: Relation zwischen Fadenstärke und Spinnwirtelgewicht (Versuche mit Wolle). Vergleich zwischen den ca. 120 g schweren Wirteln der Jevišovice-Kultur von Krems-Hundssteig und den 10–25 g schweren ältereisenzeitlichen Wirteln aus Hallstatt (Grafik: K. Grömer).

werden, indem sie an dem gerade entstehenden Faden frei hängt (Abb. 6 rechts). Es ist auch möglich, die Spindel in einer Schale (Abb. 6 Mitte) oder am Boden laufen zu lassen, sodass die Schwerkraft nicht auf sie wirkt.

Die gesponnenen Garne wurden im Neolithikum nach den Funden aus den Feuchtbodensiedlungen der Schweiz und Süddeutschland meist verzwirnt, um sie zu verweben. Die Fadenstärken der Flachsfäden liegen meist bei 0,5–1 mm[22].

Es wurden mit neolithischen Originalspinnwirteln verschiedene Versuche gemacht, um ihre Leistungsfähigkeit zu testen[23]. Verwendet wurden Wirtel von Meidling/Kleiner Anzingerberg (Jevišovice-Kultur, mit Gewichten zwischen 130–140 g). Als Vergleich wurden leichtere Wirtel aus anderen Zeitperioden herangezogen, unter anderem aus dem Gräberfeld Hallstatt (HaC, mit Gewichten von 10–20 g). Einerseits wurde die Drehdauer eruiert (wie lange dreht sich eine Spindel bei einmaligem Andrehen?), andererseits die Drehfrequenz (wie oft dreht sich die Spindel in einem bestimmten Zeitraum?). Dabei sind die Form und das Gewicht der Wirtel von entscheidender Bedeutung, vor allem bei der Frage nach möglichen erzielbaren Fadenstärken.

Wesentlich ist für die Produktivität beim Spinnprozess, dass sich die Spindel möglichst lange dreht, da man die Spindel dann nicht so oft andrehen muss – jeweils ein zusätzlicher Handgriff beim Spinnen. Eine sehr hohe Spinnfrequenz ist auch von Vorteil, da der entstehende Faden schnell mit den gewünschten Drehungen versehen werden kann.

Bei den Versuchen drehten sich die Wirtel vom Anzingerberg mit einem Gewicht von 124–147 g in 6 sec. bei einmaligem Andrehen 78–90 mal. Die leichten Spindeln von Hallstatt zwischen 10–20 g konnten vergleichsweise mit einer doppelten Drehfrequenz von 140–170 Umdrehungen aufwarten. Dieser Einfluss des Gewichtes auf die Leistungsfähigkeit (die leichteren Spindeln haben eine höhere Drehfrequenz als schwere Spindeln) ändert sich bei einer im herkömmlichen Spinnablauf zunehmenden Bewicklung. Diese wirkt sich bei den leichten Spindeln durch den vermehrten Luftwiderstand als Schwungdämpfer aus.

Bei der Messung der Laufzeit oder Drehdauer der Spindeln bei einmaligem Andrehen verhält es sich nun genau umgekehrt: leichtere Spindeln haben eine weitaus kürzere Laufzeit als schwerere. So drehen sich die schweren Spindeln mit 124–147 g Gewicht fast 1 Minute lang, während die mit um 10–15 g sehr leichten Exemplare teilweise nur 15–20 sec. laufen.

Bei Experimenten zu den mit verschieden gewichteten Wirteln erzielbaren Fadenstärken (Abb. 7) kann allgemein als Ergebnis festgehalten werden, dass sich schwere Spinnwirtel eher für dickere Wollfäden und für Flachs eignen, wobei einschränkend hinzugefügt werden muss, dass dies nur bei der Spinntechnik gilt, bei der die Spindel frei hängend verwendet wird. Wird die Spindel am Boden (in einer Schale) laufend betätigt, so ist mit einer schweren Spindel über 100 g auch bei Wolle eine sehr feine Fadenstärke von 0,3–0,4 mm herstellbar, da die Schwerkraft nicht auf den Faden einwirkt. Eine sehr leichte Spindel mit ca. 10–20 g ist hingegen nicht in der Lage, zu dicke Wollfäden (ab 1,5 mm Stärke) oder Flachs zu verarbeiten, unabhängig von der Spinntechnik. Im Gegenteil, wird sie am Boden laufend verwendet, so wird sie noch zusätzlich gebremst, was die Effizienz noch mehr beeinträchtigt.

Spulen

Zum Themenkomplex der Fadenherstellung sind letztendlich auch jene Geräte zu zählen, die den Faden aufnehmen. In einfachster Variante sind dies Holzstäbchen, im Spätneolithikum gibt es auch Spulen aus Ton (Abb. 5, Spalte 3).

22) J. Banck (Textilien) in Preuß 1998, 118.
23) Näheres bei Grömer 2005b. Mit den Messdaten und Diagrammen.

Diese Spulen gehören wie flachkonische Spinnwirtel zum bekannten Geräteinventar der Badener Kultur, wobei sie sowohl in der frühen Phase, der Boleráz-Gruppe, wie auch in der entwickelten Stufe, der Ossarn-Gruppe auftreten, etwa in Strass im Strassertal. Zur Boleráz-Gruppe gehören ein kleines Exemplar aus Mödling-„Jennyberg“, oder ein Fragment aus Pleissing-Holzfeld mit einem Durchmesser der Endscheibe von 3,5 cm[24].

Auch im Inventar der jungneolithischen Jevišovice-Kultur sind öfter Spulen belegt, wenngleich sie im zeitgleichen Cham bisher nicht auftauchen. So gibt es etwa vom Wachberg bei Melk[25], einer Siedlung der frühen Jevišovice-Kultur derartige Spulen (Länge zwischen 4,5 und 5,5 cm, Durchmesser um 2,4 cm), die häusliche Textilproduktion belegen.

Die Verwendungsmöglichkeit von Spulen im textilen Handwerk ist vielfältig. Neben dem einfachen Aufwickeln von Garn für Lagerungszwecke sind Spulen mit darauf aufgewickeltem Garn auch als Geräte für verschiedene Web- und Flechttätigkeiten verwendbar. Aufgrund der relativ geringen Größe der Spulen bin ich geneigt anzunehmen, dass eher feineres Garn darauf aufgewickelt wurde, wenn sie etwa als Materialvorrat bei Textiltechniken verwendet werden. Spulen mit Garn sind so möglicherweise auch beim Zwirnbinden gut einsetzbar.

Ein eisenzeitlicher Befund zur Verwendung von Spulen als Gewichte in der Weberei ist aus den Gräbern von Verucchio bekannt[26]. Sie wurden als Gewichte in der Brettchenweberei interpretiert, wobei je eine Spule für die Kettfäden eines jeden Brettchens verwendet wird, was den Vorteil bietet, dass die Verschnürung des Kettfadenvorrates beim Weben durch die Spulen rasch gelöst werden kann.

Flächenbildende Techniken

Im Neolithikum sind viele Methoden zur Stoffbildung bekannt, von denen einige auf mesolithischen Traditionen fußen, andere wiederum neolithische Innovationen darstellen. So sind etwa Halbgeflechte, Geflechte und Kettenstoffe in Zwirnbindung, sowie durch Verschlingen oder Verknoten hergestellte Maschenstoffe bereits in mesolithischen Kontexten vorhanden, Gewebe und Florstoffe (Kettenstoffe mit Vlieseinbindung) sind ab dem Neolithikum nachgewiesen[27].

Im Folgenden sollen wichtige stoffbildende Techniken vorgestellt und in Hinblick auf österreichisches Fundgut zu diesen näher beleuchtet werden.

Pfrieme und Ahlen[28] als textiles Universalgerät sind neben nähenden Tätigkeiten unter anderem auch beim Netzen verwendbar, sowie für viele Flechttechniken, etwa dem Wulstflechten. Außerdem sind sie für Lederarbeiten, etwa zum Vorstechen beim Nähen denkbar.

Pfrieme und Ahlen aus Tierknochen sind ab der Bandkeramik in vielen Siedlungskontexten, aber auch in Gräbern des Neolithikums bekannt. Pfrieme wurden großteils aus gespaltenen Röhrenknochen (Metapodien) von Jagdwild hergestellt, sie sind in verschiedenen Größen und Stärken zu finden und haben meist einen Gelenkskopf als oberes Ende, der gleichzeitig als Handhabe dient. Sie können geglättet, abgerundet oder zugespitzt sein. Als Zweckformen haben sie keine große Variabilität. 7–10 cm lange Knochenahlen aus den Röhrenknochen kleiner Huftiere stammen etwa aus der bandkeramischen Siedlung Poigen, Flur „Bachrain“ oder aus Rutzing. Pfrieme sind auch aus der Lengyelbefestigung von Falkenstein nachgewiesen[29].

Größere Nadeln mit Öhr, ein derartiger Fund ist aus der Kreisgrabenanlage von Kamegg bekannt (MOG Ia, Abb. 10), sind wie Pfrieme für Flechttechniken, aber auch zum Netzen verwendbar.

Abb. 8: Netzen mittels „Pfahlbauknoten“: Mit einer Netzwalze und einer Replik einer „Lüscherzer Netznadel“ wurde ein Netz aus Robenhausen, Schweiz (li) nachgebildet, das sich im Naturhistorischen Museum befindet (Photo: K. Grömer).

24) Ruttkay 1995, Abb. 16.
25) Ruttkay 2001, 67, Abb. 5.
26) Rast-Eicher 2005, Abb. 23.
27) Vgl. Rast-Eicher 2005.
28) Als Pfriem werden großteils spitze Geräte mit Gelenksende angesprochen, Ahlen sind derartige Geräte ohne Gelenksende, Nadeln haben ein Öhr.
29) Zu **Poigen**: Lenneis 1977, 20, Taf. 12. – Zu **Rutzing**: Kloiber und Kneidinger 1968, Taf. IV. – Zu **Falkenstein**: Neugebauer-Maresch 1981, 76.

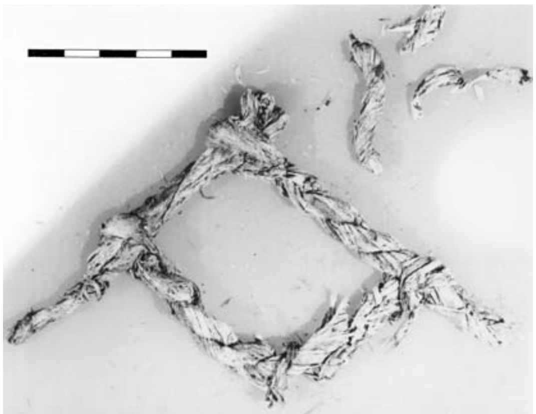


Abb. 9: See/Mondsee: Netz aus verschlungenen Maschen (Photo: Prähist. Abt., Naturhist. Mus. Wien).

Netzen/Maschenstoffe

Maschenstoffe sind Stoffbildungen, die mit nur einem fortlaufenden Faden hergestellt werden. Die Fäden können dabei mit verschiedenen Arbeitstechniken, durch Einhängen, Verschlingen oder Verknoten zu Maschen verarbeitet werden, wobei Netze (Fischernetze, Tragnetze etc.) mit Pfahlbauknoten oder verschlungenen Maschen neolithisch belegt sind.

Ein netzartiges Gebilde unbestimmter Funktion findet sich in See/Mondsee (Abb. 9)[30]. Es ist mit verschlungenen Maschen mit einer Maschenweite von 4–6 cm hergestellt und besteht aus 9 mm dicken Lindenbastschnüren (S-Zwirn).

Nach den Schweizer Funden wurden Netze mittels Pfahlbauknoten (Abb. 8) eher für Fischernetze hergestellt, feine Netze, Beutel oder Taschen fertigte man mit verschlungenen Maschen an[31]. Netzartige Gebilde aus gezwirnten und gedrillten Schnüren sind auch die „Innenschuhe“ des Mannes vom Hauslabjoch. Ebenfalls zur Ausrüstung gehörte ein grobmaschiges Netz aus gezwirnten Lindenbastschnüren[32].

Werkzeuge für die Herstellung von derartigen Maschenstoffen sind Netznadeln und Netzwalzen (Maschenmasse). Als Netzwalze eignet sich jedes längliche Gerät, das einen möglichst gleich bleibenden Querschnitt aufweist, d. h. auch nicht spitz zuläuft. Die Netzwalze ist dazu da, die beim Netzen entstehenden Maschen aufzunehmen und deren normierte Größe zu gewährleisten (durch gleich bleibenden Querschnitt). Es könnte sich bei etlichen langschmalen Knochengeräten, die ab der Bandkeramik auftauchen (Abb. 5, Spalte 4), unter anderem um Textilgeräte zum Netzen gehandelt haben, so etwa ein langschmales Gerät (Länge ca. 12 cm) aus Pulkau[33] (Jüngere Bandkeramik) oder eines aus Weyregg am Attersee (Mondseekultur)[34]. Aus der Schweiz sind in der endneolithischen Lüscherzer Kultur Netznadeln bekannt, gebogene schlanke Knochengeräte mit durchlochter Knubbe[35]. Ob ein formal ähnliches Gerät aus Eggendorf am Walde (Abb. 12 links)[36], dessen Knubbe jedoch kein Loch aufweist, ebenfalls diese Funktion hat, sei hiermit zur Diskussion gestellt. Netze lassen sich jedoch auch ohne Nadeln, nur mit Abstandhalter knüpfen.

Abb. 10: Kamegg: Nadel aus der MOG Ia-zeitlichen Kreisgrabenanlage (Photo: K. Grömer).

Halbflechten

Bei einer Halbflechterei werden zwei Fadensysteme verwendet, es ist jedoch beim Arbeiten nur ein Element aktiv, während das andere passiv bleibt. So werden etwa beim Wulsthalbflechten passive Fadenbündel durch einen aktiven Faden umschlingend oder mit einer Nadel durchstechend verbunden. Auch Pfrieme oder sonstige spitze Knochengeräte wie jene aus Eggendorf am Walde (Abb. 12 rechts) können für flechtende Arbeiten herangezogen werden. Verwendbares Rohmaterial ist Langstroh, Bast oder Binsen. Wird das passive System in Spiralen aufgewunden, spricht man von der Spiralwulsttechnik. Diese Technik wurde meist zur Herstellung von Körben, aber auch für Matten und Ränder von Sieben verwendet.

Ein sehr fragmentiertes Beispiel eines korbartigen Spiralwulstgeflechtes ist aus See/Mondsee bekannt (Abb. 11/2)[37]. Auch auf dem Boden eines Gefäßes aus dieser Pfahlbaustation ist der Abdruck eines Spiralwulstgeflechtes erhalten geblieben (Abb. 11/1)[38], der Abdruck einer Unterlage oder eines korbartigen Geflechtes, auf dem das noch nicht lederharte Gefäß niedergestellt wurde. Derartige geflochtene Unterlagen wurden offenbar bei der Gefäßherstellung öfter verwendet, auf dem ein Tonklumpen zu einer Scheibe geklopft wurde, um den Boden zu formen.

30) Holzer und Antl-Weiser 1995, 12, Abb. 6. Freundliche Hinweise von Veronika Holzer zu den Details. Unpubl. Katalog Taf. 11/4.
31) Rast-Eicher 1995, 169 ff.
32) Zur experimentalarchäologischen Rekonstruktion siehe Reichert 2001.
33) Lenneis 1995, Abb. 16.
34) Willvonseder 1963–68, Taf. 11/12
35) Wininger 1995, 169, Abb. 42.
36) Freundlicher Hinweis von Wolfgang Lobisser und Wolfgang Neubauer.
37) Holzer und Antl-Weiser 1995, 12. Unpubl. Katalog Taf. 9/1.
38) Lochner 1997, Taf. C.

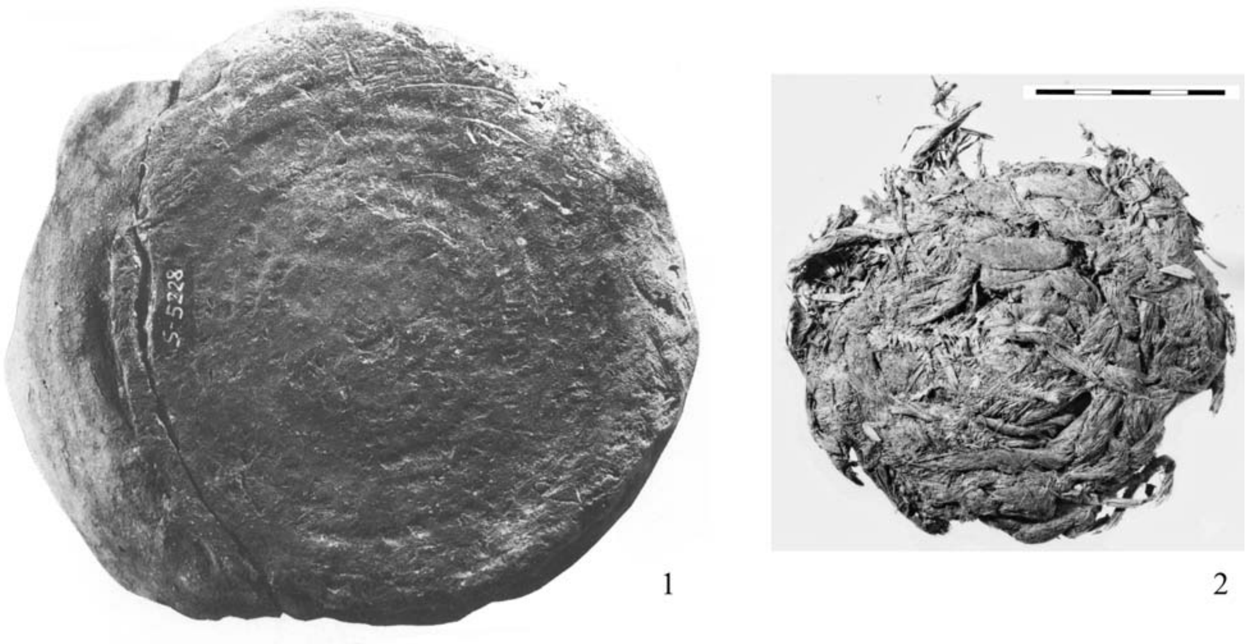


Abb. 11: See/Mondsee: 1 Abdruck eines Korbes in Spiralwulsttechnik, Mondseekultur. – 2 Rest eines Spiralwulstgeflechtes aus Bast (1 nach Lochner 1997, Taf. C, 2 © NHM).

Flechten

Im Neolithikum sind die unterschiedlichsten Flechttechniken bekannt, die auf einer langen Tradition spätestens seit dem Mesolithikum basieren. Bei Geflechten sind beide Fadensysteme aktiv. Zweidimensionale Geflechte sind in unterschiedlicher Ausführung möglich, als randparallele oder Diagonalflechtereien, wobei in neolithischen Komplexen eher randparallele Matten üblich sind. Bei dieser Technik kann in Leinwandbindung geflochten werden, wobei sich die senkrecht zueinander liegenden Elemente abwechselnd kreuzen. Es kann auch in Köperbindung gearbeitet werden, dabei überspringen die Elemente beim Kreuzen zwei Elemente. Für derartige Flechtereien wird üblicherweise steiferes Material wie Baststreifen, Schilf oder Gräser etc. verwendet, das aber beim Umbiegen nicht brechen darf. Geflechte werden meist mit der freien Hand gefertigt.

Mattenartige Fragmente finden sich relativ häufig in der Station See (Mondseekultur)[39], durch ihren schlechten Erhaltungszustand ist es jedoch nicht möglich, nähere Aussagen zu ihnen zu treffen oder ihnen gar eine Funktionsbestimmung zuzuweisen. Sie bestehen alle aus flachen, ungedrehten Fasern.

Geflechtabdrücke finden sich an österreichischen Neolithfundstellen auch auf Gefäßböden, wo sie meist zufällig entstanden, indem das entsprechende Gefäß noch in feuchtem Zustand auf eine Unterlage, etwa eine Matte gestellt wurde, und sich so die Struktur des Geflechtes abgebildet hat. Es wurden aber auch Textilien als Zierelement an der Gefäßwandung angebracht, etwa bei der Schnurkeramik oder der frühbronzezeitlichen Litzenkeramik.

Beim Exemplar aus Leonding[40] handelt es sich um einen Abdruck einer Bast- oder Grasmatte (?) auf dem Boden eines mittelneolithischen Gefäßes (Abb. 13/3). Das Mattengeflecht war in Köperbindung aus ca. 1 cm breiten Gräsern oder Getreidehalmen(?) gearbeitet. Soweit auf dem stark verwitterten Stück erkennbar, sind auch Unregelmäßigkeiten sichtbar.

Weitere köperbindige Mattenabdrücke finden sich etwa auf den Böden zweier spätlengyelzeitlicher Großgefäße aus Michelstetten[41]. Aufgrund der an den Abdrücken erkennbaren Längsstrukturen dürften die Matten aus 4–6 mm breiten Binsen oder Schilf geflochten worden sein. Interessant ist das Stück (Abb. 13/1), das bei der köperbindigen Struktur einerseits einen Richtungswechsel des

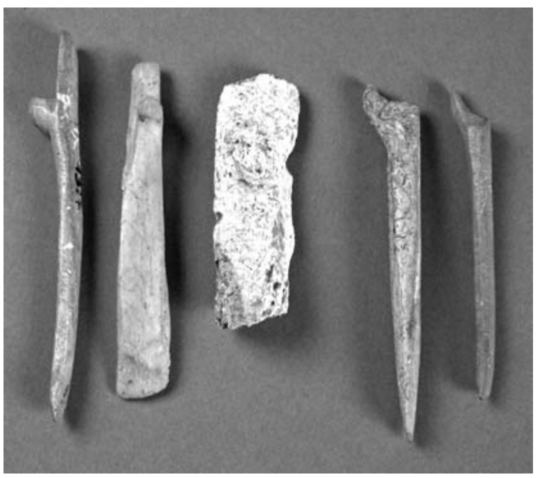


Abb. 12: Eggendorf am Walde: Knochengeräte mit Knubben und Spitzen, Lengyelkultur (Photo: A. Schumacher, BDA).

39) Holzer und Antl-Weiser 1995, 13.
40) Grömer 2001, 100, Taf. 18/6.
41) Grömer 2007 (in Vorbereitung), Abb.

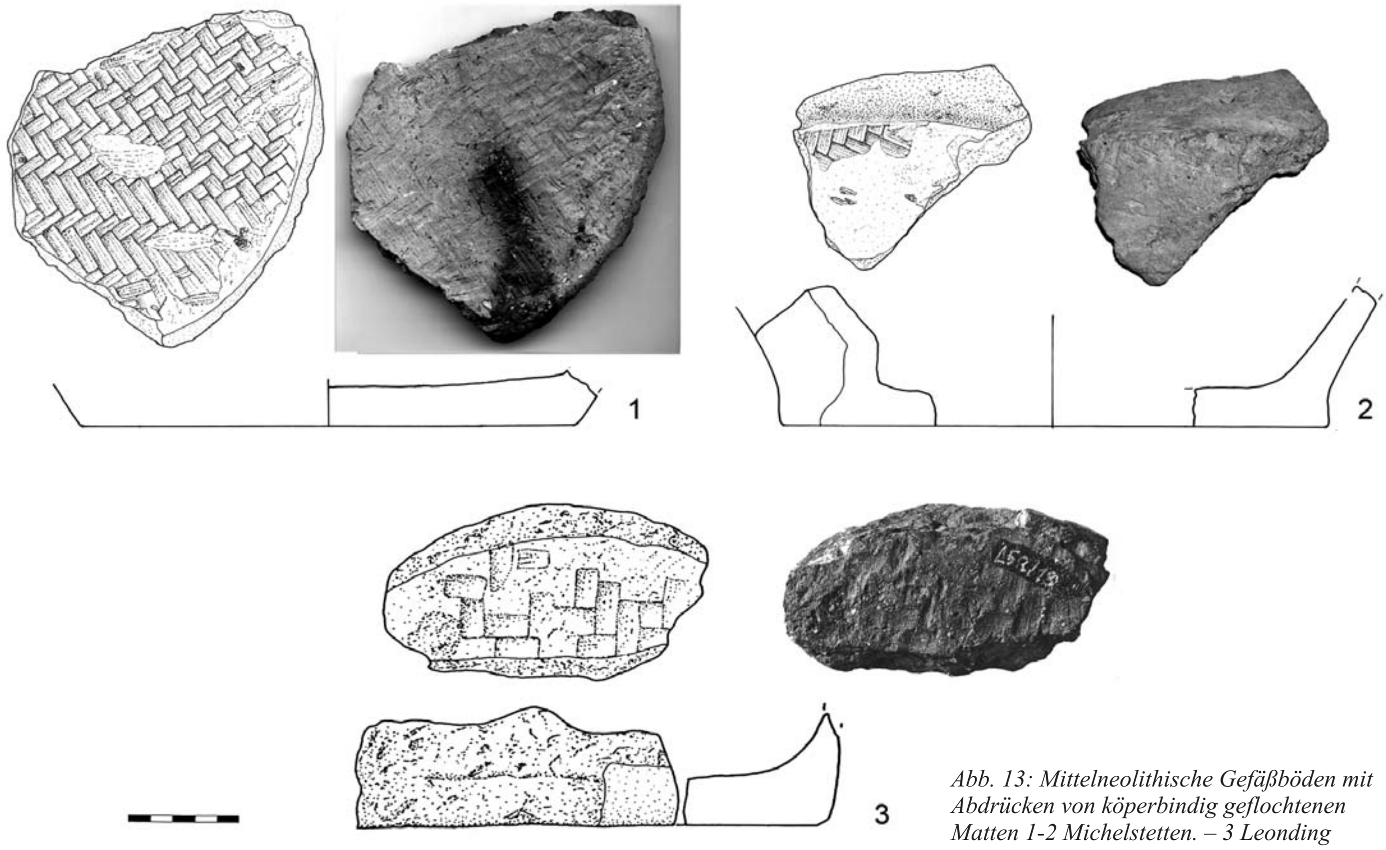


Abb. 13: Mittelneolithische Gefäßböden mit Abdrücken von köperbindig geflochtenen Matten 1-2 Michelstetten. – 3 Leonding (Photo und Grafik: K. Grömer).

Grates zeigt, sodass der Eindruck eines Fischgrätköpers entsteht, andererseits auch den Übergang von vierbindigem (2:2 Köper) zu sechsbindigem (2:4 Köper).

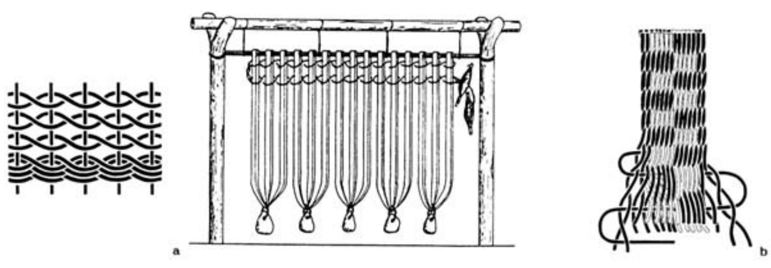
Zwirnbinden/Zwirnflechten

Bei der Herstellung von textilen Flächen durch Zwirnbindung werden passive Elemente von jeweils zwei aktiven Elementen umzwirnt und damit fixiert (Abb. 14)[42]. Je nach Abstand der Kett- und Zwirnreihen entstehen dichte oder lockere, teils sogar netzartige Zwirngeflechte. Wird die Kette fixiert und umzwirnt spricht man von einem Kettenstoff. Nach derzeitigem Erkenntnisstand kommt ausschließlich diese Stoffart in den neolithischen Komplexen, besonders in den Seeufersiedlungen vor[43]. In die Zwirnreihen können kürzere, u-förmig umgebogene (Bast-)Büschel mit eingezwirnt oder aufgenäht werden, die auf einer Seite lose herunterhängen und das Geflecht bedecken. So entsteht ein dichter, pelzartiger und wasserabstoßender Flor.

Für die Herstellung eines zwirnbindigen Textiles sind primär keine Arbeitsgeräte, nur die Hände nötig, vor allem, wenn es sich um kleinere oder auch um dreidimensionale Artefakte handelt, wie etwa zwirnbindige Körbe oder Taschen.

Werden großflächige zweidimensionale Gebilde gefertigt, etwa zwirnbindige Matten oder Stoffe, so ist es auch möglich, ein Zwirnbindungsgerät zu verwenden, wie dies durch ethnographische Parallelen belegt ist[44]. Bei einem solchen können etwa die aktiven Kettfäden den passiven Schusseintrag umzwirnen oder umgekehrt. Bei der Herstellung großflächiger Kettenstoffe kann man die Kette wie beim Gewichtswebstuhl mit Gewichten auf ein Gestell gespannt, wobei beim Zwirnbinden keine so hohe Spannung nötig ist. Daher ist es denkbar, dass die kleinen Tongewichte, die ab der Bandkeramik

Abb. 14: Schema für Zwirnbindung des Schusses mittels „Zwirnbindungsgerät“ (a) und der Kette (b). Für das Neolithikum ist Variante a belegt (Grafik: nach Wininger 1995, Abb. 32, Seiler-Baldinger 1991, Abb. 92 und 115).



42) Vgl. dazu die auch Überlegungen bei Wininger 1995, 174 ff., bes. 178.

43) Rast-Eicher 2005, 123 f., in Anm. 33 mit kritischen Anmerkungen zu Wininger 1995, 178.

44) In Korea gibt es etwa ein Zwirnbindungsgerät für die Herstellung von Matten. Vgl. Hirschberg und Janata 1986, 136, Abb. 70.

auftauchen (Abb. 5, Spalte 3), für diese Technik Anwendung fanden (näheres zu den kleinen Gewichten beim Kapitel Weben). Funde solcher kleiner Tongewichte stammen etwa vom bandkeramischen Material aus Breiteneich, oder von den bandkeramischen Siedlungsgruben aus Leonding (4,4x4x2,4 cm groß)[45]. Ebenso sind Spulen oder die nierenförmigen Webgewichte aus Melk für diese Zwecke verwendbar.

Da nierenförmige Webgewichte (Abb. 19) an beiden Enden Lochungen aufweisen, wären sie vor allem für eine Zwirnbindungsvariante gut handhabbar, bei der die Kettfäden den aktiven Part spielen, d. h. verdreht werden (Zwirnbindung der Kette). Die nierenförmigen Gewichte gewährleisten eine paarweise und drehbare Streckung zweier Kettfäden mit gleichzeitiger Fachbildung.

Prominente Beispiele für Zwirnbindung stammen vom Mann vom Hauslabjoch, der in die Zeit um 3350–3100 datiert wird, es sind die Matte und die Dolchscheide[46], letztere wurde rein von Hand zweidimensional gearbeitet und zusammengenäht (Abb. 15).

Zwirnbindige Textilien sind in Österreich von der Pfahlbaustation See/Mondsee im Salzkammergut bekannt. Es handelt sich großteils um S-gedrehte Zwirnbindungen mit teils sehr großem Abstand zwischen den Zwirnreihen (Abb. 16/2)[47].

Ein bekanntes Exemplar ist die sogenannte „Basttasche“ aus der Station See/Mondsee (Abb. 16/1)[48]. Bei diesem aus Eichenbast bestehenden Stück ist die Anfangskante erhalten, ess handelt sich dabei um ein Zwirngeflecht mit Florbildung (Vlieseinlage), der Abstand der Einträge beträgt 8–12 mm. Dabei wurden an der Außenseite zusätzliche Elemente mit eingezwirnt und das Stück durch zusätzliche Einlage von Noppen verziert.

Textilien, die in Zwirnbindung hergestellt wurden, können nach den schweizer Pfahlbaufunden für verschiedene Gebrauchs- und Trachtgegenstände wie Siebe, Matten, Taschen oder Hüte verwendet werden[49]. Solche Stoffe konnten auch zur Herstellung von Kleidern dienen, etwa warmen Überwürfen, wie der Umhang der Gletschermumie aus den Ötztaler Alpen, die ebenfalls in Zwirnbindung gefertigt ist.

Abb. 15: Dolchscheide des Mannes vom Hauslabjoch. Rekonstruktion der verschiedenen Arbeitsschritte von Anne Reichert (Photo: A. Reichert).

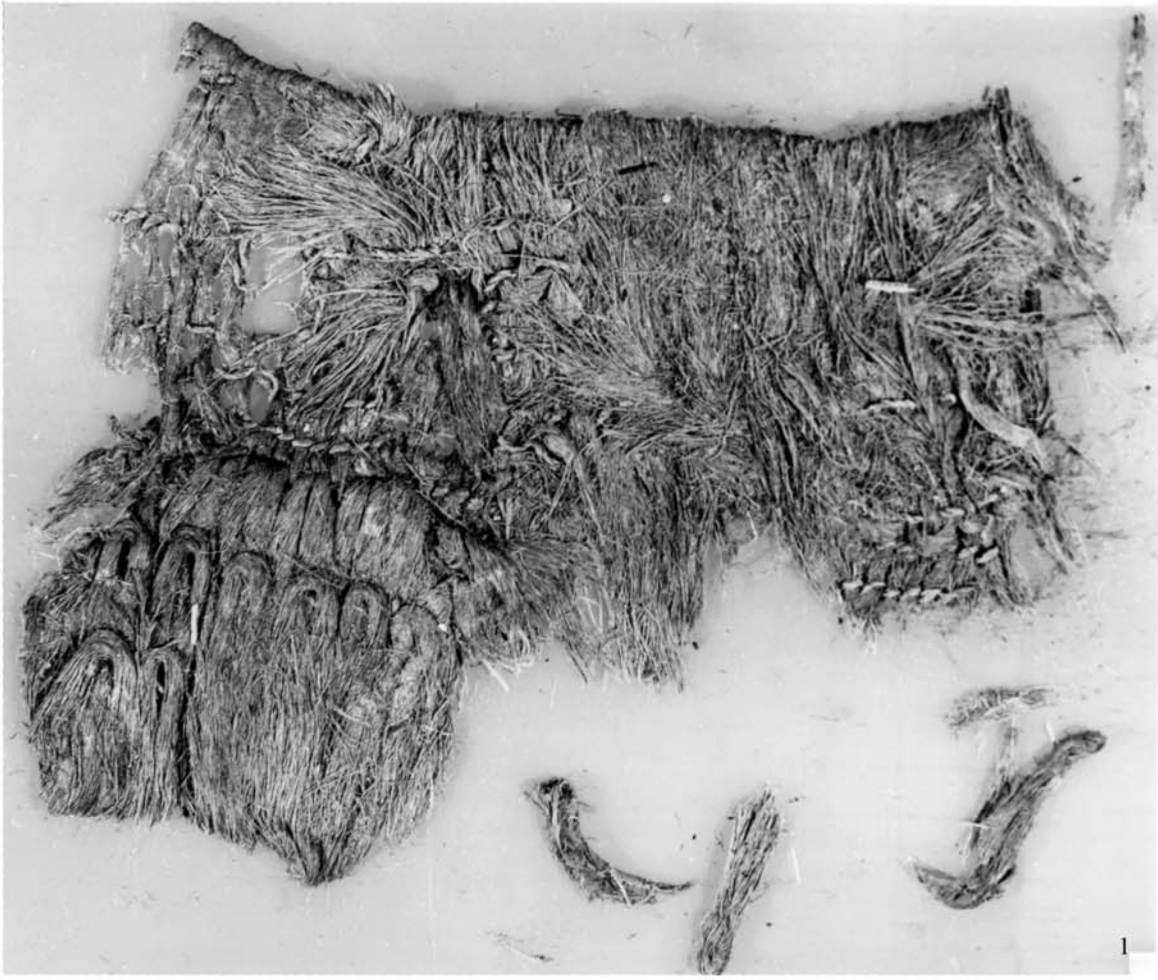
Weben

Für das Neolithikum wird angenommen, dass großflächige gewobene Textilien auf dem senkrechten Gewichtswebstuhl hergestellt wurden, archäologisch belegt durch Funde von Webgewichten. Andere Geräte, wie das horizontale Webgerät oder der Rundwebstuhl sind in Ermangelung an derartigen Holzfunden archäologisch schwer nachzuweisen. Bandförmige Gewebe sind auch auf einfachen Webgeräten mit Litzenstäben möglich. Gewebeanfangskanten werden ebenfalls am Bandwebgerät gestaltet. In Österreich sind, im Gegensatz zu den Funden aus den Schweizer Seeufersiedlungen oder aus Süddeutschland, leider keine Gewebe erhalten.

Beim Gewichtswebstuhl (Abb. 17/2) werden die in Gruppen zusammengefassten Kettfäden, die am oberen Ende am Warenbaum befestigt sind, durch Webgewichte beschwert und straff gehalten. Die Fachbildung erfolgt mittels einer Vorrichtung zur gruppenweisen Trennung der Kettfäden voneinander, sodass die Fäden nicht einzeln angehoben werden müssen, um den Schussfaden eintragen zu können[50]. Je nachdem, wie viele Litzenstäbe verwendet werden und in welcher Abfolge die Kettfäden an ihnen angezettelt sind, können unterschiedliche Gewebebindungen gefertigt werden.

Bei der Leinwandbindung, die bisher für das Neolithikum als einzige anhand der Gewebefunde nachgewiesen ist, wird jeder zweite Kettfaden am Litzenstab angehängt. Durch Heben und Senken

45) Grömer 2001, 97, Taf. 10/9.
46) Spindler 1993, 93. Dank an Anne Reichert für Hinweise zur Fertigungstechnik: Reichert 2001.
47) Freundlicher Hinweis Veronika Holzer. Im unpubl. Katalog Taf. 3/4.
48) Vgl. Holzer und Antl-Weiser 1995, 12, Abb. 7. Im unpubl. Katalog Taf. 11/2. Experimente nach genauer Analyse könnten Einzelheiten zur Fertigungstechnik klären.
49) Vgl. dazu die Funde aus den Stationen des Zürichsees. Rast-Eicher 1995, 172.
50) Definition zum Weben siehe in der Systematik bei Seiler-Baldinger 1991, 80.



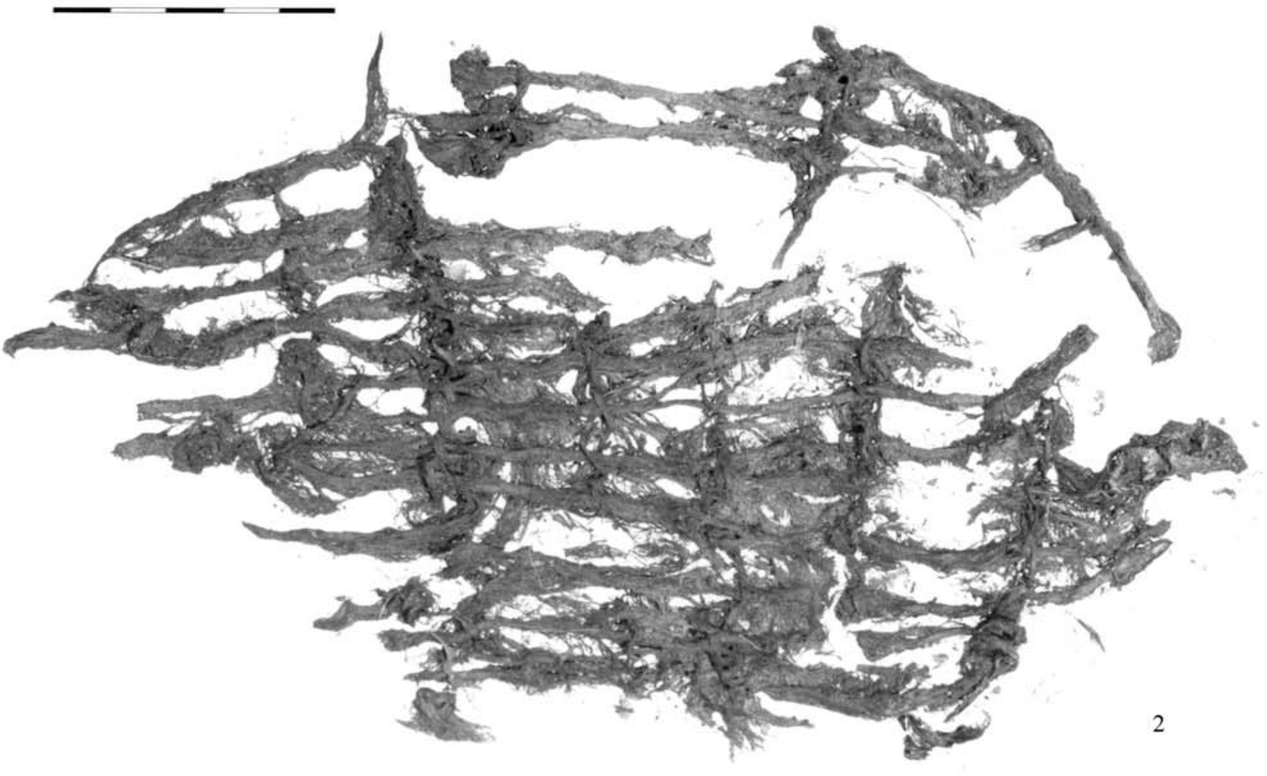


Abb. 16: See/Mondsee: Textilien in Zwirnbindung. 1 sogenannte „Basttasche“. – 2 lockeres, netzartiges Zwirngeflecht (Photos: M. Honecker, NHM).

des Litzenstabes wird ein natürliches oder künstliches Webfach gebildet, durch das der Schussfaden geführt wird.

Ein archäologischer Nachweis für das Weben kann indirekt durch die meist tönernen Webgewichte für einen Gewichtswebstuhl erbracht werden, die von österreichischen Neolithfundstellen bekannt sind (Abb. 5, Spalte 2). Webgewichte sind – ebenso wie Spinnwirtel – Zweckformen, deren Formgebung im Laufe der Zeit nur wenig variiert und bei denen die chronologische Einordnung daher auf deren Beifunde beschränkt bleibt.

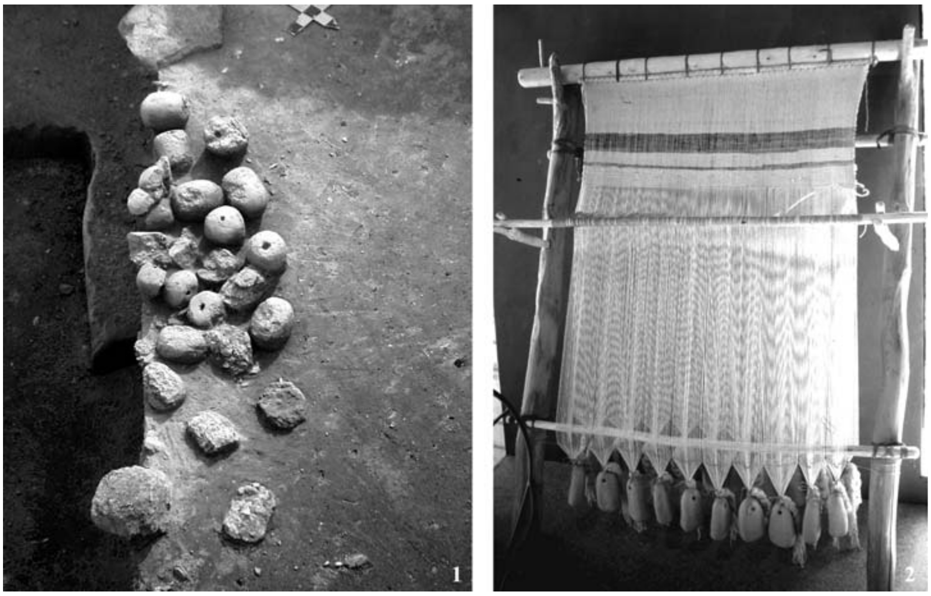


Abb. 17: Weben: 1 Krems-Hundssteig, Webstuhlbefund der Jevišovicekultur. – 2 Webstuhlrekonstruktion im Archaeopark Schnals (Photos: 1 F. Pieler, ASINOE, 2 K. Grömer).

Die frühesten Funde von diesen schlecht oder nicht gebrannten Gewichten[51] stammen aus der Bandkeramik, wo etwa walzenförmige bis zylindrische senkrecht durchlochte Webgewichte in Breiteneich und Poigen (Länge des Webgwichtes: 6,9 cm, Breite 6 cm) gefunden wurden. Das Formenspektrum der Webgewichte wird im Mittelneolithikum vielfältiger, es sind im Mährischen Kode der Bemaltkeramik laibförmige, pyramidenförmige, prismatische und kugelige Gewichte codiert; aus der lengyelzeitlichen Kreisgrabenanlage von Kamegg (MOG Ia) ist eine Kollektion verschiedener Webgewichte erhalten, ringförmige Webgewichte kennen wir auch aus Falkenstein (MOG IIa).

Aus der Mondseekultur sind zylindrische Webgewichte mit waagrechter Bohrung im oberen Teil, kegelförmige und ein abgeflachtes rundes Gewicht, alle aus der Station See, vorhanden.

In der Jevišovice-Kultur sind walzenförmige, schwere Webgewichte üblich. Unter den 37 Gewichten aus der in das frühe Jevišovice datierende Siedlung Melk-Wachberg wurden auch verzierte Webgewichte beobachtet. Die Gewichte verteilen sich auf 3 Schichten und stellen leider keinen zusammenhängenden Webstuhlbefund dar. Ein großes Exemplar trägt eine senkrechte Reihe von eingestochenen Punkten. Die Webgewichte vom Wachberg haben eine Länge von 10–13 cm und einen Durchmesser um 8–9 cm.

Der älteste in-situ-Webstuhlbefund Österreichs wurde 2001 in der befestigten Höhensiedlung Krems-Hundssteig (Abb. 17/1)[52] entdeckt und datiert in die Jevišovice-Kultur. Im Inneren der zweifachen Befestigungsanlage in Spornlage über dem Tal der Krems war in einer Verfärbung eine Lage Webgewichte erhalten. Es handelte sich um ein breit-rechteckiges, seichtes Grubenhaus, bei dem parallel zu einer der Hüttenwände etwa 35 eiförmige Webgewichte gefunden wurden. Die Gewichte lagen auf einer Länge von ca. 1,20 m in drei Reihen; links und rechts davon wurde je eine Steinplatte angetroffen, die offenbar als Auflager gedient hatte. Es darf als gesichert angenommen werden, dass an dieser Stelle ein in Betrieb befindlicher vertikaler Gewichtswebstuhl stand, an dem ein großflächiges Textil gewoben wurde.

Die im Spätneolithikum üblichen, großen schweren Gewichte eignen sich gut für Flachsgewebe, da diese Fäden viel Spannung benötigen. Ab der Schnurkeramik finden sich in der Schweiz kleinere Gewichte; die Veränderung der Form und des Gewichtes wird im Zusammenhang mit der zunehmenden Bedeutung der Wolle gesehen[53].

Kleine Tongewichte mit Maßen unter 5 cm Höhe und geringerer Breite kommen im gesamten Neolithikum[54] vor (Abb. 5, Spalte 3). Derartige Stücke verschiedener Form treten häufig in der Bandker-

51) Referenzen zu den einzelnen Fundorten: Zu **Poigen**: Lenneis 1977, 20, Taf. 9. – **Bemaltkeramik**: Mährischer Kode: Podborský et al. 1977, Abb. 25. – **Kamegg**: Doneus 2001, 77. – Falkenstein: Neugebauer-Maresch 1981, Taf. 90/6-9, 139. – **Mondseekultur**: Holzer und Antl-Weiser 1995, 13, Abb. 10. – **Melk-Wachberg**: Ruttkay 2001, 66–67. Fundvorlage bei Schwammenhöfer 1990.

52) Pieler 2001, 503 ff, Abb. 59.

53) Vgl. Rast-Eicher1995, 169 ff.

54) Referenzen zu den einzelnen Fundorten: **Leonding**: Grömer 2001, Taf. 10/9. – **Breiteneich**, Flur Trift: Fundber. Österreich 1980, 1984, 1987, 1990-1994. – **Ossarn**: Ruttkay 1978, Taf. XV/6. – **Melk-Wachberg**: Ruttkay 2001, Schwammenhöfer 1990.

Abb. 18: Melk-Spielberg: Nierenförmige Webgewichte der Mährisch-Österreichischen Baalberger-Gruppe der Trichterbecherkultur (Photo: G. Gattinger).

amik auf, etwa ein gequetscht kugeliges Stück mit gelochtem Ende aus Leonding (H: 4,4 cm, Dm: 4,1 cm) sowie flache oberständig gelochte aus Breiteneich. Ein kleineres walzenförmiges senkrecht gelochtes Tongewicht ist aus Ossarn bekannt (H: 5,1 cm, Dm: 5,2 cm) und datiert in die Wolfsbach-Gruppe des Epilengyelkomplexes. Auch in späterer Zeit, etwa in der Jevišovice-Kultur treten kleine Gewichte auf, so ein flächendeckend verziertes, zylindrisches, senkrecht gelochtes Tongewicht (H: 5 cm, Dm 4 cm) aus Melk-Wachberg.
Aufgrund ihrer geringen Größe und Gewicht sind m. E. diese kleinen Tongewichte nicht als Webgewichte für einen Gewichtswebstuhl anzusprechen, sondern könnten wohl als Netzsenker gedient haben oder als Gewichte für ein Zwirnbindungswebgerät, was hiermit zur Diskussion gestellt werden soll.
Werden die kleinen Tongewichte als Gerät für Zwirnbindung interpretiert, so hängt ihre Häufigkeit im Frühneolithikum und Abnahme im Spätneolithikum zugunsten großer Webgewichte (mit Funktion am Gewichtswebstuhl) möglicherweise damit zusammen, dass offenbar zum Beginn des Neolithikums als feinere Stoffe noch zwirnbindige Kettenstoffe (aus Basten) überwiegen, erst im Spätneolithikum Gewebe (aus Flachs) wichtig werden. Gewebe aus Wolle gewinnen erst in der Bronzezeit an Bedeutung. Ein Bild, das sich auch durch die Funde aus der Schweiz und Süddeutschland bestätigen lässt. So schreibt Wininger 1995[55]: „*Relativ zur Baumbastverarbeitung zu Geflechten in einem weitesten Sinne, nimmt die Flachsverarbeitung zu Geweben im Laufe des 4. Jahrtausends v. Chr. zu. Im Laufe des 3. Jahrtausends v. Chr. könnte sie durch aufkommende Wollverarbeitung wieder zurückgegangen sein*.“

Von Melk-Spielberg (Mährisch-Österreichische Baalberger-Gruppe der Trichterbecherkultur) gibt es nierenförmige Webgewichte (Abb. 18)[56], die aus einem schwach gebogenen ca. 20 cm langen Tonwulst mit 5–6 cm Durchmesser bestehen. An beiden Enden finden sich 0,5 cm starke Lochungen, der Lochabstand beträgt ca. 15 cm. Vergleichsfunde für die nierenförmigen Webgewichte wurden von Alexandra Krenn-Leeb 2002 umfassend zusammengestellt, wobei diese Gewichte im Jungneolithikum europaweit, von Spanien beginnend, besonders an den Küstenländern des Mittelmeeres, vor allem in der Lagozza-Kultur in Italien, auch in Deutschland, Frankreich, Ungarn bis in die Türkei verbreitet sind.
Die genaue Funktion dieser meist luftgetrockneten oder nur leicht gebrannten nierenförmigen Webgewichte gibt Anlass zu vielerlei Rekonstruktionen, wobei die zahlreichen Abnützungsspuren im Lochbereich Hinweise auf die ehemalige Verwendung geben. Manche Autoren sehen diese Gewichte an einem Webstuhl für Leinenbindung, wobei die parallel hängenden Gewichte an je einem Ende an einem Kettfadenstrang der vorderen und hinteren Reihe hängen. Annemarie Feldtkellner rekonstruiert sie als Gewichte für ein Bandwebgerät[57]. Ebenso ist es m. E. möglich, dass sie bei einem Zwirnbindungsgerät Anwendung fanden, vor allem bei der Technik mit Zwirnbindung der Kette. Experimentalarchäologische Versuche zu diesem Thema sind in einem eigenen Projekt zur Textiltechnologie der Jevišovice-Kultur geplant.

Fazit

Es ist aus dem österreichischen Neolithikum eine Vielzahl an archäologischen Hinterlassenschaften zum Themenkomplex Textile Techniken bekannt, die nicht nur – wie üblicherweise angenommen – das Spinnen (Spinnwirtel) und Weben (Webgewicht) umfassen. Neben Kleidungsstücken (auch Schuhen und Hüten) wurden in der Jungsteinzeit Gegenstände des täglichen Bedarfs hergestellt, etwa Matten, Körbe, Siebe und dergleichen, dazu wurden sowohl Flecht- als auch Zwirntechniken

55) Wininger 1995, 143 ff., bes. 173.
56) Krenn-Leeb 2002, 302, Abb. 21–26, Taf. 5.
57) Feldtkeller 2003, 16 ff., Abb. 15, mit Hinweis auf andere Interpretationen.

angewandt. Obwohl durch die klimatischen Gegebenheiten in Österreich die Erhaltung organischer Materialien selten ist, so finden wir doch Nachweise in den Pfahlbausiedlungen. Auch indirekte Hinweise, etwa textile Abdrücke oder verschiedene Gerätschaften aus Ton und Knochen helfen, diesen in der prähistorischen Forschung meist stiefmütterlich behandelten Bereich der Textilen Techniken etwas zu erhellen. Für Aussagen zu chronologischen Entwicklungstendenzen des neolithischen Textilhandwerkes in Österreich ist die Datenbasis noch zu dünn.

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4.2. Dressing Central European prehistory – the sheep's contribution. An interdisciplinary study about archaeological textile finds and archaeozoology

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Dressing Central European prehistory – the sheep's contribution
An interdisciplinary study about archaeological textile finds and archaeozoology

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(with 10 figures)

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For Erich Pucher

Abstract

The current article presents the archaeological and archaeozoological evidence about the exploitation and utility of sheep wool for garments in Austria and its neighbouring countries. For this aim, the finds of sheep bone and textiles will be discussed, combined and evaluated in order to gain insights into the history of sheep, and especially its economic exploitation. The finds derive mainly from sites in Austria from the Neolithic to the Roman period.

In present day, cattle and pigs are by far the most common farm animals in Austria; the wild forms of both species have/had their natural habitat here. Nevertheless, the archaeozoological and archaeological results show that sheep have gained a place in the cultural history of Austria too. To name one example, textiles from Hallstatt salt mine indicate that sheep wool products played a very important role in Central Europe as early as the Middle Bronze Age.

Keywords: prehistory, sheep, textiles, wool products, Central Europe.

Introduction

The analysis of animal bones from archaeological excavations can deliver significant information about the economic importance and exploitation of the domesticated species. This type of analysis was always one of the main focuses for the archaeozoologist Erich PUCHER. In this context he has extensively discussed the question of sheep wool

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exploitation in different archaeological periods. The occupation as a scientist in an institution like the Natural History Museum Vienna enabled Erich Pucher to work on different topics and to pursue different research interests. In this regard, he was engaged with the archaeozoological analysis of many important Austrian sites from the Neolithic to the Early Modern period, resulting to a very long and important publication record.

Also important finds of archaeological textiles are kept at the Natural History Museum Vienna, in that case the Prehistoric Department. They have been found in the Bronze and Iron Age parts of the salt mine Hallstatt and are an essential source for our understanding of textile technology in prehistoric Central Europe.

In the following, a synthesis between archaeological textile finds and results gained from the study of archaeozoological material shall demonstrate the significance of sheep wool for prehistoric garments. An article about leather and fur is presented by Gabriela Russ-Popa (this volume).

A sheep story: let the bones talk

Faunal remains that have been found in archaeological contexts carry essential information about past ways of life. Their investigation is a crucial step for archaeological analysis and interpretation, since they can be used as valuable indicators to better understand historical processes, connections, interactions, and social dynamics.

Methods and Challenges

Archaeozoological analysis can contribute to our knowledge about the socio-economic organisation of past human societies; in this specific case, the interest focuses on the exploitation of sheep wool.

The identification, which is conducted at an element (animal bone) and species (cattle, pig, sheep, etc.) level, is the first step of the analysis. When identifying bones of small domestic ruminants (sheep and goats) there is often a respectable number of unidentified fragments summarized as sheep/goat (*Ovis/Capra*; O/C), illustrating the difficulties when trying to separate these two closely related species.

Although osteological criteria for distinguishing between sheep and goat have been established (Boessneck *et al.* 1964; Schramm 1967; Kratochvíl 1969; Gabler 1985; Payne 1985; Prummel & Frisch 1986; Helmer 2000; Halstead *et al.* 2002; Gillis *et al.* 2011; Himstedt 2014; Salvagno & Albarella 2017), it is not always possible to assign each animal bone to either sheep or goat. The degree of fragmentation and/or the lack of features and anatomical details, important for the species' identification, make this task even more challenging. Thus, only a small number of identified sheep bones remains, which actually discourages the statistical processing of the material.

Despite these difficulties it is of great importance for the archaeozoological and the archaeological analysis to distinguish between the two species, whenever possible; this is because sheep and goats exhibit crucial differences related to ecology, ethology, keeping, secondary exploitation, economy, and cultural background, which have a serious impact on the archaeological discussion and interpretation.

The aforementioned challenges should be also considered during the quantification of the archaeozoological material. The question about the presence or absence of species is decisive, but of equal importance is also the estimation of the percentages in which the species occur. In this way it is possible to find out which animals prevailed, and to develop preliminary observations about their economic significance of a specific site, region or period. However, the quantification methods reveal only general tendencies; the faunal remains – and especially small-bodied animals or very young individuals – are influenced by different taphonomic processes. Therefore, the social importance of numerically underrepresented species shall not be underestimated (SYKES 2015: pp. 9–10).

The next important step is the skeletal element representation. The presence or absence of body parts can provide significant information about the socioeconomic structure (supply, use imports, etc.). As an example, the processing and production of skin, pelt, and leather is usually linked to an over- or underrepresentation of specific skeletal elements, like horn cores, metapodials, and phalanges (PRUMMEL 1978; NOODLE 1994; BARTOSIEWICZ 1995; SALIARI & FELGENHAUER 2017). The analysis of modifications, such as cut marks, offers additional information about the economic activities that took place (BINFORD 1981; KNIGHT 2002; SEETAH 2005).

Another significant step to better understand the animals' management is the age and sex reconstruction. In this way it is possible to find out if the animals were important for the meat supply or if they were further exploited for milk and wool (ZEDER 2006; FISCHER 2014; MARCINIAK 2014). Concerning age distribution, when the exploitation of secondary products (such as milk or wool) is the main focus, adult individuals and in general older animals are more frequent. Age assessment is usually based on the teeth and the epiphyseal fusions. Mandibles and especially teeth belong to those elements that cannot be attributed with certainty to sheep or goats, and thus the age distribution usually concerns both species (sheep/goat).

Sex ratio provides additional information about the nature of the secondary exploitation. The predominance of female individuals is usually associated with milk production. In cases where wool exploitation is of central importance, sex distribution can vary and often a high number of male or castrated animals is observed. The various forms of exploitation (wool, milk) are osteologically more recognisable when they are conducted in an advanced and pronounced form; sometimes, there are only scarce (or no) indications.

The morphometric analysis is a fundamental step for the interpretation of the socioeconomic profiles. When essential morphometric similarities between the archaeozoological material and recent animal populations (in that case sheep) have been confirmed, it is expected that there would also be physiological similarities. This analogy is a very useful tool that helps us to extract vital information about properties and characteristics of past animal populations (for instance, if a specific population produced more meat, milk, or wool, or other observations related to the different product qualities).

The estimation of height at withers is an important part of the morphometric investigation and various bones can be used for its calculation. It is always advisable to note the bones used for the size reconstruction. This is because not all the bones – even if some are better preserved (*e.g.* talus bone) – are appropriate for estimating the height at withers. Moreover, as it has turned out, the factors that were proposed by various authors are not always reliable; these factors were often calculated based on modern material, requiring the final estimation to be corrected for the archaeological finds in many cases because of differences in the proportions.

Other important factors that should be taken into consideration during the archaeozoological analysis and interpretation are: taphonomic processes, dating (especially for isolated contexts), lack of organic remains (leather, skin etc.), archaeological context (rural settlement, mining settlements, graves etc.), cultural background (customs, traditions, taboos etc.), excavation techniques, and laboratory treatment.

Finally, every method has advantages and disadvantages and there are various systems that can be employed for the processing of the data. Based on the scientific question(s) and the research strategy, it is possible to choose among the proposed methods and systems.

Neolithic: early sheep in Europe

The Neolithisation is characterised by technological achievements and important socio-economic changes. One of the most significant features of this period is the appearance of domestic animals (cattle, sheep/goat, pig, and dog). Domestication is "a complex biological and cultural process" (Herre & Röhrs 1971) and although the term "domestic animal" has universal meaning, fundamental questions regarding the processes underlying domestication remain largely unanswered (Dobney & Larson 2006).

Archaeological as well as archaeozoological finds from Central Europe indicate that the earliest farming cultures spread through different ways (Balkan, Mediterranean). Nevertheless, during specific periods, the domestic animals from the Danube region and the alpine region suggest different origins and evolution. The investigation of the faunal assemblages from the Early Neolithic in Austria shows that the domesticated animals prevailed with 70 % of the total material (Schmitzberger 2009a: p. 28, fig. 6). During the early phases of the Linear Pottery Culture (5500–4900 BC) sheep and goats were represented with more than 40 % (Schmitzberger 2009a: p. 34, fig. 8). The prevalence of the small domestic ruminants has been linked to their Middle Eastern origins and the new subsistence strategy (Pucher 1994, in press a). With the transition to the later phases of the Linear Pottery Culture, an essential change, and namely a decrease in the number of sheep and goats, was noted.

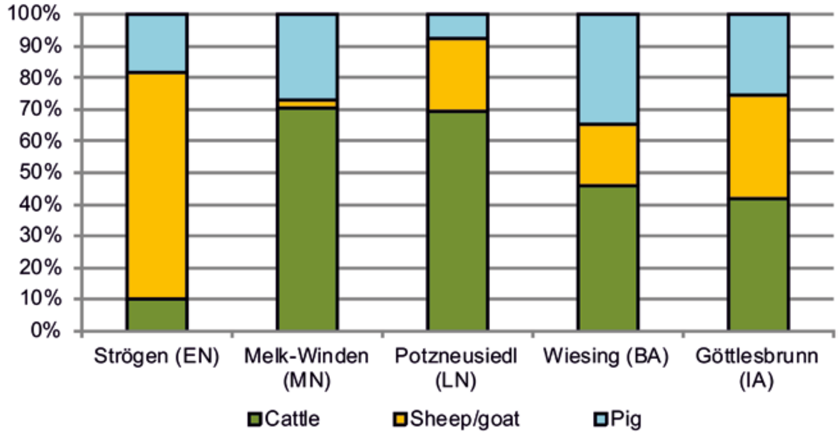


Fig. 1. Fauna composition from the Austrian sites Strögen (PUCHER 1987), Melk-Winden (PUCHER 2004a), Potzneusiedl (SCHMITZBERGER 2009b), Wiesing (PUCHER 1986b), Göttlesbrunn (PUCHER 2006). Abbreviations: EN: Early Neolithic, MN: Middle Neolithic, LN: Late Neolithic, BA: Bronze Age, IA: Iron Age.

At the beginning of the Middle Neolithic, c. 4900/4800 BC, two major structural changes took place (SCHMITZBERGER 2009a: p. 28): the number of small domestic ruminants dropped dramatically (Fig. 1), and the general percentage of the domesticated species was significantly reduced; at the same time the faunal assemblages exhibit intensive hunting activities. This noteworthy decrease in the number of sheep/goat was interpreted as the result of an adaptation process, during which only a few individuals survived (PUCHER in press a).

Environmental stress is thought to be one of the causes for these alterations (BARTOSIEWICZ 2008; PUCHER in press a). Sheep and goats, whose wild forms did not exist in Europe, come from semi-arid regions with warmer climate. In the Danube region, they already have to cope with less favourable habitats (BÖKÖNYI 1974: p. 56; PUCHER 2004a). Oral pathologies observed on sheep dentition from Austrian sites have been interpreted as markers of unsuitable pasture conditions (PUCHER in press a). Similar pathologies were found elsewhere too (compare BARTOSIEWICZ 2008).

For this reason, it has been suggested that the crisis observed on the species, which were not yet adjusted to the geographic and climatic conditions (especially sheep), caused an increase in hunting activities (PUCHER in press a); sheep and goats were at the beginning the prevalent species. Such a crisis would have seriously influenced the Neolithic economy and way of life. Thus, intensive hunting would have been an alternative way to survive. The earliest indications from the Stroke-ornamented ware culture (Stichbandkeramik) show that sheep and goats were present with just 10% of the total material. Other reasons that might have caused these dramatic changes, such as a social alteration, cannot be excluded, but it is difficult to find adequate evidence (BÖKÖNYI 1974: p. 56; PUCHER 2001; SCHMITZBERGER 2009a: p. 33).

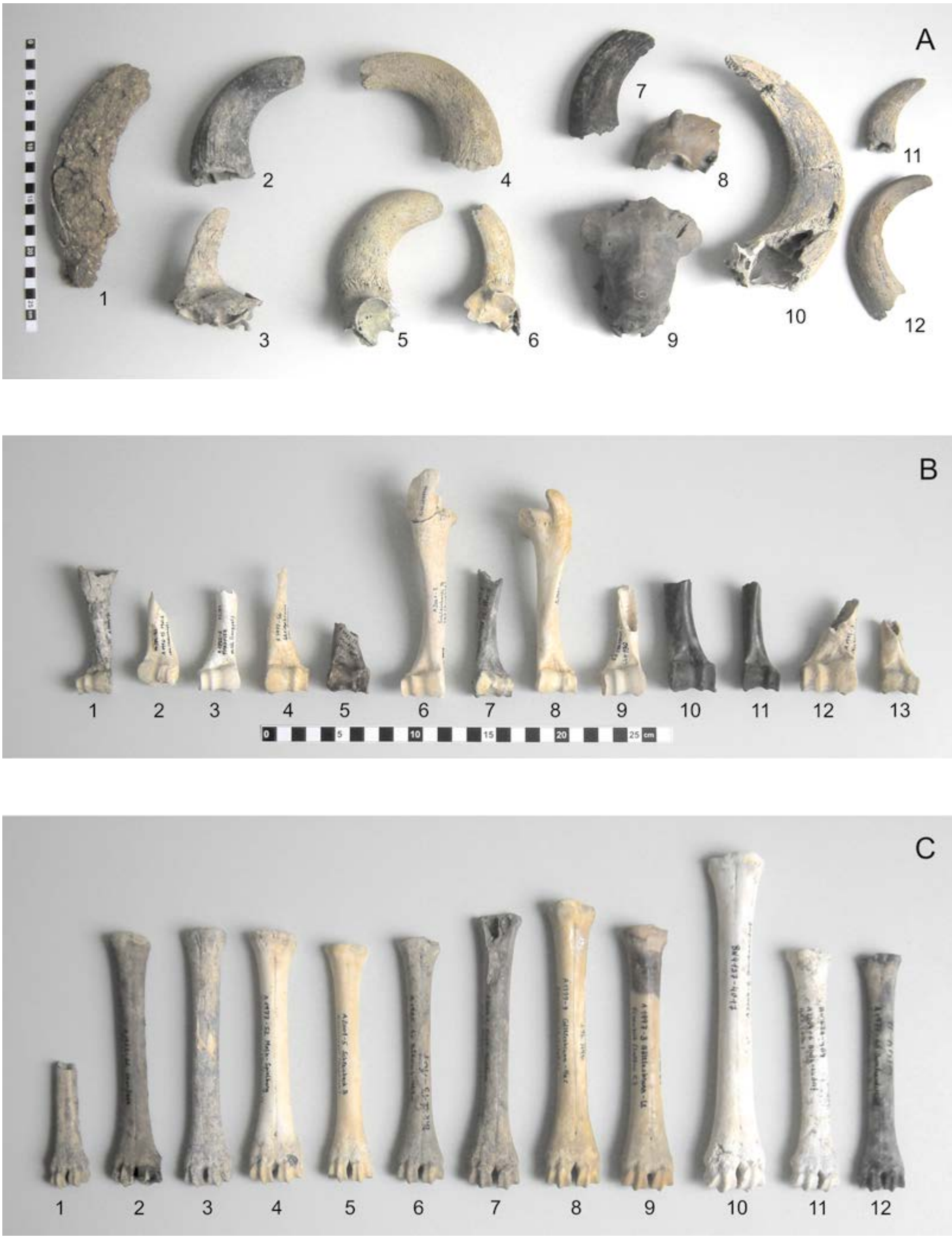
Fig. 2. Reconstruction of Neolithic pig (male), goat (male), sheep (male), and dog (male) by Erich PUCHER (in press a).

Fig. 3. Horn cores and cranial parts (A), humeri (B), and metacarpale (C) of sheep from Austrian sites from the Neolithic to the Roman period, kept at the Natural History Museum Vienna (Photo: E. PUCHER). Abbreviations: NÖ = Lower Austria (Niederösterreich), ♂/♀ = male/female individual. ▶

A: 1: ♂ Mold, NÖ (Early Neolithic, Linearbandkeramik); 2: ♂ Böheimkirchen, NÖ (Early Bronze Age); 3: ♀ Böheimkirchen, NÖ (Early Bronze Age); 4: ♂ Brixlegg, Tirol (Early Bronze Age); 5: castrate, Brixlegg, Tirol (Early Bronze Age); 6: ♀ Brixlegg, Tirol (Early Bronze Age); 7: ♂ Dürrnberg, Salzburg (Late Iron Age, Latène); 8–9: ♀ Dürrnberg, Salzburg (Late Iron Age, Latène); 10: Nickelsdorf, Burgenland (Roman period: italic fauna); 11–12: Bruckneudorf, Burgenland (Roman period: local fauna).

B: 1: Brunn 1, NÖ (Early Neolithic); 2: Mold, NÖ (Early Neolithic); 3: Friebritz, NÖ (Middle Neolithic); 4: Steinabrunn, NÖ (Late Neolithic: Funnelbeaker Culture/ Trichterbecherkultur); 5: Mondsee, Upper Austria (Spätneolithic); 6: Scheinbach, NÖ (Early Bronze Age); 7: Böheimkirchen, NÖ (Early/Middle Bronze Age); 8: Unterhautzenthal, NÖ (Late Bronze Age: Urnfield Culture/Urnenfelderkultur); 9: Göttlesbrunn, NÖ (Iron Age); 10–11: Dürrnberg, Salzburg (Iron Age: Latène); 12: Nickelsdorf, Burgenland (Roman period, italic fauna); 13: Bernhardsthal, NÖ (Roman period: local fauna).

C: 1: Brunn 1, NÖ (Early Neolithic); 2: Mondsee, Upper Austria (Spätneolithic); 3: Potzneusiedl (Late Neolithic: Baden Culture/Badener Kultur); 4: Melk-Spielberg, NÖ (Final Neolithic); 5: Schleinbach, NÖ (Early Bronze Age); 6: Böheimkirchen, NÖ (Early/Middle Bronze Age); 7: Pichl-Fischteich, Steiermark (Late Bronze Age: Urnfield Culture/Urnenfelderkultur); 8–9: Göttlesbrunn, NÖ (Iron Age); 10–11: Bruckneudorf, Burgenland (Roman period: italic and local fauna); 12: Bernhardsthal, NÖ (Roman Period: local fauna).


A
1
2
3
4
5
6
7
8
9
10
11
12
B
1 2 3 4 5 6 7 8 9 10 11 12 13
0 5 10 15 20 25 cm
C
1 2 3 4 5 6 7 8 9 10 11 12

It seems that during the Lengyel culture (Lengyel-Kultur/ MBK I) the Neolithic economy was stabilized. Sheep and goats were better represented, but they did not reach the high percentages of the Early Neolithic (SCHMITZBERGER 2009a: p. 35). Only a few sheep survived the crisis and were ecologically suitable to form the basis of the future populations in northern Europe. Cattle and pigs, whose wild forms existed in Middle Europe, became the prevalent genera (PUCHER in press a).

At the end of the 4th millennium BC, the profiles of the domestic fauna remained stable; similar tendencies have been observed during the Late Neolithic. Sheep (and in general, small domestic ruminants) were however found in lower numbers (SCHMITZBERGER 2009a: p. 96). According to the present state of knowledge, the age and sex distribution suggests that the main role of these early sheep populations was meat supply and that they were only occasionally exploited for products such as wool (SCHMITZBERGER 2009a: p. 96).

Morphometric investigation (Fig. 3) shows that the first sheep populations of the Early and Middle Neolithic Period belonged to the small and gracile type with strong and robust mouflon-like horn cores (SCHMITZBERGER 2009a: p. 96; PUCHER in press a) (Fig. 2). One cranial find from Falkenstein (Lengyel culture, 4900–4300 BC) indicates the presence of a hornless female sheep (PUCHER 1986a). Female horn cores can significantly vary already during this period; this is also the case for the wild sheep. The height at withers was between 55–70 cm for female and male individuals (SCHMITZBERGER 2009a: p. 82, fig. 32). One talus bone from Mold (Linear Pottery Culture) with 33.5 mm (greatest length of the lateral half/ GLl) suggests that some individuals – probably males – could become astonishingly large with 75 cm height. No remarkable differences have been recorded regarding the size and shape of the Middle and Late Neolithic sheep in the Danube area.

In the second half of the 4th millennium and first half of the 3rd millennium BC remarkable regional differences can be recognized. The animals of the Mondsee culture (3800–3200 BC), located in Upper Austria, seem to be a special case. The analysis of sheep and goat remains from the site Mondsee suggests essential differences with contemporary sheep bones found in the Danube region (PUCHER & ENGL 1997).

Indeed, the investigated sheep remains from Mondsee exhibited individuals of smaller size (62.5–63 cm average withers height). Their horn cores were very close to the wild form, but smaller and with more similarities to animals from sites in Switzerland. Thus, it has been proposed that these animals might have reached Austria through the Alps. PUCHER & ENGL (1997) noted that the sheep and goats of the Mondsee culture exhibited an important grade of uniformity, but they demonstrated differences with the animals found in foreland. Also the cattle bones from Mondsee were of smaller size and much more gracile. The position and orientation of the horn cores shows more similarities with cattle deriving from southern regions.

Assemblages of the Baden culture (3500–2800 BC) from Slovakia and Hungary show remarkable differences in the morphometrics. The archaeozoological analysis indicated that the average withers height increased at about 10 cm (BÖKÖNYI 1974: pp. 169–171;

BENECKE 1994: p. 234). Similar changes were detected up to northern Germany and they were connected to the arrival of new sheep populations from the Middle East and the south-eastern Mediterranean. Such, the evidence was interpreted that the first woolly sheep appeared during the later phases of the Neolithic (BÖKÖNYI 1974: p. 169; BECKER *et al.* 2016).

Surprisingly enough, these changes have not been confirmed for the Austrian assemblages up to now (SCHMITZBERGER 2009a: p. 96). Newly excavated material from Weiden am See (Burgenland, Austria) seems to support this observation (SALIARI, unpublished data).

Bronze Age sheep type

In the Bronze Age, in statistic data small domestic ruminants usually are represented in lower numbers than cattle or even than cattle and pig (during this period, pigs gained economic importance). In many assemblages sheep are more frequent than goats, which is mostly associated with their ecological background (Fig. 1).

Finds from Early Bronze Age (2200–1600 BC) settlements provide evidence for the secondary exploitation of the animals due to the age and sex distribution, but their weak representation suggests that they were economically of minor importance (PUCHER 1986b; BOSCHIN & RIEDEL 2009; TECCHIATI 2012). Although the prevalence of female sheep indicates milk exploitation (PUCHER & ENGL 1997), cows were the most significant milk suppliers (DESCHLER-ERB 2010; TECCHIATI 2012). Due to the low number of Middle Bronze Age settlement sites in Austria, it remains difficult to explain the role of the small domestic ruminants during that period.

A study from the site of Százhalombatta-Földvár in Hungary showed that meat production was the main reason for keeping sheep during the Early Bronze Age (VRETEMARK 2010). A decisive change took place in the transition to the Middle Bronze Age, when the importance of sheep increased and the age profiles suggest intensive sheep exploitation and a growing emphasis on wool production (VRETEMARK 2010).

More information derives from the Urnfield culture (Late Bronze Age, 1200–800 BC). During that period, the percentage of sheep (and goats) varies significantly. For instance, sheep and goats from Pichl (Early Urnfield culture) and Prigglitz Gasteil (Urnfield culture) were present with almost 20 % of the total material (in both cases the small domestic ruminants were dominated by sheep). The faunal assemblages of this period mainly derive from mining settlements (Bergbausiedlungen), like Prigglitz Gasteil (TREBSCHE & PUCHER 2013) and Hallstatt (PUCHER 2009, 2010, 2015), which archaeologically and archaeozoologically constitutes very special cases. The animal bones from these sites indicate the presence of consumers and not of producers (PUCHER 1999, 2015). In this context, and in order to better understand the role of the animals, it would have been preferable to have material from the producers too.

Morphometrically (Fig. 3) the sheep horn cores from the Early Bronze Age show significant similarities with the Neolithic sheep populations (PUCHER 1986a; H. BÖHM, pers. comm.); their examination demonstrates the same position and orientation with the Late Neolithic sheep.

Early Bronze Age faunal assemblages from Tyrol and Lower Austria show that the sheep populations north of the Alps were of bigger size than those at the southern part; at the northern part of Italy small-sized breeds have been found (PUCHER 1986b; RIEDEL 1998; BOSCHIN & RIEDEL 2009; TECCHIATI 2012; PUCHER 2014). It is interesting to mention that the sheep populations in the Alpine region exhibit a great variability and that the horn cores vary impressively from valley to valley (PUCHER pers. comm.).

The Early Bronze Age sheep also demonstrate morphometric similarities during the Middle and Late Bronze Age, representing a middle-sized population (RIEDEL 1998). Osteologically they are quite similar to the *Scottish Soay sheep,* with a withers height between 50 (female) and 60 (male) cm (SAMBRAUS 2001: p. 157). The average withers height of sheep found in the Eastern Alpine region was between 60 and 65 cm (PUCHER 2014). Differences of the average cannot be easily interpreted; they might reflect sexual dimorphism, local populations, or hybrids, which are not yet osteologically traceable. The low frequency of sheep bones also adds to the difficulties.

Iron Age variety

During the Iron Age in Austria the frequency of domestic animals is stable and pretty similar to the profiles of the Bronze Age (PUCHER 1998; GALIK 1998; TREBSCHE 2007) (Fig. 1). Chronological differences among the sheep population of the Hallstatt Period (800–400 BC) and the Latène Period (400–15 BC) are not easily detectable, mainly because the presence of sheep was influenced by numerous factors, including geographic and climatic conditions (SALIARI *et al.* 2016).

The animal bones from the early Latène site Oberschauersberg suggest that both sheep and pigs contributed equally to the meat supply (SCHMITZBERGER, pers. comm.). In the case of Michelstetten during the Hallstatt Period sheep were the second most significant species after cattle, whereas during the Latène Period sheep appear in the statistics after cattle and pigs (SCHMITZBERGER 2010). According to the age and sex profiles, sheep were further exploited (milk and wool), but cattle was economically the most important species.

Faunal material from burials indicates that cattle (KUNST 2005; ABD EL KAREM 2014) and pigs (RAMSL 2011; BRUCKNER *et al.* 2006) were usually deposited as grave goods; the case of Statzendorf (Hallstatt period) is interesting, where it seems that sheep performed a crucial role at the local funerary practices (SCHMITZBERGER 2006).

The morphometric analysis of the archaeozoological material (Fig. 3) brought to light a lot of variations. The Iron Age sheep from the settlement Faggen exhibited 58–60 cm height at withers, indicating that the animals were a bit smaller than those from the Bronze Age, which were between 60–63 cm (TECCHIATI 2012). The height at withers for the sheep population from the Latène Period settlement in Göttlesbrunn varied between 56 and 65 cm with an average of 61 cm (PUCHER 2006). The same

Fig. 4. Reconstruction of Latène Period male and female sheep and goats by Erich PUCHER (2002).

range of variation was exhibited for the sheep population in Inzersdorf (PUCHER 1998) and Michelstetten (SCHMITZBERGER 2010). In general it could be said that the size of sheep ranged between 55 and 65 cm and that hornless female individuals became more frequent. The Iron Age sheep exhibit osteological similarities with the *Steinschaf*.

However, there are some noteworthy exceptions. The sheep bones from the settlement of Göttlesbrunn (Hallstatt period) exhibited some large-sized individuals with 76 cm height at withers (68.7 cm average) (PUCHER 2004b and compare with PUCHER 2006). They are bigger than the animals from the Latène Period settlement in Göttlesbrunn with an average of 61 cm (PUCHER 2006). Similar results come from Vienna-Oberlaa with 66 and 76 cm (CZEIKA 2006).

Sheep bones from Dürrnberg settlement indicate the presence of some large-sized animals with 66 cm (average withers height) were also found, holding a special position among the other studied Latène Period populations (Fig. 4) (PUCHER 1999). Similar values are reached by sheep during the Roman Period (when the average of imported and local sheep is calculated).

Based on the current state of knowledge it is difficult to explain the presence of these large-sized individuals. One important question is if these differences could be attributed to a mixed population or to sexual dimorphism. Morphologically there is no clear evidence for the appearance of a new sheep population. On the other hand, establishing the limits of sexual dimorphism is challenging because of difficulties in identifying castrated animals, the low number of sheep bones (which cannot be always statistically processed), and due to the concentrated presence of female animals, which affects the average withers height.

An interesting aspect regarding the large-sized sheep individuals is their archaeological context, especially for the cases of Dürrnberg and Göttlesbrunn. In both sites large-sized animals were found at a low quantity. In the case of Dürrnberg, the sex distribution showed an obvious prevalence of male/castrated animals. For this reason it would be logical to assume that some large-sized male or castrated sheep were delivered to the mining workers of Dürrnberg for meat supply. The large-sized animals from the settlement of Göttlesbrunn are mainly represented by metapodials found in craft contexts. Thus, a deliberate selection of large-sized bones for the manufacture of specific objects cannot be excluded.

Addendum: Sheep bones from Roman contexts

A distinct change regarding the sheep population took place during the Roman Period (Benecke 1994: pp. 235–236). The material from the Villa rustica in Nickelsdorf (Burgenland) provides evidence for the presence of italic animals; based on the talus bone, the sheep from this assemblage reached 74–85.5 cm withers high (Riedel 2004). An overlapping with large-sized individuals from the Iron Age was observed. The italic sheep population exhibited morphologically decisive differences and especially the horn cores were very characteristic. Even if the italic fauna appears regularly, the archaeological assemblages of this period suggest that local populations usually coexisted together with the newcomers (Pucher *et al.* 2015; Pucher in press b; Saliari, unpublished data).

A story of textiles and garments: fibres for clothing

In addition to the evidence provided by the archaeozoological analysis from Austrian sites, it is essential to discuss the products that can be gained from the exploitation of sheep in order to obtain a more concrete picture of their economic role and significance. This paper, which aims to investigate the contribution of sheep to the history of clothing in European prehistory, will now focus on sheep wool, and more particularly, on textiles made of sheep wool.

Clothing before the woolly sheep: bast fibre and leather/fur

The European neolithic cultures based their cloth production mainly on bast fibres such as flax or tree bast (lime or oak: Rast-Eicher 2005), leather, and pelt (see Russ-Popa this volume). Although flax was used for the production of woven textiles, it is difficult to recognize the shape and intention of the final product due to the small size of the finds which survived the various taphonomic processes.

Items and fragments of clothing are mainly noted in neolithic lakeside dwellings. The most significant finds have been discovered in Switzerland (Rast-Eicher & Dietrich 2015) and Southern Germany (Wininger 1995); they include hats, shoes and fragments of cloaks. These finds indicate that various techniques have been used such as twinning or plaiting. Particularly well-known are the shoes from Allensbach and Sipplingen in Germany, both dated at around 3000 BC. Although they were not appropriate for the weather conditions in winter time, they protected the soles from rough surfaces. The finds from Hornstaad and Wangen, which are hat-like headcovers, had a very small diameter of only 30 cm; for this reason they are usually interpreted as hats for children (Banck-Burgess 2016: fig. 196–199; Wininger 1995: fig. 13).

Concerning the history of clothes and clothing equipment, it is important to mention that materials and products coming from animals did not survive the impact of alkaline sediments at the lakeside dwellings; therefore there is a significant gap concerning our knowledge about the presence and use of objects made of leather and pelt in these settlements. However, there are some surprising exceptions, such as organic material from the Late Neolithic Period which survived thanks to favourable conditions in ice; the most famous example of this period is the frozen body of "Ötzi", which was found in 1991 on the Austrian-Italian borders (EGG & SPINDLER 2009).

The impact of the woolly sheep

The first textiles made of wool are known from the later phases of the Late Neolithic Period (compilation: BENDER JØRGENSEN & RAST-EICHER 2015). The wool textile attached to a flint dagger from Wiepenkaten in Germany was published as one of the oldest so far, but there is some ongoing research with new ^{14}C dates. From the lakeside dwelling Molina di Ledro in Italy, we know of a linen weave with decoration made with wool threads dated to around 2200–2100 BC. One other early textile made of wool was found in a grave in Tursko-Těšina (Czech Republic) dating at around 2000 BC. Also the Early Bronze Age fabric from Lenk-Schnidejoch (RAST-EICHER 2015: pp. 33–34) belongs to the very early wool textile finds.

During the Early and Middle Bronze Age the textile history changes fundamentally with the use of sheep wool. Some examples that mark these changes are the new weaving and patterning techniques such as twill (Fig. 5) (GRÖMER 2016: pp. 130–138) or dyeing, which are mainly related to the wool and its properties. This has a direct influence on products made of textiles and especially on clothes. During the Bronze Age the oldest examples of dyed fabrics from Central Europe (HOFMANN-DE KEIJZER 2016: fig. 84), include the woad-blue dyed textile from the Hallstatt salt mine in Upper Austria (at around 1500–1200 BC); dyestuff analysis also brought to light the oldest evidence for plant dyes for yellow and red on wool textiles from Pustopolje, Bosnia-Herzegovina (17th cent. BC) and Mitterberg in Salzburg (16th cent. BC).

The early wool textiles are still quite coarse, as the finds from Mitterberg in Austria (GRÖMER 2014: pp. 188–190) and Castione dei Marchesi in Italy (BAZZANELLA 2012: fig. 8.12; GLEBA 2012) indicate; interestingly enough they are much coarser than contemporary linen textiles which can be attributed to different causes. One explanation could be that due to the thermic properties of the sheep wool, such a coarse material was deliberately used for the production of more robust and warmer fabrics. However, the coarse quality of these early wool textiles could also be attributed to the primitive characteristics of the early sheep populations, whose wool was characterized by a high content of coarse guard hair (kemp: see Fig. 6).

There are only a few examples of complete garments from the Bronze Age. The most famous were found in oak coffin graves (Denmark), dating between 1500 and 1300 BC (BROHOLM & HALD 1940; MANNERING *et al.* 2012). In the graves of women, long woolen skirts, blouses, sprang bonnets, sashes and corded skirts were discovered, whereas

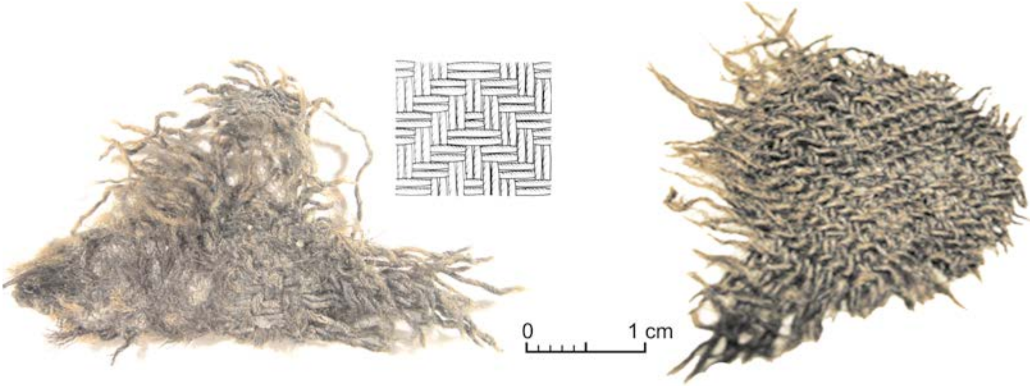


Fig. 5. Wool twill textiles from Hallstatt, Austria, 1500–1200 BC (HallTex 211 and 275) (© NHM, photo: A. RAUSCH).

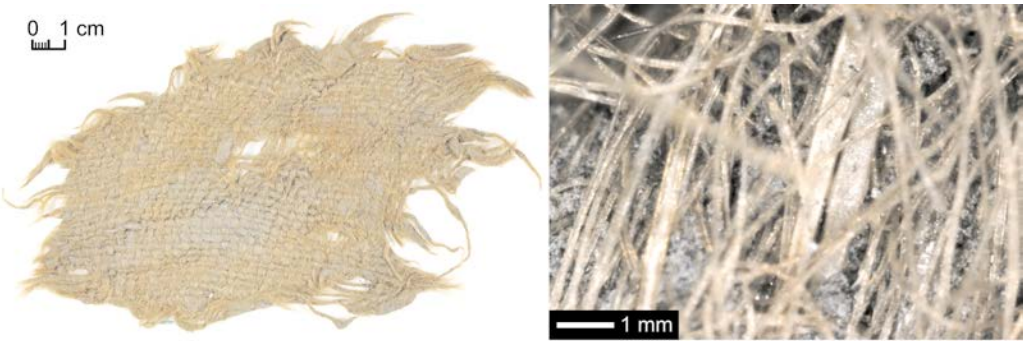


Fig. 6. Hallstatt, HallTex 209: coarse Bronze Age textile with microphoto of the fine fibres and kemp, 1500–1200 BC (© NHM, microphotos: K. GRÖMER).

the finds from the graves of men we found loincloth, knee-long wrap-around garments, and oval cloaks. The fabrics used in these garments were also coarse. Based on present finds and current studies we know of only one large wool textile from Central Europe; it derives from the Early Bronze Age grave of Pustopolje in Bosnia-Herzegovina (MARIĆ BAKOVIĆ & CAR 2014). Nowadays torn into pieces, it was reconstructed as a 1.70 × 3 m large wool tabby textile with selvedges. On this textile the starting border as well as the finishing border survived. Experimental archaeology has demonstrated that the textile could be used as a draped garment together with large pins and belts – as they are known for example from the Danube area (GRÖMER *et al.* 2013: fig. 7).

Bronze Age to Iron Age: changes in the fleece type

The fleece of sheep consists of different kinds of fibre: short guard hair, kemp and fine under wool (RAST-EICHER 2008: p. 122). The principal function of kemp is to provide water drainage, whereas the fine under wool keeps the animal warm.

For the production of textiles all of these different fibre types are of great significance. Fleece, which consists of many thick and stiff kemp, can also be spun but there are some limitations regarding the thickness of the threads; for example, finer threads cannot be produced (compare RÖSEL-MAUTENDORFER *et al.* 2012) due to the stiffness of kemp and such, a thread spun with this kind of coarse hair type appears to be quite irregular. On the contrary, when the fine underwool is used, thinner and more uniform threads can be produced. Fleece with fine fibres and the absence of kemp provides a higher comfort factor (comfortable to wear and pleasant to the skin, not scratchy). The role that this parameter played and how it influenced the choices and preferences of the people in prehistory remains unknown, but it is still worth mentioning.

After investigating archaeological finds made of sheep wool, it can be suggested that Bronze Age and Iron Age people have also been able to influence the properties and characteristics of the wool, in order to optimize the material available for the production of textiles and clothing equipment. There have been two circumstances to do so:

- Breeding for finer qualities
- Wool selection

Influencing fibre properties by sheep breeding

A very efficient and long-term impact way to influence the properties of the fibres is targeted breeding. Based on archaeological textile finds from prehistoric sites of Central Europe, it seems that breeding efforts were concentrated on the properties of the fleece type, and more particularly on three essential components:

1. The first efforts concentrate on the reduction of the stiff and thick kemp fibres (Figs 4, 7), which have been a vital part of the earlier sheep populations (still detectable at some populations today, such as the primitive *Soay-sheep:* RAST-EICHER & BENDER JØRGENSEN 2013). These changes had a positive impact on the spinning techniques and they improved the comfort factor. Thus, it can be proposed that a fleece type with fibre diameters of low variation was a decisive criterion. This has been also confirmed by the study of the archaeological material after conducting wool measurements (see GLEBA 2012; RAST-EICHER 2008: pp. 122–149). For this, the dimensions of the fibres are measured on a statistically sufficient number of fibres (*c.* 100). The histogram plotted (Fig. 7) gives information about the sheep type (especially if skins are measured) and/or about the degree of processing up to the spun yarn (see RAST-EICHER 2013: pp. 166–168). Similar studies for the Bronze Age and Iron Age material from Hallstatt (measurements have been taken from sheep skins and textiles: RAST-EICHER 2013) provide evidence for breeding improvement, which also influenced the properties of the material. For Hallstatt Period, three different kinds of fleece types have been detected: still, a coarse category can be detected which resembles that of the Bronze Age quality. Other histograms display wider curves with bi-modal peak. Additionally there are high quality textiles with long staples and a peak around 21 µm.

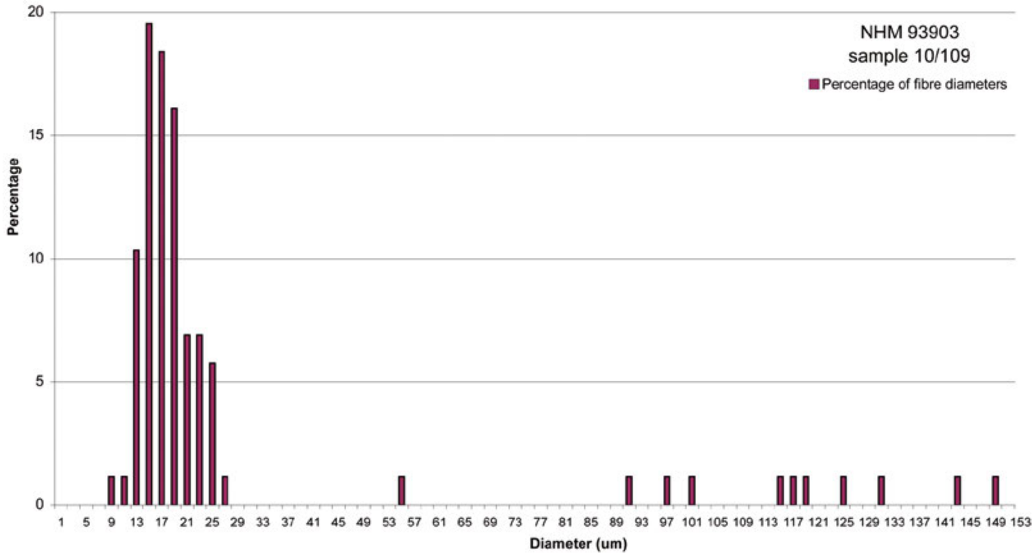


Fig. 7. Hallstatt wool measurements: Histogram of a Bronze Age skin with coarse kemp fibres (after RAST-EICHER 2013: fig. 61).

2. The manipulation of the length of the wool was also of great significance, since the so-called staple length (the average of the length of fibres in a sample, https://en.wikipedia.org/wiki/Staple_(wool)) can have a positive impact on the spinning techniques. The Bronze Age sheep wool finds from Hallstatt have a staple length of about 5 cm, whereas the Iron Age finds exhibit an increase in length of 7–8 cm (RAST-EICHER & BENDER JØRGENSEN 2013: pp. 1227–2130).

3. The most impressive criterion seems to be the deliberate selection of particular colours. A special desideratum might have been the selection of bright and even white wool, because with this, good results in dyeing are possible. Particularly bright colors such as yellow and red could not be dyed with naturally dark pigmented wool (bleaching was seemingly not yet invented). Sheep skins and textiles found in the Hallstatt salt mine provide more evidence about the natural colour of the sheep (Fig. 8): there are 70 textile units from Bronze Age Hallstatt, but only 13 have exhibited highly pigmented wool what results into dark brown to blackish wool. The other remains indicate less pigmented or even non pigmented fibres, which include both the fine underwool as well as the kemp – it is a light, off-white wool (see GRÖMER *et al.* 2013: catalogue Bronze Age; RAST-EICHER 2013).

Selection of the wool during the textile production process

The selection of fibres in order to achieve specific characteristics can be carried out in various stages of the textile production process: during the exploitation of the raw

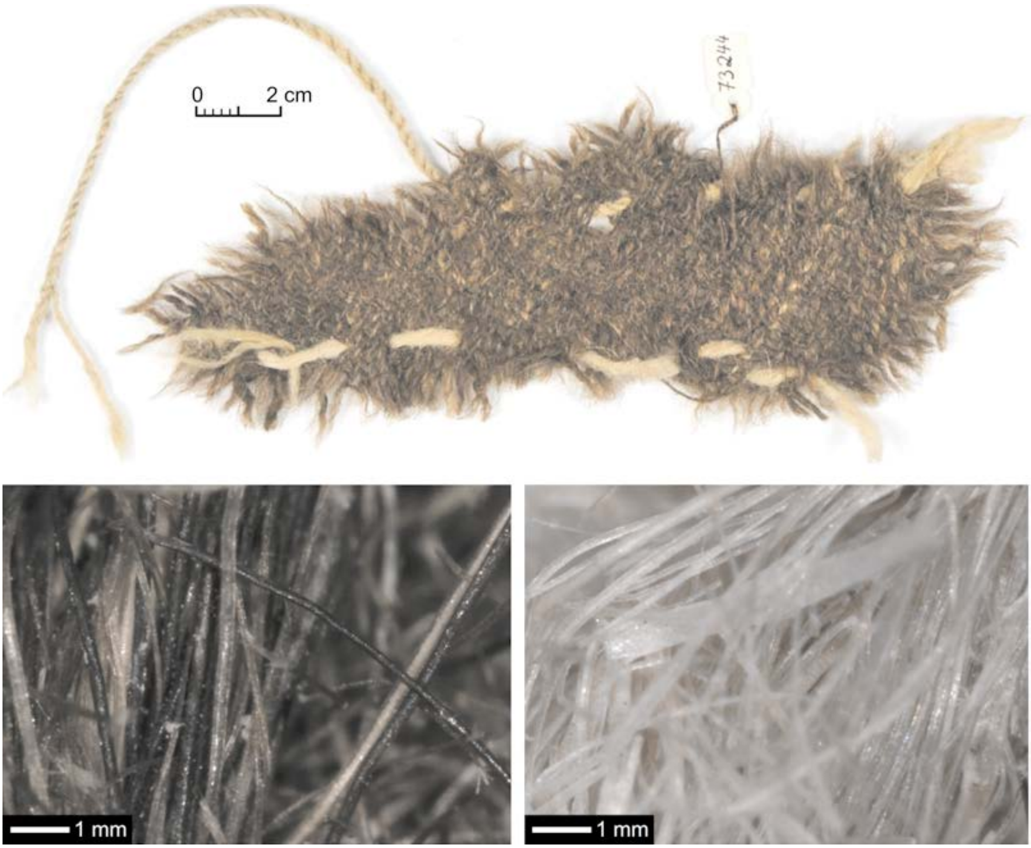


Fig. 8. Hallstatt, HallTex 45, white (less pigmented) wool and brown (highly pigmented) wool, both with fine fibres and kemp, 1500–1200 BC (© NHM, microphotos: K. GRÖMER).

material, the preparation, and even during spinning (GRÖMER 2016: pp. 69–71, 88–91) (Fig. 9).

The wool can be removed from the animal in various ways (see also RAST-EICHER 2013: pp. 170–172). Similarly to the wild animals, sheep populations with more primitive characteristics are characterized by an annual rhythm of natural hair change. The hair can be obtained by plucking or rooing, whereby they can also be selected. With rooing or plucking it is possible to achieve fine wool, but also the particular hues of different natural colours that might be found on one sheep can be selected deliberately; in this way it is feasible to obtain off-white, brown or black wool to be used for the production of patterned textiles.

Equipment that is related to sheep shearing has been found already during the Latène Period at the second half of the 4th century BC; the shears that were excavated at the graves of Pottenbrunn in Austria (RAMSL 2002) are well-known. In principle, it is also possible to remove the hair by the help of other sharp cutting tools, such as flint blades

Fig. 9. Spinning wool with kemp, removing the kemp while spinning fine threads (photo: K. GRÖMER).

or knives made of bronze or iron. Current studies associate the presence of animals with continuously growing fleece with the typological evolution of shears (RYDER 1997). After shearing, a selection of the fleece according to fibre quality and colour is feasible, as wool deriving from the belly and from the back of the animal can also be selected.

Success: Clothing and textiles of the Iron Age

The textile culture from the Hallstatt Period is mainly based on sheep wool; between 800 and 400 BC it is statistically the most important raw material to produce fabrics and clothes (*e.g.* in the salt mine Hallstatt, GRÖMER *et al.* 2013: catalogue). The dominant use of wool changes during the Iron Age, as linen textiles tend to be dominant in the Late Iron Age (GRÖMER 2016: p. 46; Dürrnberg: STÖLLNER 2005).

During the early phases of the Iron Age, colourful and decorated textiles were preferred; the various properties of the wool were exploited in a skilful way. Sheep wool can be more easily dyed than plant fibers, as it absorbs the colour better, and when combined with mordants it produces light-fast and washable fabrics.

Not only were monochrome textiles produced, but also a variety of patterns were in use. The natural hues of wool as well as dyed yarn were employed to weave striped and checkered cloth. In the salt-mines Hallstatt und Dürrnberg both houndstooth-checks and larger block-pattern checks have been found, some of them resembling scottish tartans

(GRÖMER 2016: fig. 99; STÖLLNER 2002: colour plate 2–4). Similar fabrics also appear at the elite graves of Verucchio in Italy (STAUFFER 2012); there the houndstooth-pattern, for example, was preserved in red and blue.

Worth mentioning as well are decorative bands. A rigid heddle enables many various designs based on the use of different coloured warp threads. Depending on the arrangement of the threads, striped or even chess-board patterns are possible, as is demonstrated by the impressive Iron Age finds from Hallstatt (GRÖMER *et al.* 2013: fig. 29). Concerning the complex patterned tablet woven bands from Hallstatt and Dürrnberg (GRÖMER 2016: fig. 102), it could be proved that the threads used have usually been made of high-quality wool; this means that the material was carefully selected and prepared.

Among the different objects, a multi-coloured patterned band with floating warp threads was found in Hallstatt; in this example, hairs of horse have additionally been used, in order to take advantage of the special properties of this specific material. In this case, the stiffness and wear-resistance of the horse hair were of great significance. Consequently, the band should be on the one hand elastic and on the other hand dimensionally stable (GRÖMER 2016: fig. 24).

The so-called spin pattern is an interesting tone-on-tone pattern and appeared during the Hallstatt Period exclusively on wool textiles (GRÖMER 2016: pp. 171–173); it was made by the use of groups of z- and s-twisted yarn in warp and/or weft. This type of pattern can be connected to the material itself and its properties. Another significant characteristic of the textiles produced during the Hallstatt Period is the very fine quality of the objects.

Until now, complete Iron Age garments made of wool have been only rarely found in Central Europe. Some well-known examples derive from Italy, namely the cloaks and capes from Verucchio (STAUFFER 2012). The cloaks feature the typical checkered and spin patterns that are characteristic for other contemporary wool textiles. Moreover, various pieces of clothes and clothing equipment that date to the second half of the 1st century BC have been found in the bogs of northern Europe (HALD 1980; MANNERING *et al.* 2012): trousers, shirts, skirts, tube garments and cloaks.

Addendum: Sheep use in Roman Period

At 15 BC the South Danubian part of Austria was integrated into the Roman Empire to form the provinces of Noricum and Pannonia. Similarly to the previous periods (Bronze and Iron Age), a great variety of finds related to the topic textiles and clothing came to light, including animal bones (see RIEDEL 2004), remains of textiles (GRÖMER 2014: catalogue) and textile equipment, but also a high number of pictorial sources like funeral stelae (GOSTENČNIK 2014) with depictions of textile tools. Additional to the biological remains and the archaeological finds, written sources add to our knowledge, offering a more complete picture of roman textile production.

To begin with a very interesting observation from Varro (ling. 5,54), an ancient roman writer from the 1st century BC: “*…ante tonsuram inventam vellere lanam…*” (…before shearing was invented the wool has been plucked). It seems that it was already known to the ancient authors that there were sheep with natural moulting, whose wool had to be plucked (rooing).

As it has already been confirmed by the textiles and the textile equipment of the Latène period, it is likely enough that in Central Europe, too, this change of animals with natural moult in springtime to such that have to be shorn because of continuous growing wool took place in the last BC centuries. However – as it is also evident from the roman sources – some "primitive" sheep populations should have coexisted together with the new sheep populations.

According to the written sources, during the Roman Period sheep were chosen and bred based on their colour and other properties/qualities (see Moeller 1976: pp. 9–10; Wild 1970: p. 10). Furthermore, there were specific regions of the Roman Empire which were known for specific wool qualities.

The art of breeding sheep with pure white wool is attributed to the regions around Mutina, Parma and Padua in Northern Italy (Plinius, Naturalis Historia VIII. 191). According to Columella (VII, 2.4.), sheep from Spain and Pollentia deliver black fleece (*velleres nigri*), sheep with reddish fleece (*color rutilus*) could be found in Spain and Asia Minor, whereas yellowish wool (*velleres fulvi*) was characteristic for Tarent and Canossa. Special interest presents the observation of Columella (VII, 2.5) that sheep from Tarent were even covered with fabrics (*oves pellitae*), so that the quality of wool would not be damaged by weathering and sunlight, while the hair grew at the back of the animal. According to Strabo (IV. 4.3) and Varro (Rust. II.2.18) the same was practiced in some regions of Greece and Northern Gaul (nowadays France). Varro (Rust. II.11.7) also mentions that during shearing of the different coloured sheep, particular caution was payed so that the various colours were carefully separated from each other and that coarse fleeces were not mixed with the finer ones. Finally, the sheep have been shorn on a mat, in order to avoid dirt on the precious fleece (Varro, Rust. II.11.8).

The mineralized textiles found in Roman Period graves from Austria present no evidence for colour and there are no wool measurements, which could be connected to specific fleece types. For Switzerland, the wool type known since Latène Period and in Roman Period has well as very fine wool (Rast-Eicher 2008: pp. 149–150), and at the end of Latène Period with the growing influence of the Romans, sheep with fine wool reaches the areas north of the Alps (Rast-Eicher 2013: p. 178).

Furthermore, as Kordula Gostenčnik (2014: p. 60) mentioned, the acuteness of the roman textiles is not only associated to the sheep populations and the type of fleece, but also to the techniques employed for cleaning and preparing the raw material. This is analogous to observations that have been made for the Iron Age textile production in Central Europe. Latin sources are also helpful here: the *lanarius purgator* cleans the wool, the *lanarius pectarius* is responsible for combing the clean wool, the *lanarius carminator* is the one who does the carding. Relevant equipment and tools have been discovered in several austrian sites (based on Gostenčnik 2014: p. 60, with further sources).

As it has been confirmed from grave finds, wool was also used during the Roman Period for the production of clothes and clothing equipment. The Edict on Maximum Prices, issued 301 AD by the roman Emperor Diocletian, suggest that special wool products were delivered from the province of Noricum to the entire Roman Empire (Ed. Diocl. 19 und 22; see also GOSTENČNIK 2014: Tab. 5).

Interlacing sheep and textile history

Combining that evidence, the textile finds (together with them also the possibility to analyse wool fleece types) as well as archaeozoological material, it is a challenge to get a conclusive picture of sheep economy from Neolithic to Roman Period in Austria. Here we discuss some first ideas, but in awareness that we have to be carefully in interpreting the evidence.

The majority of identified bones in prehistoric settlements in Austria usually belongs to the category of sheep/goat. This means that there is a respectable amount of unidentified material – at species level – and thus the number of identified sheep bones to draw conclusions is usually low. In order to understand the socioeconomic organisation of past human societies, which is linked to all the aforementioned steps (age and sex reconstruction, skeletal element representation, and morphometric investigation), more material is necessary. For systematic archaeozoological research on Austrian material, Erich PUCHER plays an important role. He analysed some significant faunal assemblages which produced crucial results, also concerning the role of sheep and their exploitation. Examples are Mondsee (Late Neolithic), Bachsfall (Early/Middle Bronze Age), Dürrnberg (Latène A-C) and Bruckneudorf (1st century AD.).

Based on the present state of research it seems that during the Neolithic sheep mainly served as meat suppliers. Though Late Neolithic finds from Slovakia and Hungary have been interpreted to belong to the first woolly sheep that arrived Central Europe from South-East through the Balkans (see in a compilation BECKER *et al.* 2016), similar evidence for Austria have not been yet found.

Organic finds such as textiles are rare and we have a lot of gaps, nevertheless, there is sound evidence that Neolithic textile culture was based on plant material. The beginning of sheep wool use for spinning threads and weaving fabrics seem to date to the 3rd millennium BC, and we know the earliest wool tabbies from *c.* 2000 BC.

Although sheep (and goats) were usually among the main three domesticated species during the Bronze and Iron Age in settlements in Austria, the relatively weak representation of sheep bones suggests that economically they played a secondary role. The age and sex profiles of the animals indicate that wool was widely used during the Early and Middle Bronze Age, as they have been kept to an older age and adult ewes appear in the material.

From the point of view of archaeological textile research, there is a definitive intensification of wool use from the transition Early/Middle Bronze Age (*c.* 1600 BC) on; wool is then the dominant fibre type till the beginning of the Latène period. The increased use of sheep wool from the Middle Bronze Age changed the way people understood clothing and thus the appearance of the prehistoric people. Wool offers new possibilities such as dyeing and colour-patterns. Together with metal objects, new ways of representative and individual expression were created.

Even if at the current state of research does not allow to draw a clear direct connection between archaeozoological evidence and the textile and skin finds, our attention has to be drawn to some interesting observations: As mentioned, the Early and Middle Bronze Age sheep show osteological similarities to *Scottish Soay sheep*. Interestingly, recent investigations on Bronze Age textiles and sheep skin can be linked with that – as wool fineness measurements demonstrated, that the wool of *Soay sheep* is also the closest comparison material. Both, Bronze Age wool and *Soay sheep* display kemp with diameters up to 120 µm, whilst most fibres are of fine underwool around 17 µm (Rast-Eicher 2013: p. 177). From a *Soay sheep* 0.5–1.5 kg wool can be obtained (Sambraus 2001: p. 157).

The evidence is not yet that clear for the Iron Age mainly because of the low number of archaeozoological finds that could be studied and due to the fact that the morphometric observations cannot be easily interpreted. In general it could be said that the Iron Age sheep demonstrate osteological similarities with the *Steinschaf,* with a withers height between 60 cm (female) and 80 cm (male) cm (Sambraus 1994: pp. 320–321). One very interesting question that still remains open is the appearance of some large-sized animals during the Hallstatt and Latène periods. The morphometric analysis of the faunal remains from Dürrnberg was of great significance (Pucher 1999). The relatively large-sized sheep (average withers height 66 cm) were for the region and the period especially remarkable. It is still not yet clear if these individuals represent a local or a mixed sheep population.

Wool measurements carried out with Iron Age sheep skins and textiles, *e.g.*, from Hallstatt, display the evidence of three different fleece types. As described, one of them resembles the Bronze Age fleece type. The other fleece type with a histogram with bi-modal peak, has a strong similarity to today's old breeds, *e.g.*, the *Alpines Steinschaf* (Rast-Eicher 2013: pp. 176–177). Whereas the finest quality from Hallstatt (Fig. 10) resembles the Vrin sheep, which seems to be more developed than the *Alpines Steinschaf.*

Clearly, from Bronze Age on, but especially in Iron Age, people tried to gain the most suitable wool for high quality textile products, i. e. fine, bright fibres. That was tried to do by selection of wool during the textile production process, or by breeding – and maybe by importing and cross-breeding new sheep breeds. Future research in combination with advanced methods might give more insight into how that osteological and fleece type evidence can be drawn together.

Concerning Iron Age economics, the textile finds themselves clearly demonstrate that sheep wool has been the most important fibre source for cloth production, especially between 800 and 400 BC. Nevertheless, osteological material found in Austrian settlements, indicate that sheep have been less important in local economy compared with cattle and pig. The reason for that might be that sheep bones in settlements are the result

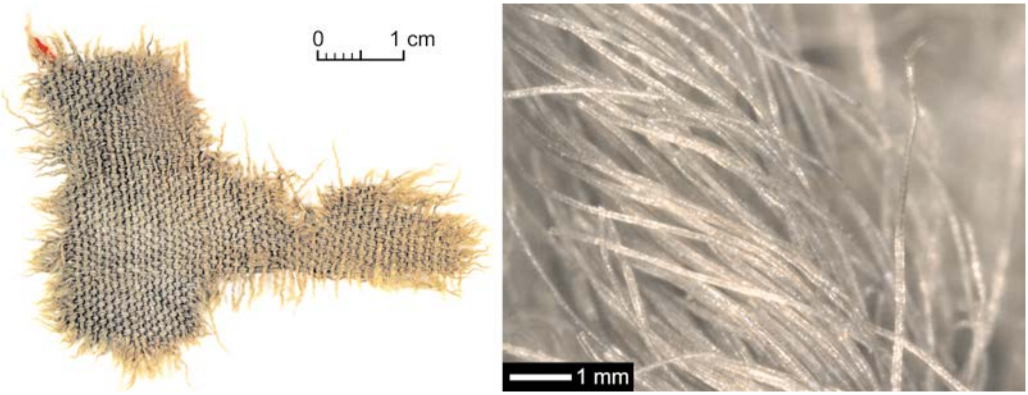


Fig. 10. Hallstatt Textile 98 with fine fibres, 800–400 BC (© NHM, photo A. RAUSCH, microphoto: K. GRÖMER).

of primary use, i. e. meat and skin use, while wool is a secondary product (see BECKER *et al.* 2016) that can be gained lifelong. In that respect, the sex/age ratio helps to understand the type of secondary exploitation.

The morphometric observations so far demonstrate that a new sheep population arrives with the Romans. The animal bones from the Roman site of Bruckneudorf aroused great interest, since Erich PUCHER was able to identify different animal populations attributed to the local and italic domestic fauna (PUCHER in press b); this distinction was also possible in the case of the sheep population. These new animals, which are connected to the appearance of fine wool in Austria, seem to be an early form of the later *Merino sheep,* with withers height of 75 cm (female) to 100 (male) cm. Annually 4–5 kg wool can be obtained from the female individuals (SAMBRAUS 2001: p. 107).

So far, we cannot prove that with wool measurements on textile material from the Danube provinces, but literary sources point to a variety of special breeds (especially for different colours and wool qualities) among the roman textile economy.

The analysis of textiles, fibres from sheep skins and sheep bones brought to light many challenges and highlighted the need for a systematic survey together with the application of new methods, in order to gain more information about past subsistence strategies.

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4.3. Dull Hues versus Colour and Glamour. Creative Textile Design in the 2nd Millennium BC in Central Europe

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4. Dull Hues versus Colour and Glamour. Creative Textile Design in the 2nd Millennium BC in Central Europe

Karina Grömer and Regina Hofmann-de Keijzer

In prehistoric societies, as today, textiles served various purposes (see Grömer 2016, 291-318, fig. 171). Archaeological finds provide evidence for the use of textiles as clothing, soft furnishings, and even textiles for special use, such as sacks for hauling salt in a mine. The perception of prehistoric clothing and textiles, especially of Bronze Age textiles, is usually of simple, coarse, dull fabrics in natural shades of colour. However, although this may be the case for many Bronze Age textiles in Europe, recent investigations have allowed us to draw a new picture of high quality production, patterns and even glamour, reflecting substantial creativity in textile objects (Grömer 2013, 2018). It is therefore of interest why people made an extra effort to decorate them when plain coarse fabrics would serve those purposes as well.

In order to explore this creativity it is useful to turn to theories of human motivation drawn from psychology and neuroscience. The American psychologist Abraham Maslow (1954) analysed human motivation in his theory of the 'Hierarchy of Needs' (Figure 4.1). According to Maslow, there are physiological and basic needs of life such as food, clothing, and a place to live, as well as safety needs, including security of the body, of health, of resources and of property. Each of these have to be served as a matter of priority. The next steps in the hierarchy are the social components - belongingness and love - as well as a need for esteem. The latter describes the need for affiliation; to be accepted, and to gain approval and recognition. This is followed by cognitive needs - to know and to understand. As part of these cognitive needs it is important for humans to explore and to problem-solve. Aesthetic needs are part of this and manifest in symmetry, order, elaboration, balance and form. At the top of Maslow's hierarchy stand self-actualization needs, including religion. He suggests that all of these needs can be found in all cultures and throughout all periods. They are *universalia humana* (universal human behaviour), as defined by the Austrian ethnologist Karl Wernhart (1987). However, although Maslow placed human needs in a strict hierarchy, the existence of such a definite ranking has been disputed (e.g. Wahba and Bridwell 1976). In this chapter, while we accept the existence of human needs and motivations, and find such insights useful in understanding Bronze Age creativity, we do not give one priority over another and they are seen as standing equally beside each other.

Bronze Age textiles served aesthetic and visual purposes as well as basic physiological, functional ones. Peter Wells (2008, 42-46) analysed the visual qualities of objects and their perception and reception by humans. Informed by recent research in cognitive neuroscience and cognitive psychology, these form the theoretical basis for his approach to understanding the visual basis of communication in early Europe. When a person or object is observed by a human being, the eyes scan the surface, looking for the edges and points that attract most attention. More time and attention is given to complex objects with highly decorated

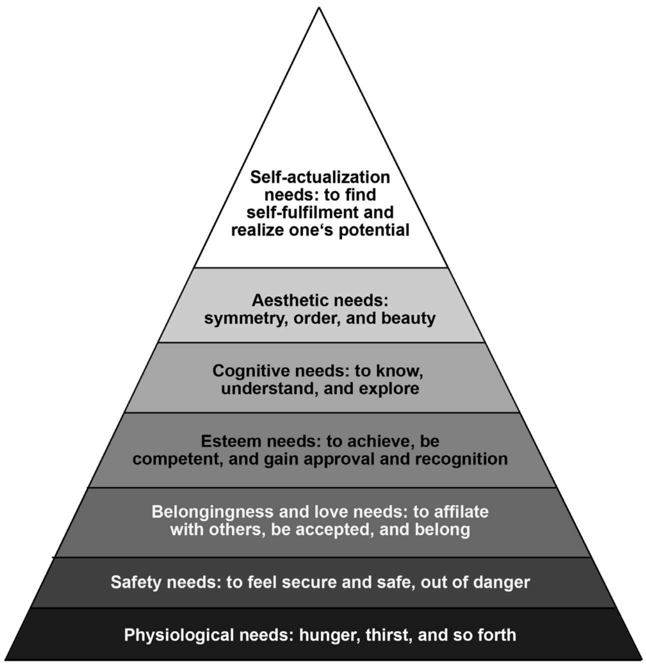

Figure 4.1. Abraham Maslow's Hierarchy of Needs

surfaces. This means that surfaces, edges, texture, colour, decoration and glitter are very important in perception. Wells (2008, 68-69) shows how this is reflected in Iron Age burial where the head, upper torso, wrists and feet are decorated with glittering gold objects, framing the important parts of the body. Thus the visual qualities of things played an important role in the expression of the self and the interaction between members of social groups.

In the following we wish to relate these insights into human motivation and visual qualities to Bronze Age textiles in Central Europe in order to explore creativity in their production and use.

Creating Different Surfaces and Textures

Bronze Age textiles were usually woven in a uniform way, most often as simple flat tabby items. Nonetheless, a range of different methods was employed to create various textile surfaces and effects. A surface texture can not only be seen but also felt, and this is especially relevant for textiles. They are often in contact with the body – for example when used as clothes or blankets – and so the haptic aspect of the surface is an integral part of the perception of these items.

The first step in altering the haptic impression of a cloth in order to obtain different kinds of surfaces is the preparation of the wool-fleece and the method of spinning a thread (Grömer 2016, 62-85). Different thicknesses of threads also provide varied textile qualities when woven into a cloth. Bronze Age people produced both flat, shiny threads which have a cool, smooth impression, as well as spinning thick yarns to weave into a dense cloth in order to get a warm, windproof fabric. Additionally, the Bronze Age weavers began to create variants of tabby, namely repp and basket weaves. The invention of a loom with more shafts also enabled people to produce twill weaves (see Grömer 2016, 130-137). All of these weave variants have different haptic qualities, some are more flexible than others, and also differ in surface structure (Figure 4.2).

Changing the surface structure of a cloth is also possible during and after weaving. Even if textiles are carried out as simple tabby and woven with coarse yarn, their surface texture can vary according to creative decisions taken by the weaver. Variations in the thread count create elastic, open weaves or dense stiff fabrics with different characteristics. The surface texture can also be changed after weaving by fulling (Barber 1991, 216-217), which results in a dense surface of interlocked fibres, sometimes to the extent that the weave type may even not be visible.

A three-dimensional effect, along with a special haptic experience, can be created by attaching looped threads to the surface of a two-dimensional fabric. This technique goes back to a patterning tradition dating to the Neolithic. Late Neolithic and Early Bronze Age weavers incorporated pieces of threads into their textiles in several creative ways, as examples from Zürich-Mythenquai and Twann-Bahnhof suggest (Médard 2010, 163-164, 203, 214). This technique was also used for twined and plaited fabrics. The wetland settlements of northern Italy in particular have revealed many finds including various twisted fringes knotted in linen tabbies on several Early Bronze Age textile fragments from Lucone di Polpenazze (Bazzanella *et al.* 2003, 188). Woollen loop-pile fabrics are also known from the Nordic Bronze Age, for example from Trindhøj (Broholm and Hald 1940, 27-30; Mannering *et al.* 2012, Fig. 3.8.). Creating a pile fabric of good quality and density is a huge amount of work. It may be that such an effort was made in order to imitate the appearance of fur but fabric has the advantage that it can be washed, which is not very well possible for fur. Furthermore, a dense and coarse weave with pile is clearly warmer than one without a pile. Finally, textiles can be dyed, thereby offering more design opportunities.

Enhancement Through Colour

Colour, in terms of bright colours of rainbow shades, is not usually associated with Bronze Age textiles. Until recently it was considered that natural hues of beige and brown represented the colours available for textiles in the 2nd millennium BC. However, modern chromatographic and microscopic techniques have permitted insights into the beginning of textile dyeing in Europe (Joosten and Van Bommel 2008; Hofmann-de Keijzer *et al*. 2013; Hofmann-de Keijzer 2016, fig. 84); high performance liquid

Figure 4.2. Bronze Age textiles from Hallstatt , Austria, 1500-1200 BC (© Natural History Museum, Vienna)

chromatography with photo diode array detection (HPLC-PDA) used for dye analysis and optical light microscopy and scanning electron microscopy with energy-dispersive X-ray analysis (SEM-EDX) serve to study colours, fibres, their contamination and degradation, and elements which could originate from mordants (Hofmann-de Keijzer *et al.* 2013, 136-140).

In some cases the analytical results enable the identification of dyes and the determination of the dyeing material. However, the dye analysis of prehistoric and archaeological textiles is confronted with limiting factors (Hofmann-de Keijzer *et al.* 2013, 138-141). Compared to historical textiles many fewer prehistoric ones have been analysed. The identification of dyes is sometimes hampered by analytical issues, such as baseline disturbance of the chromatogram, the low concentration of dyes, and the lack of reference data; a dye can only be identified when both its retention time and UV-VIS absorption spectrum correspond to a reference dye. In archaeological textile fragments, red and many yellow unknown coloured components are found. The lower the concentration of an unknown component, the more difficult it is to assign it to a certain dye. Such components may be degradation products of dyes or fibres, or contamination from materials with which the textile came in contact throughout its history. If no components are detected, it cannot be concluded that the textile was not dyed; as a result of degradation processes the once present dyes may have diminished below the detection limit of the HPLC system. While in later periods cultivated dye plants were used preferentially, in prehistory the emphasis lay on wild plants. The Bronze Age can be seen as an experimental phase of textile dyeing in which nearly every plant could have been used. The determination of dye plants is therefore difficult because the markers, or chemical fingerprints consisting of major and minor components of these plants, are not known or do not exist. Furthermore, varieties or cultivars of prehistoric dye plants could have contained dyes in different ratios to those plants used in later periods. Additionally, the ratio of the major and minor compounds could have been modified by the dyeing processes and by degradation.

Despite the caveats outlined above, recent research has revealed that the Bronze Age was a very innovative period in the development of textile colours. Around 1600 BC, wool started to play a major role in textile production (Rast-Eicher and Bender Jørgensen 2013), marking a difference to the Neolithic textile tradition that was based mainly on plant fibres (Rast-Eicher 2005). As wool takes dyes better than plant fibres, it is understandable that the development of dyeing techniques went hand-in-hand with the use of wool. Additionally, during the Middle Bronze Age the selection of sheep with low pigmented wool took place (Bender Jørgensen and Rast-Eicher 2018). White wool can be dyed to bright hues of yellow, red or blue. Pigmented wool in natural hues of beige, brown, black and grey continued to be valued and developments in wool selection therefore expanded, rather than entirely replaced, the available repertoire of colours.

It is obvious that the development of textile dyeing in prehistoric times required creativity. Prehistoric people perceived numerous colours in their vicinity: red, yellow, blue and violet occur in the sky, in flowers and fruits, while green is in various plants. To meet their aesthetic needs (following Maslow 1954), they wanted to transfer those colours to their clothing. Unfortunately, this could not be achieved directly with the colourants (the anthocyanins) present in flowers or fruits. Nor could the chlorophyll that makes leaves green be used to dye textiles durably and beautifully. In order to make things 'work' and achieve coloured textiles, the archaeological record shows that Bronze Age people embarked on a creative trial-and-error phase.

The bark of trees, certain herbs and galls had already been used for tanning leather. It was thus easy for Bronze Age people to build on this knowledge and to find out that they also could create stable shades of brown on textiles. Tannins are amongst those chemical compounds which bond directly to the textile fibres without any additives (Forbes 1964). This technique is called direct dyeing and the hues obtained range from reddish brown to yellow brown. In addition to tannins only a few other dyes can be used for direct dyeing, such as the red dye orcein from orchil which has to be prepared from certain lichens, the brown dye juglone from the green parts of walnut trees (*Juglans regia*), and the yellow dye crocetin from the stigmata of saffron (*Crocus sativus*). Although dyeing with tannins seems to be easy, they are rarely detected in brown prehistoric textiles from the Bronze and Iron Age. An explanation could be that brown colours were preferentially obtained from brown sheep wool. Dyes similar to those occurring in saffron and orchil have been detected in Iron Age textiles (Hofmann-de Keijzer *et al.* 2013, 150, 154, 156-157).

Nearly all red and yellow dyes are so-called mordant dyes; soluble colourants that have to be fixed to the fibres by tannins or by mordants containing the elements aluminium, copper or iron (Hofmann-de Keijzer 2016, 153-154). To prepare a mordant bath, tannins or metal salts had to be dissolved in water to treat the textiles before or after the dyeing process. The mordants could also be put directly into the dye bath. However, the use of these mordants is not easy to prove in archaeological textiles because these elements can also originate from the archaeological environment. Fermentation processes also cause brighter and more stable colours (Vajanto 2015).

Due to their chemical properties, animal fibres could be dyed in bright yellows and reds whereas plant fibres receive less intense shades. Mordants could also have been used to influence the hue. While mordants containing aluminium (obtained from clubmoss, alunit or alum shale) do not change the colour of the dye, mordants containing copper or iron (metal, metal alloys, metal salts, or iron containing mud from fens) and tannins (e.g. from barks or galls) cause a darkening of the colours. Yellow dyes, for example, yield olive-green shades with the addition of copper mordants, and olive-green to brownish shades with iron mordants. The discovery of mordant dyeing added an additional colour to the palette: black. Iron mordants mixed together with tannins result in iron gall black.

It was probably easy to figure out that textiles can be dyed yellow with almost all yellow flowers and green parts of plants. This is due to the yellow dyes, the flavonoids, which are found in many plants. The most important flavonoids detected in prehistoric textiles are luteolin, apigenin and related components. They have been detected in two Hallstatt textiles from the Bronze Age and in many fragments from the Early Iron Age (Hofmann-de Keijzer *et al.* 2013, 151-154). The most famous dye plant containing luteolin and apigenin is weld (*Reseda luteola*). Weld was originally distributed in West Asia and South Europe and was spread in Europe by cultivation. Beside weld, other plants native to Europe could be the sources for luteolin and apigenin, such as saw-wort (*Serratula tinctoria*), dyer's broom (*Genista tinctoria*), yarrow (*Achillea millefolium*) and dandelion (*Taraxacum officinale*). Textiles that contain apigenin as the main dye could have been dyed with the scentless chamomile (*Tripleurospermum inodorum)*, which is also native to Europe.

In the Bronze Age, red dyes were obtained from the rhizomes of Rubiaceae species. The red dye purpurin has been identified in two textiles from Hallstatt (Hofmann-de Keijzer *et al.* 2013, 147-150). Sources are different bedstraw species as *Galium verum, Galium mollugo, Galium sylvaticum* and *Asperula tinctoria*. Another source for purpurin could be wild madder (*Rubia peregrina*), which is native to Mediterranean Europe and Great Britain (Cardon 2007, 119-121). The most important cultivated plant in Europe for dyeing red was dyer's madder (*Rubia tinctorum*). Textiles dyed with rhizomes of madder generally contain more alizarin than purpurin. The plant, native to south west and Central Asia, was known to the ancient Egyptians, Greeks and Romans, and was cultivated under the Roman Empire in Italy and Gaul (Bender Jørgensen and Walton 1986, 185; Walton 1988, 154-155). In other parts of Europe, however, madder does not seem to have been cultivated before the Early Middle Ages (Ploss 1989, 8; Hofenk de Graaff 2004, 94). Therefore the identification of madder in Iron Age textiles in Central and Northern Europe (Dürrnberg in Austria and Danish sites) has been interpreted as an import in the form of textiles or of the dyeing material (Walton 1988, 154-155; Stöllner 2005, 169-171). One Iron Age textile from Hallstatt contains alizarin and rubiadin as well as purpurin. It is not possible to conclude if bedstraw species or dyer's madder is the source. Recent analyses of woollen yarns dyed with rhizomes of Rubiaceae species, suggest that the distinction between textile reds dyed with madder, wild-madder and bedstraw species is not unambiguous, especially if the degradation of dyes is considered (Hofmann-de Keijzer *et al.* 2013, 147-148).

An outstanding achievement of the Bronze Age is the production of the blue pigment indigotin from the green leaves of dyer's woad (woad, *Isatis tinctoria*; Cardon 2007, 357-377) and the invention of vat dyeing, a suitable dyeing technique for insoluble pigments. Analysis has revealed indigotin in one Hallstatt textile from the Bronze Age and in samples of seventeen textile fragments of the Early Iron Age (Hofmann-de Keijzer *et al.* 2013, 141-147). Although it was not too difficult to discover woad blue as people could see it on damaged parts of the leaves, to dye a beautiful blue was more difficult (Hartl 2012, 35; Hartl *et al.* 2015a, 2015b). Prehistoric people succeeded in transforming woad blue into a greenish-yellow liquid (vat) by adding water and urine or potash, and allowing the mixture to ferment. At this point, they had discovered the tecchnique of vat dyeing. Fleece, yarns or fabrics could be submerged in the vat. People must have been amazed when the textile material was removed for the first time from the vat and exposed to air, at which point the colour changed from greenish yellow to green and finally to blue.

A combination of different dyeing materials and dyeing techniques was necessary to obtain even more shades of colour. Shades of green different to olive green occurring in leaves and grasses were only achieved by combining vat dyeing used to make blue with woad, and mordant dyeing with yellow dyes. The use of this dyeing technique to create green existed in the Early Iron Age (Hofmann-de Keijzer *et al.* 2013, 157). Durable violets, similar to the colour of blackberry or blueberry juice, were in principle achievable by vat dyeing for blue with woad and dyeing with red mordant dyes. These have not yet been identified by dye analysis in Bronze and Iron Age textiles, although they are common in Late Antique textiles from Egypt.

Prehistoric people were pioneers in developing textile dyeing by following creative trial-and-error-processes. There are obviously no standardised written dyeing recipes available, such as exist from the Medieval period (Hofenk de Graaff 2004, 2-11; Cardon 2007, 3-19). Instead, their knowledge was passed on to the next generation through the observation of dyeing processes and by oral tradition. As yet unknown yellow and red dyes detected in the Bronze Age textiles may well point to experiments with local plants. For example, in two samples of the Bronze Age textile fragment from Pustopolje, Bosnia-Herzegovina (1670 BC ± 120 years) HPLC-PDA analysis indicated the presence of unknown yellow, orange and red components (Bender Jørgensen and Grömer 2012, 58; Van Bommel, Joosten and Hofmann-de Keijzer 2013). The yellow components are related to the flavonoids luteolin and apigenin, which occur in dye plants discussed above. The red components, however, may originate from an unknown plant; although they may be the result of the archaeological environment, the relatively high concentration of flavonoids suggests that this textile has been dyed and that some of the coloured components could be degradation products of dyes or fibres.

Developments in dyeing need to be understood not just with regard to the development of colour but also in terms of how coloured textiles were related to other objects. In the case of costumes and individual garments the fabric forms a background and carrier material for attached metal objects such as jewellery or dress fittings (see Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013). One only has to imagine a bright blue dyed textile with attached fresh bronze dress fittings with a golden shine. In this case the blue dyed textile forms a perfect contrast to the attached metal objects. The colour of textiles is thus an important aspect of perception, as expressed by Wells (2008).

Creating Patterns

Patterns serve the aesthetic needs of people by channelling and holding visual attention. Following Wells (2008, 45), decoration provides a link between the observer and the material world in which he lives, moves and interacts. The varieties of decoration employed within a society are thus clues for understanding the social place people inhabit. Though Wells describes this phenomenon with regard to metal objects, decorations on textiles can be discussed from this perspective.

Various methods of adding pattern to textiles are found in the Neolithic (Médard 2010; Rast-Eicher 2005; Vogt 1937) and Neolithic patterning systems continued into the Bronze Age. Most are based on inserted elements like seeds or additional fringes, but patterns are also made in a creative way with floating threads. In the Neolithic most of the decorations are made on linen items and are tone-on-tone in natural hues like beige or brown. In the Bronze Age the use of these techniques became more complex. A linen band from Molina di Ledro in Italy dating to the Early Bronze Age (Bazzanella *et al*. 2003, 161–163) is decorated with a woven pattern of concentric lozenges. This was made on a tabby ground weave by picking out and floating the warp threads. This complex technique is a creative interaction of the weaver with the fabric. The design principles of the Molina di Ledro find can also be seen on contemporary iconography. The pattern appears on clothing depicted on the large grave stones from Sion-Petit Chasseur in Switzerland (Bocksberger 1978, fig. 28; Rast-Eicher 2012, 382–383), clearly echoing the decoration on the Molina band. However, developments in dyeing also offered something new for Bronze Age textile producers: the possibility to make colour patterns. The option to have colourful cloth had a deep influence on how textile material was used. Before the invention of dyeing, natural shades like off-white, grey, brown and black were used for making patterns but brightly dyed yarns in red, blue or yellow made 'signal' patterns possible, with much higher visibility.

Bronze Age textiles show design developments in which the monochrome appearance of a textile surface was interrupted by bundles of threads of different colour forming stripes. They define edges and channel the viewer's attention in particular directions. For warp stripes, the threading of the loom

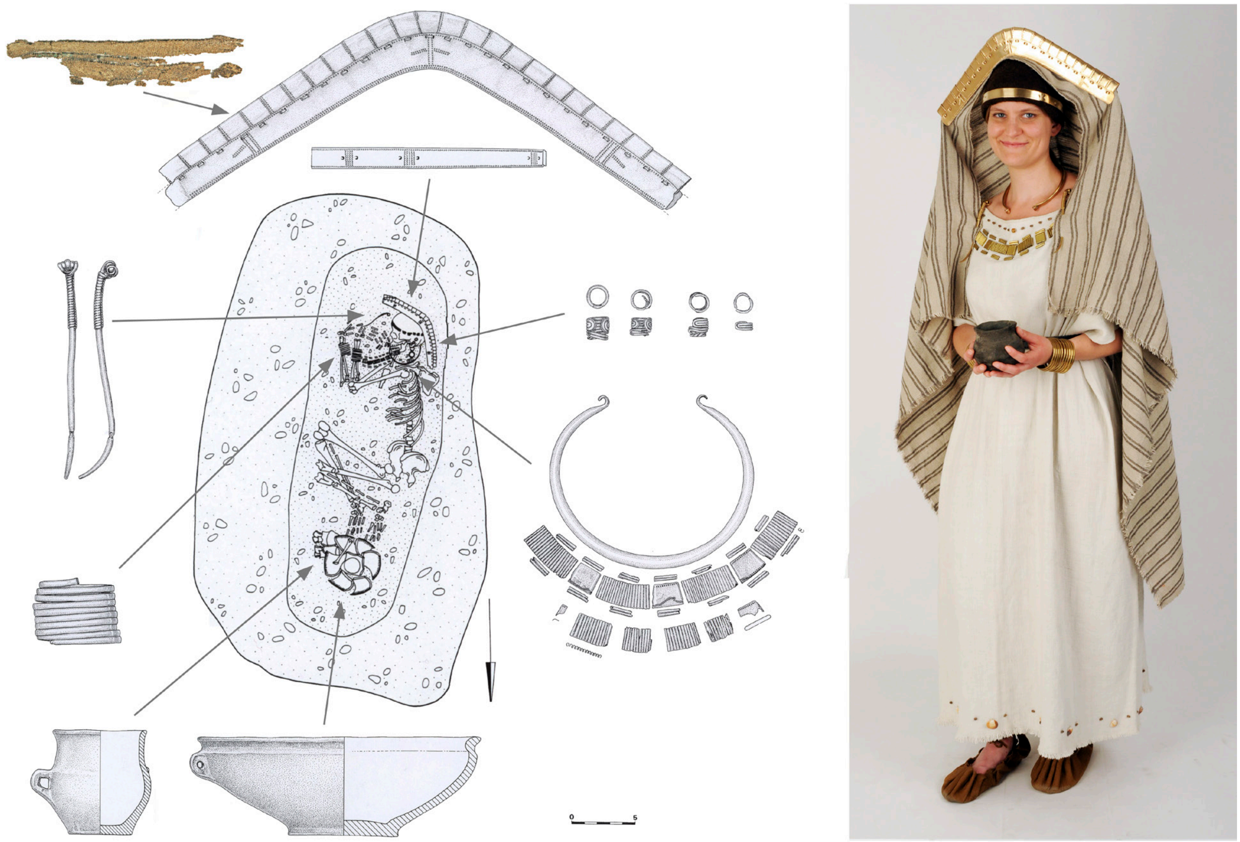

Figure 4.3. The Franzhausen textile, grave context, and its reconstruction, Austria, c. 2000 BC (© Bundesdenkmalamt and Natural History Museum, Vienna)

determines the pattern and this is usually not changed during the weaving process. For weft threads creative possibilities exist during the weaving process; with the use of different colours, the pattern can be varied very easily. The earliest evidence for colour stripes comes from Franzhausen in Austria (Figure 4.3; Grömer 2012, fig. 1.1), from a grave of a high status women who was buried around 2000 BC (Neugebauer and Neugebauer 1997). It is a linen ribbed tabby, decorated with narrow brown stripes. Stripes are also a design principle used for a Bronze Age tablet woven band from the Hallstatt salt mine (c.1500-1200 BC). The tablet weave with blue dyed warp stripes (Figure 4.4) is the earliest known object of its kind (Grömer, Rösel-Mautendorfer, Reschreiter 2014, 136-138).

Whereas woven colour patterns usually depend on the geometric system of warp and weft to form stripes and checks, applied decoration allows a much freer design process. There is only one Bronze Age textile known so far with a more complex pattern. The fine linen from Pfäffikon-Irgenhausen in Switzerland (1685-1493 BC) was decorated with embroidery (Vogt 1937, 76-90, fig. 112-150; Rast-Eicher 2012, 381). The rich decoration consists of chess-board-patterns, triangles and stripes. This is a very sophisticated piece and a good example of creative textile decoration. The same motifs can be found on contemporary objects such as the clay figurines from Serbia, Hungary and Romania, dating to c.1500-1400 BC (Müller-Karpe 1980, Tab. 326-327). They demonstrate how textiles with such decoration could have been used; the figurines are of women wearing a wide skirt with the seam and the belt region decorated with triangles and a chess-board pattern similar to those of the Irgenhausen textile.

Recent reconstruction of a Middle Bronze Age grave ensemble from Winklarn in Austra (Figure 4.5) has revealed how the different elements composing a costume can combine together to give particular kinds of optical effects and draw the eye to focal points (Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013). In the reconstruction, a heavy belt plate, a splendid necklace, pins and bracelets were combined with a garment inspired by the figurine from Kličevac and the Irgenhausen embroidery. Following Wells

Figure 4.4. Hallstatt Textile 288, Austria, with striped tablet woven border, 1500-1200 BC (© Natural History Museum, Vienna)

(2008), human visual perception focuses on edges and borders, and then later on the inner areas. The more complex the surface, showing decorative patterns, curved shapes, three-dimensional features and multiple colours, the more time and attention our brain devotes to examining it. Wells (2008) argues that in costumes with impressive bronze adornments visual focus lies with these; in the case of Winklarn on the upper body because of the massive and shiny bronze objects (Figure 4.5, 1-2). No metal items were found between the waist and footwear, however, the elaborate designs on the textiles on the lower part of the body also serve to catch the viewer's attention thereby attracting the attention of observers to this part of the body. A bright and complex decorated textile surface placed at the lower hem of the skirt clearly catches the eye and directs attention to the lower legs (Figure 4.5, 3). Here the focus is not only on the marvellous bronze objects on the upper body and the textile is more than just a background.

Glitter and Glamour

Wells (2008, 45) points out that the sparkle or shininess of an object can be an important aspect of attracting and holding visual attention. The effect of glitter, especially of gold, dazzles viewers who see it in bright light. From the Bronze Age on, metal elements were used for the embellishment of cloth and form a contrast with textiles. The use of metals on textiles refers both to the need for esteem and aesthetic needs identified by Maslow (1954).

Metals can be attached to fabrics in various ways and with different techniques. Metal threads can be woven in a textile. They may consist of gold and bronze wires, strips, or a wire or strip wound

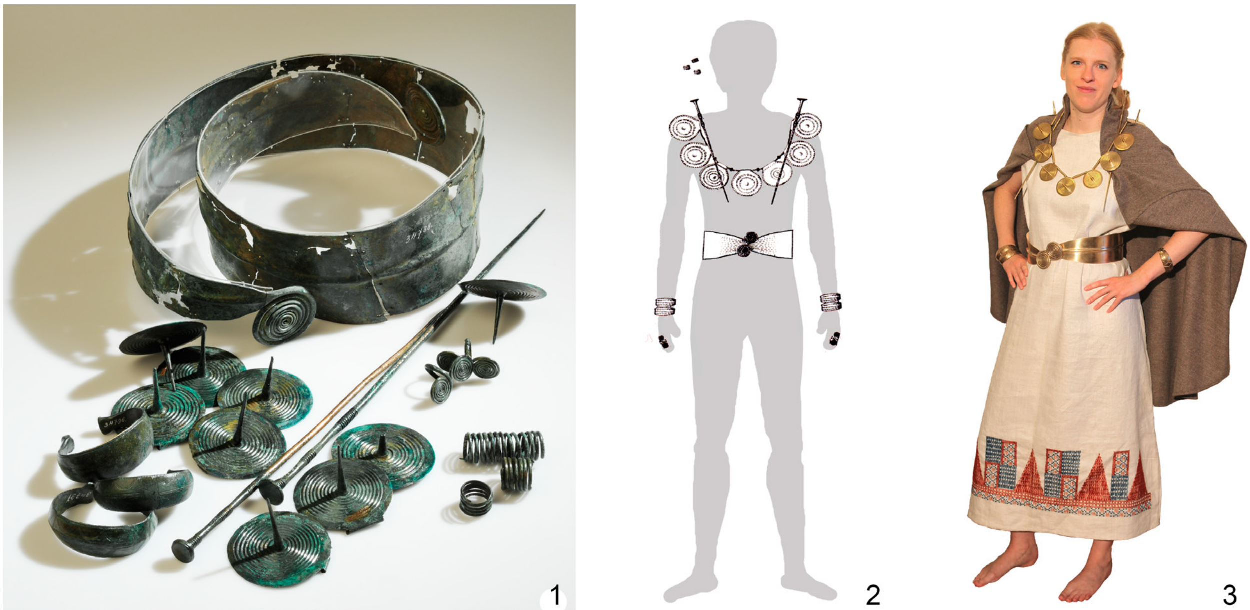

Figure 4.5. Winklarn, Austria 1) Dress fittings and jewellery; 2) Pattern of placement on the body; 3) Reconstruction of a dress based on the figurine from Kličevac and the textile from Irgenhausen with objects from Winklarn (© Natural History Museum, Vienna)

around an organic core made of textile fibres or leather. In the Late Bronze Age, finds of gold threads that may originally have been integrated into textiles are known. Around 1100-1000 BC they appear in modern Austria and Hungary in burials, such as at the site of Vösendorf (Grömer 2012, fig. 1.3), as well as in hoards such as those from Óbuda and Várvölgy in Hungary (Barth 1988/89; Müller 2012, 117-120). In the case of the latter, the gold threads were made of gold sheet, cut into strips (Figure 4.6). The incorporation of gold threads into textiles is also known from the Eastern Mediterranean and Near East (Gleba 2008). Gold threads were woven into fabrics by Assyrian and Babylonian craftspeople. In the *Iliad* Homer mentions one hundred golden tassels on Athena's garment (Homer, *Il.* 2.530), providing a tantalising suggestion of what the spiral ends of the Vösendorf find could have been used for.

The use of gold threads is clearly a choice related to showing status, but it can also be a creative choice in how to enhance materials. Gold objects as luxury goods have advantages over bronze objects when used together with textiles. Gold stays flexible, glittery and shiny, as opposed to bronze which becomes brittle and tarnishes during use. Another reason to use gold instead of bronze for permanent attachment of metals on clothing is that, unlike bronze threads or buttons, gold threads do not suffer from corrosion caused by acid and grease arising from skin contact, as well as use and washing.

Textile Design in Bronze Age Society

Although Bronze Age textile culture was primarily based on simple cloth types, it has become clear that this was a period of substantial experimentation and innovation in the production of surface texture, colour, pattern and sparkle. This experimentation phase also offers hints regarding the resource management of this period and the shifting value of plants for dyeing, sheep for wool, and the finished textiles themselves. Within the social context of the central European Bronze Age, skill and creative design became important in textile craft, as well as in more widely analysed metal and ceramic production.

This creativity can be related to human aesthetic needs as suggested by Maslow (1954). However, the design principles seen in Bronze Age textiles are distinct from those shown by contemporary objects made in other materials including pottery or bronze. Thus curved lines or naturalistic motifs, such as birds or horses, are not found on textiles although the sophisticated embroidery seen on a few textiles

Figure 4.6. Gold threads from Óbuda in Hungary, 11th century BC (© Natural History Museum, Vienna)

indicates that, in theory, it would have been possible. The reasons for a distinct set of textile design principles based on straight lines and geometry may lie on one hand in specific social understandings of the function of particular materials, and on the other hand in the technology of how textiles are made, with warp and weft forming a very strict underlying geometric system.

Bronze Age textiles sometimes offer a high degree of visual complexity. Some of the patterns, decorations and structures show freedom for individual creativity and improvisation, especially with floating thread techniques and embroidery. Following Wells (2008, 34), the more complex the surface of an object appears, the more time and attention the brain devotes to examining it and figuring out what it is. Textiles with structures, patterns and applied decoration therefore had the potential to play an important role in social strategies and were designed to impress the onlooker and create social categories, for men as well as for women (Sørensen 1997; Vandkilde 2007, 137-138). Social dynamics were thus closely linked to creativity in textiles. The former provided motivation which spurred developments in textile production, while the latter offered specific solutions to the human needs embedded within those dynamics.

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4.4. Cloth Qualities from 800 BC – AD 800 in Austria: Context – Development – Handcraft

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Cloth Qualities from 800 BC-AD 800 in Austria: Context - Development - Handcraft

Introduction

The analysis of Roman period textiles from archaeological contexts in Austria has been a neglected topic for a long time. This paper presents a short overview of the recent research into the subject. To understand Roman period textile production, a wider overview in the centuries before and afterwards is essential. Therefore information about cloth qualities from 800 BC to AD 800 in Central Europe has to be considered in order to explore the pertinent questions. For example, what was the cloth culture of the prehistoric population in the Iron Age and how (and if) did it change with the Roman occupation? Furthermore, what was the impact of the Roman Empire on the trade routes and production structures of the "Romanised" tribes in the Danube Provinces (especially Noricum)? The Empire with its centralised organisation controlled this region for at least 500 years. In the following Migration period (Early Medieval period), many of the cultural and economic achievements of the Roman period were lost and the organisation level of society changed from a centralised one to a more local tribal structure.

In terms of quantities of textiles preserved in Austria for the period in question, the following numbers can be summarised. From the Iron Age there are about 1000 textiles, primarily from the salt mines of Hallstatt and Dürrnberg, preserved in the salt in their organic state. Additionally there are mineralised textiles preserved in burial contexts (Grömer, forthcoming 2011). The collection of data on the Roman period resulted in approximately 150 textiles to date (Grömer, forthcoming), although the chronological distribution of finds is uneven. From the 1st and 2nd centuries AD there are only few finds, e.g. from the settlement of Magdalensberg, and cremation burials in Styria. Most of the Roman period textiles were found in graves dated to the 3rd-5th centuries AD. Finally, the Early Medieval cemeteries (6th-8th centuries AD) provided information about 230 textile finds.

Although these textiles derive from different contexts - graves, salt mines and settlements, they allow us to summarise the information on the cloth qualities and therefore the 'textile culture' that existed in Austria. It is hoped that the growing databases will eventually allow this general knowledge to be applied to special textile contexts and functions.

Various methods of research were applied to this material. For the quality of the textiles the basic aspects of textiles were recorded: the thread count, the yarn diameter, pattern, weave structure, twist of the yarn and colour. Fibre quality analysis was carried out with the help of the microscope. Organic fibres such as those from the salt mines were analysed using light microscopy, while mineralised objects from graves were analysed with the Scanning Electron Microscope. Dyestuff analyses of the salt mine textiles from Hallstatt were done using HPLC (Hofmann-de Keijzer *et al.* 2005).

Cloth Qualities in Iron Age Austria (800-15 BC)

The prehistoric textiles are a key source for understanding the development of the textile craft, because all main textile techniques known already during the Hallstatt period (e.g. different patterning techniques, band weaving, dyeing, twill weaving, various sewing techniques), were used through to Medieval times and even later. A distinction between Hallstatt Period (800-400 BC) and La Tène Period (400-15 BC) is necessary, because during the 1st millennium BC

significant changes took place.
From the Hallstatt Period, Austria has a rich body of textiles from the salt mines on the site of Hallstatt (Fig. 1). The textiles were found in the caves and tunnels of prehistoric mines, where they have been discarded (Kern *et al.* 2009). In the so-called 'heathen's rock', a mixture of salt and the deposit of mining activities (torch-wood, tool handles, leather items, carrying bags, *etc.*), the woven fabrics survived in a perfect organic condition. The salt even preserved the colours. Textiles have been recovered from various find spots within the salt mines. The oldest parts are dated via dendrochronology to the Middle Bronze Age. The majority of textiles however date to the Early Iron Age (Hallstatt Period). The fabrics from the find area "*Ostgruppe*" provide much information about the cloth qualities (Grömer 2005, 20-25). There is a variety of different thread counts and different yarn diameters. There are many fine textiles with 10-15 threads/cm, and even finer ones, for example, a basket weave with 40 threads/cm. The yarn diameter is generally medium-fine (*c.* 0.5 mm), but there are coarser and finer ones. The main fibre at Hallstatt is wool, but there are some rare examples of horse hair used as weft for bands. The Early Iron Age textiles come in a variety of different weaves: tabby, basket weave, different twill variants. There are also many different patterns of stripes or checks created during weaving. Spin patterning was very popular and the change of s- and z-spun yarn was applied in more than 50 of the textiles. It was used in tabbies as well as in twills and basket-woven fabrics. Sometimes there are even combinations of spin patterns and colour patterns. Dyestuff analyses demonstrated the use of woad, madder and several unknown yellow and red dyestuffs. There are indications that different dyeing techniques were used: dyeing the fleece, dyeing the yarn or piece-dyeing the woven cloth (Hofmann-de Keijzer 2010).
For the Hallstatt Period, we know products of different loom types, exemplified again by the salt-mine textiles from Hallstatt. There are narrow rep bands, which were probably made with heddle rods or a rigid heddle. Other band weaves are tablet-woven ribbons and broader bands of 8-15 cm in width. The repp bands and tablet-woven borders are patterned: different colours were used to create stripes, checks and even geometric motifs such as triangles, meanders and so on. The loom used in the Hallstatt Period for larger weaves is of the warp-weighted type. This is indicated by the starting borders and numerous loom weights found on Hallstatt settlements and even in graves (cf. Belanová Štolcová and Grömer 2010, 15-17).
Interestingly, most of this textile creativity is mirrored in contemporary grave finds (due to preservation it is impossible to judge the dyes and colour patterns). Thus, the variety of weave types, thread counts and spin patterns can be found in the grave material from Austria (Grömer, forthcoming 2011), as well as the surrounding countries (e.g. Bender Jørgensen 1992; Banck-Burgess 1999; Rast-Eicher 2008). It is noteworthy that there is a distinction between Eastern and Western Hallstatt culture in some details, such as the use of single and plied yarn. At Hochdorf and Hohmichele in Germany (Banck-Burgess 1999, 55-62) we know of textiles with the "flying thread technique" (*Fliegender Faden*). They are dated to the late Hallstatt Period/early La Tène Period.
To sum up, for the Hallstatt period there is evidence of many different cloth qualities with a wide range of different patterns, structures, thread counts and yarn diameters. Some of these textiles could be the products of specialists (for theoretical implications see Grömer 2010, 223-239). This specialised production is also discussed for the contemporaneous textiles from Italy, from the Pre-Etruscan and Etruscan cultures (see Gleba 2008, 193-194).
From *c.* 400 BC onwards, in the La Tène period, changes in textile quality are discernible (Stöllner 2005; Grömer, forthcoming 2011). There are over hundred La Tène period textiles from Austria, mainly from the salt mine on the Dürrnberg near Hallein (Catalogue of K. von Kurzynski in Stöllner 2002; Stöllner 2005) and some from graves. At Dürrnberg, the textiles were embedded in the salt deposit and, similar to Hallstatt, the textiles were preserved in their organic state with bright yellow, red and blue colours.
Although the context and the preservation are very similar in Hallstatt and Dürrnberg, the cloth culture of the latter presents a completely different picture (Fig. 2). The dominant type of weave in the La Tène period is tabby, with twill used less frequently and usually of the 2/1 variety. The more complex weave types like the zig-zag, herringbone or lozenge twill have almost disappeared. Some patterned weaves do exist from Dürrnberg, but not in the numbers known for the Hallstatt period. Spin pattern is not common among the Dürrnberg material. In terms of fibres there appears to be a change from the use of wool as the main fiber to predominantly flax.
Grave material from the Middle and Late La Tène indicates that most fabrics were produced in tabby weave, and there are only a few examples of twill (Belanová 2005). This shift to a common use of tabby is visible also in southern Germany and Switzerland (Rast-Eicher 2008). Generally from the La Tène period

Fig. 1. Textile mosaic from Hallstatt. © Karina Grömer.

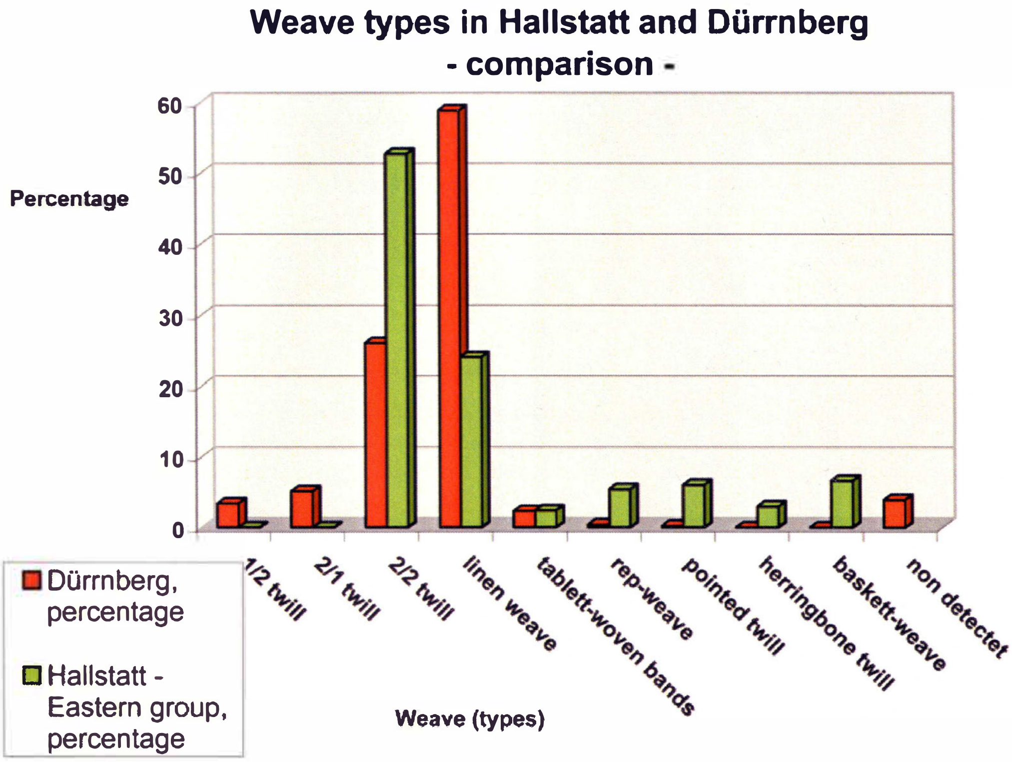

Fig. 2. Statistics about weave types from Hallstatt and Dürrnberg (e.g. Stöllner 2005)

onwards there is a more reduced repertoire of cloth types, but still in good quality. The textiles look standardised with yarn diameters of 0.3-0.6 mm.
If we look at La Tène tools (Belanová Štolcová and Grömer 2010), there is a similar change from the Hallstatt to La Tène period. Hallstatt period spindle whorls are well made tools, they have varied shapes and are heavily decorated, mirroring the creativity of the producer or owner/user. In contrast to these carefully produced Hallstatt whorls, the Middle and Late La Tène whorls appear standardised and are often made of reused potsherds. This kind of "recycling" is an indication that the design was of no interest. The beauty of a tool, the pride in working with it seems to have diminished. The spindles were just intended to be efficient for a maximum output, which is a completely different way to think about the craft. Furthermore, during the La Tène period the number of loom weights found in settlements diminishes compared to the Hallstatt period. It is possible that a two-beam loom or some other loom type without weights was used beside the warp weighted loom. This evidence gives us a hint of the organisation of textile handcraft in the La Tène period. The uniform textiles and the standardisation of tools could be seen in connection with an incipient mass production (serial workshop production) during the La Tène Period (von Kurzynski 1996, 36; Grömer 2010).
In connection to this issue, later written sources are of interest. Livy (Liv. 21,31,8; cited after Timpe 1981, 54) writes, that the Allobroges, a Celtic tribe inhabiting parts of present-day Eastern France (between the Rhone, Isère and Genfersee) supplied textiles to the soldiers of Hannibal during the Second Punic War (218-201 BC). Such a system, to supply goods for the army, requires more than household activity. Production of such a mass of textiles requires more advanced organisation structures.

Cloth Qualities in Roman Austria (15 BC to the 5th century AD)

During the 1st century BC, the Romans added the areas north of the Alps to their empire as the new provinces Noricum, Pannonia, Raetia and Germania. In the archaeological record of Central Europe new types of tools appear in the Roman period: the wool comb and new types of distaffs and spindles (with spindle hooks: Fig. 3). Examples of these tools have been found in Austria, *e.g.*, at the site of Magdalensberg (Gostenčnik 2009, fig. 5 and 7). Those new tools indicate different techniques of preparing the wool and spinning it: with a fine wool comb it is possible to produce a very regular wool fleece, which can be spun into a high quality thread. The spindle hooks

Fig. 3. Spindle hooks from Magdalensberg (e.g. Gostencnik 2009).

suggest a different way of spinning (Fig. 4). Thus, while iconographic evidence from the Iron Age depicts a type of low-whorl spindle where the whorl is fixed on the lower part of the spindle shaft, a spindle hook is used on a high-whorl spindle, as known from the eastern and southern Mediterranean area (e.g. Egypt; Barber 1991, Fig. 2.6 or 2.40), where those tools may have originated. The way of spinning differs between a low-whorl and a high-whorl spindle. The former is turned with the fingers on the top of the spindle shaft, while the latter is rolled along the thigh. This is depicted for a sitting position as well as for a standing one (Barber 1991). Spinning technique, learned by tradition from childhood, is sort of 'embodied knowledge', and would not change (if there is no significant reason). Both techniques produce the same kind of threads. This suggests that the new spinning tool arrived with the people from other parts of the Roman Empire, who settled in the new provinces next to the native populations.

In contrast to this interesting tool evidence the extant Roman period textiles from Austria found in graves and on settlements (Grömer, forthcoming) do not demonstrate many new characteristics. In terms of weave types, the picture is similar to Late La Tène period textiles. Tabby is the main weave type from the 1st to the 4th centuries AD. Sometimes, we found repp and basket weave. Twill is very uncommon and appears mainly in the 5th century AD. The yarn diameter is usually 0.2-0.3 mm, which is on average finer than is known for the Iron Age. There are just a few coarser fabrics. As yarn diameter, the thread count is standardised ranging between 15 and 20 threads/cm. The textiles are of a fine and high quality. The raw material includes both wool and bast fibre, presumably flax.

In terms of patterning there is not much evidence. Unfortunately we do not know of colour patterns from the grave finds, because the textile fragments are mineralised. Spin pattern has almost disappeared. The textiles from settlements like Magdalensberg (Grömer 2009, fig. 1) survived under waterlogged conditions and have darkened in colour (Fig. 5). There is just one Late Antique textile from Austria with surviving colour. It is a large piece of cloth (45x26 cm) which was kept at the Basilica of Lorch in Enns as wrapping for the relics of St. Florian, who was martyred on the 4th of May AD 304. It is a medium-fine linen tabby with blue stripes, crossing each other (Ubl 1997, 223, Kat.Nr. IV/S-1). The estimated date of the textile (based on the context) is the 5th century AD (not yet proven by ^{14}C-analysis).

Recently, an interesting find came to light from the excavations at the Archaeological Parc Carnuntum. It is a sarcophagus burial of a woman from the Roman municipio (Rauchenwald 2009). On her upper body gold threads and other fibres (maybe silk) were found. Further investigation is necessary on this extraordinary find, but it demonstrates that the highest quality textiles were known in Roman Austria, especially for the Roman upper classes. This differs substantially from the very simple cloth types of the local people in the Danube region which are similar to the Middle and Late La Tène textiles.

Cloth Qualities in Early Medieval Austria (Migration Period, 6th-8th centuries AD)

With the arrival of different tribes and the breakdown of the Roman Empire, the "textile culture" in Austria changes. The Bavarians and Alamans in particular used a rich variety of textiles. Fom Austria the Bavarian cemeteries Rudelsdorf (Hundt 1977) and Schwanenstadt (Hundt 2002) are representative of this phenomen. Beside the simple tabbies, different twill variants reappear, including newly introduced *Rippenköper* and *Kreuzköper*. Spin and other patterns are also found. There is a reappearance of patterning techniques with floating threads, as is known from the Celtic burials like Hochdorf. Early Medieval examples have been found at Rudelsdorf.

Thus, from the 6th century onwards, Austria sees the return of the Iron Age creativity in weave structures

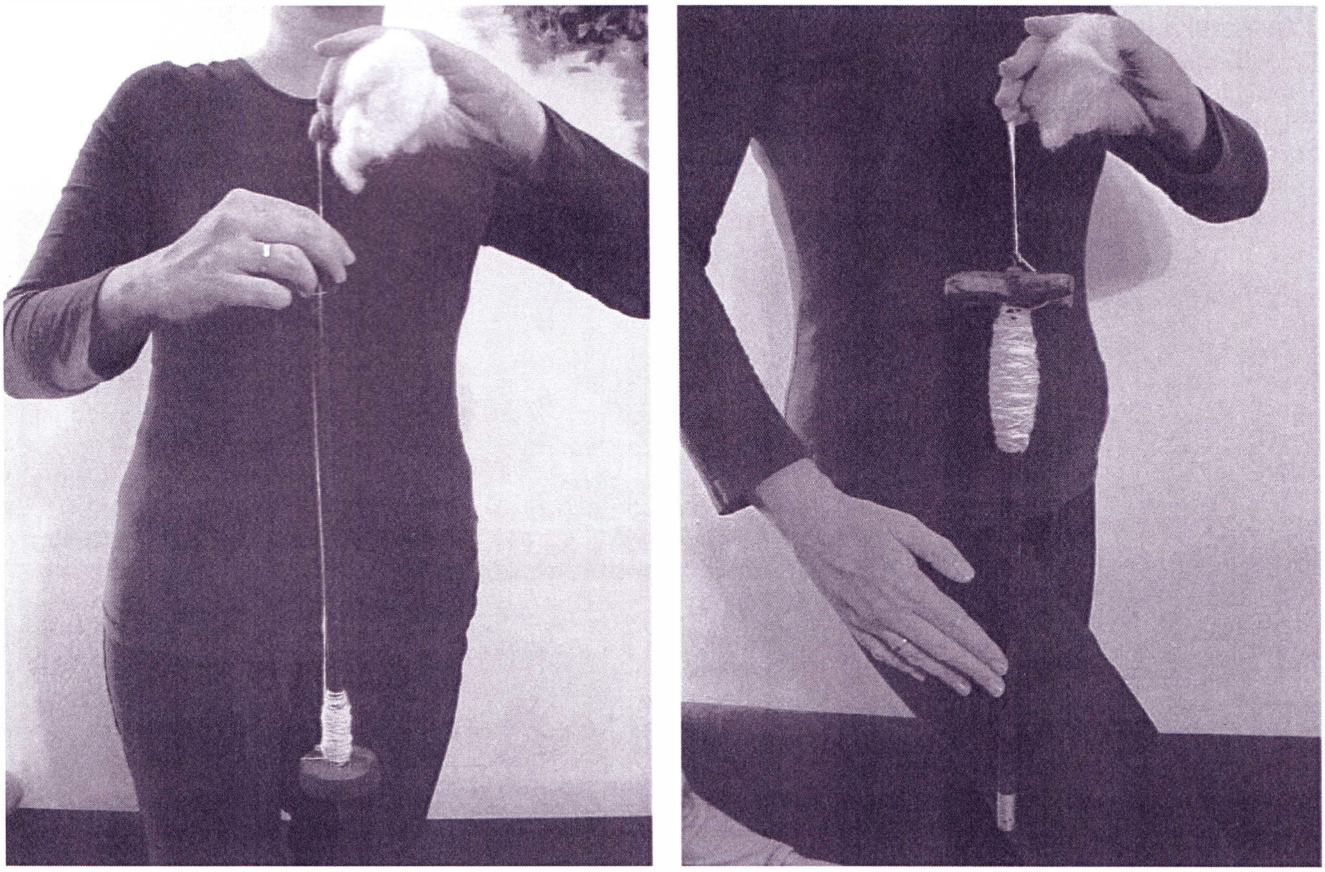

Fig. 4. **Low whorl and high whorl spindle and their use (ethnographic exsamples from Bulgaria and Saudi Arabia). © Karina Grömer.**

and patterns. Even the textile cloth qualities range in the way seen during the Iron Age. The average yarn diameter is about 0.3-0.5 mm, *e.g.* from Schwanenstadt (Hundt 2002).
A different cloth culture can be recognised among the Avars, who entered Eastern Central Europe from the Asian Steppes in the 6th century AD. Here we find a reduced repertoire of weave types. As exemplified by the Avar graveyard Zwölfaxing (Grömer and Müller 2008), we usually have tabby, seldom basket weave and repp. There is linen tabby and wool cloth of finer quality with 0.2-0.3 mm yarn, with coarser ones with yarn diameters of 0.5-0.8 mm yarn being less frequent. In Zwölfaxing, there is a textile with a pattern made with floating threads.

Conclusions
To conclude, in Hallstatt period Austria there is a very creative textile art with different weaves, patterns and cloth qualities. From the Middle La Tène period on (earlier at the site Dürrnberg), the textiles and even tools become more standardised, indicating mass production or serial workshop production. As mentioned above, the written sources indicate that the Allobroges traded textiles with other tribes as well as with the army of Hannibal in the First Punic War. That means that the mass production in this region did not start with the Roman occupation. Rather, when the Romans came, they found these structures in the organisation of textile handcraft in place and used them.
In Roman times, the cloth culture changes little - there are uniform and easily produced weaves like tabby in standardised, but fine qualities. The period sees an introduction of new tools, perhaps in connection with people arriving from the Mediterranean parts of the Roman Empire. Remarkable are textile finds with gold threads and silk, illustrating the new Roman fashion and extensive trade routes.
After the collapse of the Roman Empire, the variety known in the Iron Age textile culture returns. Especially the Germanic tribes like the Alamans or Bavarians used a wide range of textiles, including a wide range of weaves, twill variants, spin patterns, patterns with floating threads etc.
This quick overview of cloth cultures in Austria demonstrates that the history of textile craft is not just a development from simple weave types to

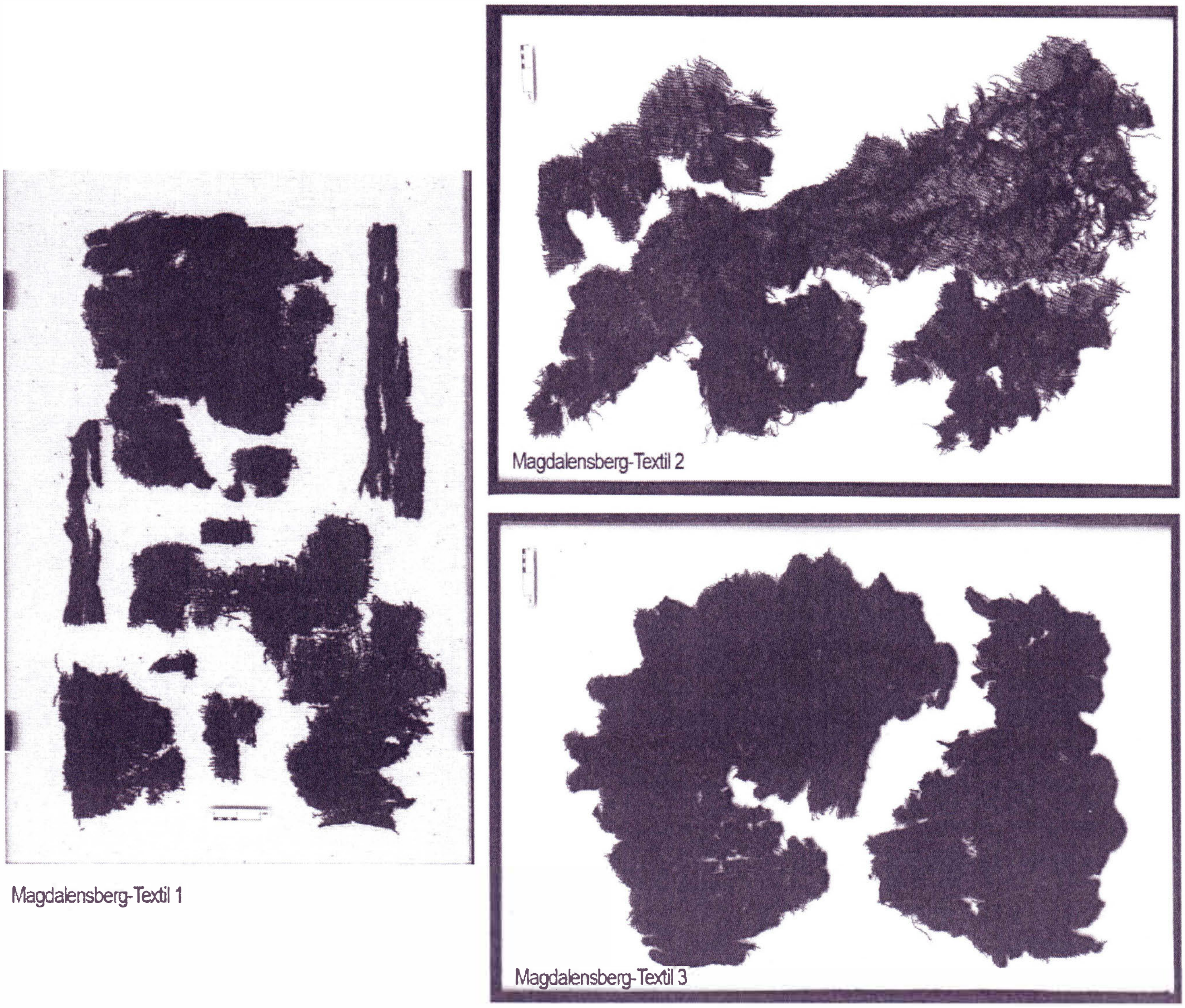

Fig. 5. Textiles from Magdalensberg, Carinthia. © Karina Grömer.

complicated ones. It also follows other dynamics; it is a matter of tradition and innovation, as well as the level of production organisation. It is influenced by the contact between different peoples and cultures. Once the collection of data is completed, the next lines of inquiry will involve the investigation of cloth qualities according to different contexts (graves, settlements, working areas like salt mines) as well as according to gender and age of their wearers (in graves) and according to the function of the objects (clothing, wrappings and shrouds in graves, "recycled" textiles etc.).

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4.5. How to Make a Sassanian Tunic? Understanding Handcraft Skills based on a Find from the Salt Mine in Chehrābād, Iran

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How to Make a Sassanian Tunic: Understanding Handcraft Skills based on a Find from the Salt Mine in Chehrābād, Iran

Karina Grömer[1] – *Abolfazl Aali*[2]

Abstract: How can we understand the people behind the artefacts we find – in our case a tunic dated to 400–600 CE and found in a salt mine in Chehrābād, northern Iran? Applying the concepts of *chaîne opératoire*, we tried to search for the people involved in making the tunic as well as those who used and discarded it. This multi-approach investigation is supported by different analytical tools such as fibre analysis with a Scanning Electron Microscope, analysis of the tailoring patterns as well as use-wear analysis.

The tunic was made of a cotton tabby fabric and tailored in a sophisticated way. As the fabric of the base web is a little irregular and some weaving faults were detected, we tend to assume that the maker of the fabric and the tailor were not the same person. It is also unclear how many users the garment had before it was discarded and left at a salt mine as a rag. Traces of greasy tissue and pilling on the inner side of the tunic show hints of hard physical work, i.e. the garment had been worn during hard labour.

Keywords: Chehrābād salt mine; complete tunic; Sassanian period; spinning; weaving; tailoring; object biography

Introduction

In searching for new perspectives in ancient textile research the workshop focussed on a comparative analysis of textile workers in the Aegean and Near-Eastern world. The aim was to highlight the people involved in textile craft, the technical skills and intellectual knowledge they needed, their gender and social status, labour organisation, working organisation and more.

Methodological Approach

In the following paper we present a case study about a Sassanian tunic found in a salt mine in northern Iran. Analysing this archaeological textile find involves studying the whole *chaîne opératoire*,[3] especially the production steps, but also the use, re-use and discard.[4] Studying the technical details of the textile gives indications about the techniques used, even about technical skills and specific knowledge. After that, we can take a further step and ask about what happened to the garment after its production, i.e., how the finished product was handled in terms of use, re-use and disposal. It is important to understand the people involved, the life history of individual objects in relation to human beings and human behaviour. Besides questions about where things come from and how and who made them. Another focus is on how the item's use changes with age and what happens to it when it reaches the end of its usefulness. Salt mines offer very specific conditions that differ from other archaeological contexts such as graves or settlements. The use, re-use and discarding processes of textiles in the mine even offer insights into the organisation of the salt mine and subsistence strategies.

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[3] Concept introduced by French anthropologists, e.g. Leroi-Gourhan 1993.
[4] See, e.g. Grömer 2016, chap. B, especially fig. 15.

Archaeological Background: Chehrābād Salt Mine

The salt mine of Chehrābād, known as Douzlākh (salt ground), is located 75km north-west of Zanjan and is the oldest salt mine in Iran.[5] Archaeological research started after 1994 when a salt mummy was found. During the excavations, remains of six human mummies and also large numbers of organic material (leather, wood, textiles,[6] human faeces, ropes, etc.) were detected. The 'Chehrābād Saltmummy & Saltmine Exploration Project',[7] an international and interdisciplinary research project, is a cooperative project with the Iranian authorities, with the Miras Farhangi Iran (ICAR) and the Deutsches Bergbau-Museum Bochum/Ruhr University of Bochum, Institute for Archaeological Studies as the main project partners. The aims of the project are to analyse the mining technology and to establish a chronology but also to analyse the social and economic background of individuals involved in the mining activities.

At the salt mine, mining activities took place over a long time span,[8] which began with the Achaemenid period dating from the 6th to the 4th century BCE. This period perhaps ended due to a large-scale catastrophe (429–359 BCE), when parts of the cave collapsed. It is quite likely that salt men 3, 4 and 5 died during this event. With the beginning of the Sassanid era (c. 3rd to 7th century CE), the exploitation of the salt mine resumed and continued until the end of the period. Salt man 1 dates back to between the late Parthian and early Sassanian period and salt men 2 and 6 belong to the late Sassanian period. Mining activities also took place in the Safavid and Qajar periods between the late 17th century and early 20th century CE. To date, the main body of textiles found in the mine belongs to the Achaemenid and Sassanian periods. In the following section there is a specific focus on a complete garment from the Sassanid era.

The Sassanian Tunic

During the excavation season of 2004, a big piece of cloth (Find No. 180) – a tunic (Fig. 1) – was found in Trench C of the salt mine[9]. It was folded and reposed in Sassanian layers and no human remains were recorded in direct context with it. The remains of saltman 6 have been found in some distance in the layers above, but due to layer movements which resulted in the displacement of the mummy, the excavator also discusses, that the tunic might be associated to this saltman. It is also possible that the tunic belonged to another Sassanian miner who had taken off his tunic before the mine collapsed.
The tunic is stored at the Archaeological Museum Zanjan in Iran. As well as the garment, a brown cord was found which might have been used to close the tunic (around the waist?).

The Tunic: Technical Description

The tunic is technically complete; it is just a little torn and some minor parts (such as on the front side, right chest area) are missing. What makes this tunic very interesting are the cut pattern and tailoring details. The garment is composed of eleven parts. The technical details of all parts of the textile are similar so it is supposed that all parts were cut from one big piece of fabric. The base fabric was presumably a piece of 0.54 × 3.30m ready-woven fabric, woven as part of a number of piece goods, which was then cut into the desired pieces and sewn together, so the technical details of the weave are given in summary for all eleven sewn together parts of the tunic[10].

Material identification carried out with a Scanning Electron Microscope[11] proved that the raw material used for the garment is cotton. Even today, the main part of the textile, where there is no dirt,

[5] For general information about the salt mine Chehrābād see Aali et al. 2012; Aali – Stöllner 2015.

[6] Hadian et al. 2012; Grömer et al. 2015a and 2015b.

[7] For more information about the project, funding and project partners see Chehrābād Saltmummy & Saltmine Exploration Project <http://www.saltmen-iran.com/> (last accessed 20 Oct. 2018).

[8] C14 dates see Pollard et al. 2008; Stöllner et al. 2015, 49–52, fig. 48.

[9] Trench C, „locus 3", under the straw layer. See Aali (in prep.), chapter 4.4.7.

[10] Detailed see: Grömer et al. 2015b.

[11] Scanning electron microscope (JEOL, JSM-6610LV) at the Central Research Laboratories, Natural History Museum Vienna.

is of a light beige colour (NCS-Code: S2010-Y30R)[12] so we are able to deduce that the tunic was originally made of natural-white cotton.

The weave of the fabric is simple tabby with 9 and 14 threads per cm in warp and weft, respectively. The weave structure is quite regular and the fabric is not very dense. There are simple side selvedges on two sides of the main fabric and also on the sleeves (the part where the sleeve is attached to the main fabric and on the wrist end). As both selvedges survived, we are able to identify warp and weft. A single yarn, s- and z-spun, is used for both; it is of a rather fine quality with 0.2–0.4mm diameter thread (Tab. 1).

Fig. 1 Chehrābād, Trench C, Sassanian tunic (photo: N. Kanani, Museum Zanjan).

	Warp	Weft
Yarn/plied yarn	yarn	yarn
Twist direction	z	s
Twist angle	35-40 °	35-40 °
Thread thickness	0.4 mm	0.2-0.4 mm
Thread count (threads per cm)	9	14

Tab. 1 Technical details of the Sassanian tunic

The Cord: Technical Data and Context

The cord has a thickness of 7–8mm; brown wool (NCS-Code: S5040-Y20R) was used for plying. To make this cord, four threads, consisting of s-plied yarn, were twisted together to form a z-plied rope (Z4S2z cord) (Fig. 2).

[12] Natural Colour System is used to provide standardised descriptions of textile colours. For the Natural Colour System (NCS) see NCS.

The cord was found in context with the tunic but was torn off and it is not clear where it belonged. The cord itself is knotted together with a simple knot with one loop. The ends after the loop which were intended to be the ‘natural ends’ of the cord have a knot to prevent fraying. The part of the cord that perhaps went around the waist is torn and disintegrating on one end. The other end was knotted to a tabby fabric. This textile has similar characteristics to the main fabric of the tunic, but it is cut into a narrow strip that was sewn together to form a cord-like narrow band; perhaps that fabric band was attached to the garment to hold the cord in place around the waist.

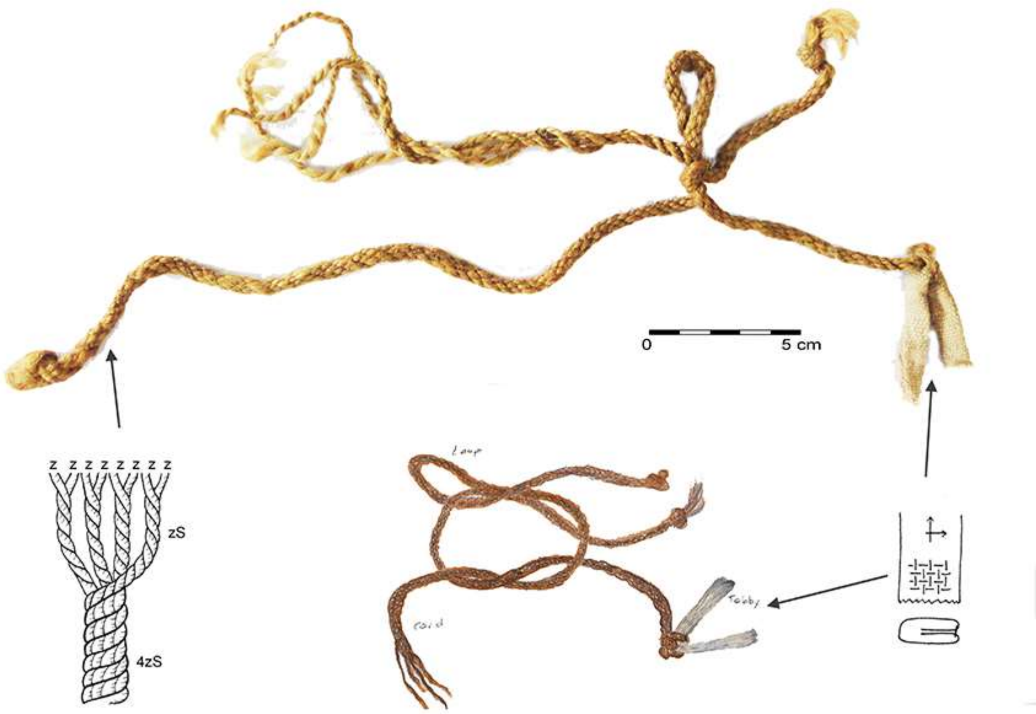

Fig. 2 Chehrābād, Trench C, cord found together with the tunic, below: schematic drawings regarding cord construction, knot and tabby band (photo: N. Kanani; graphics: K. Grömer and N. Alidjani).

People Involved

After the context information and the technical description of the garment, we return to the concept of *chaîne opératoire* and also look at the relationship between this object and the producer(s) and user(s). In nearly all cases, the tunic gives no hint as to the gender and age of the people who made it.

Making the Fabric: The Work of the Spinner and Weaver

People involved in making the fabric can be traced though the various steps of the production process, starting with the raw material and the different steps necessary to produce it: raw material preparation, spinning and weaving.[13] In a Sassanian context, as the tunic dates somewhere between 400 and 600 CE, we can deduce that trade[14] was also involved – trade of both raw material as well as half-finished (e.g. yarn, piece goods) and finished garments.

[13] For a description of the production steps see Grömer 2016, chap. B.
[14] For trade in Ancient Persia see Yajima – Kamioka 1988; Potts 2009. For textile trade for the Roman market see Casson 1989.

Provision of Raw Material

The analysis of the fibres demonstrated that the raw material of the tunic was cotton (Fig. 3). At this stage of the research, we have no information about the provenance of the cotton, so we are unable to make statements about the people involved in cotton harvesting, preparation and possible trade. In general, for the first half of the 1st millennium CE, cotton was an established raw material for garments.[15] Cotton textiles can be found, for example, in Egypt, Iran and as far away as China.[16] Unprocessed cotton, consisting of fibres of raw cotton with seeds, was also found in the Sassanian layers of the Douzlākh salt mine.[17] That cotton could have been imported from regions such as India or Egypt; Boehnke also discusses that the cotton found in the mine 'as part of the miner's equipment could be a hint for the cultivation of cotton in the region, because the import of unprocessed bulky cotton to other regions might have been too expensive.'[18]

Within the project,[19] further analyses on stable isotopes are planned, so that in the future we can get some idea about which region the cotton for the Chehrābād tunic came from.

Fig. 3 Chehrābād, tunic: raw material cotton (microscopic image: K. Grömer).

Spinning

The cotton was then spun into threads with different twist directions. Within the fabric, the warp-threads are z-twisted and the weft is s-twisted. Therefore, we have to ask if just one person made all the yarn (s- and z-yarn with slightly different thread diameter) or if there were more suppliers or porducers of thread. After all, the threads are a more or less balanced yarn with 0.2–0.4mm thread diameter. All of this hints at a practised, skilled handcraft to be able to produce such a thin yarn; in addition, the twist angle is more or less regular at 35–40° which indicates skilled work.

For the warp of this 54cm-wide fabric, c. 490 threads were used (calculation based on 9 threads per cm in warp direction); the fabric in this case is 330cm long, so we can calculate 1,617m of warp yarn at a minimum. We could not count the length of warp fixed on the loom. Depending on the loom type, the warp thrums can be more than 1m per warp thread (in the described case, about 490m of thread). The weft was inserted with a higher thread count than the warp – 14 threads per cm were used. So we know that for a 54cm-wide by 330cm-long fabric c. 2,495m of weft threads were needed at a minimum. The calculations show a total need of c. 4.500m of thread, i.e. 4,5 km of yarn (incl. unwoven warp threads) to make the fabric for the garment! To spin such an amount of thread, a lot of time was needed. Again, we are not sure if one or more persons were involved in spinning, but they were practised and skilled.

[15] Alvarez-Mon 2015.

[16] For Egypt see Falck – Lichtwark 1996, no. 347; for Iran see Vogelsang-Eastwood 2006, 237–238 (site Shar-i Qumis); for China see Wieczorek – Lind 2007, e.g. 217, 240.

[17] Boehnke 2015, fig. 64.

[18] Boehnke 2015, 66.

[19] For isotopic analysis on the salt mummies from Chehrābād and some of the textiles see Ramaroli et al. 2010.

Weaving

The weaver chose a particular yarn to weave the fabric. We do not know whether he or she bought it in the market or if the spinner worked in the same household or workshop. Nevertheless, the yarn was chosen with care; the twist angle between 35 and 40° demonstrates that a stable yarn was needed,[20] one that doesn't break during the weaving process. This twist angle also influences the final weave and therefore the use of the finished fabric. The yarns are not very soft, but durable.

The threads were woven into a simple tabby – in general, this is quite a balanced weave. The weaving itself was carried out with skill, but not very carefully. A lot of weaving faults (Fig. 4) could be detected. Irregularities in warp direction point to the fact that sometimes the shed was not opened fully, causing floats. Also paired yarns can be recognised in the weft direction due to threading errors. Sometimes the paired yarn runs over the full width of the fabric. Perhaps it was not a mistake; it might be the case that if you run out of weft yarn, you will insert a thread next to the old.

In general, the person weaving the garment did not work very carefully, but the overall appearance of the fabric is of quite a fine and regular one and the faults can only be seen upon close inspection.

Fig. 4 Chehrābād, tunic: weaving faults: left: paired yarns in weft; center and right: floating warp threads (DinoLite microscope 50x and 200x) (K. Grömer).

Making the Garment: The Work of the Tailor

It seems as if the tailor and the weaver were not the same person. Here, the decisions made by the tailor are of interest: why had he or she chosen that particular fabric to make a tunic? The thread diameter and density of the weave selected demonstrate that the intended fabric should not be too fine so that it could serve as functional clothing. It is not too warm but also not too cold, stress resistant but not too dense which is good for keeping the body temperature regulated.[21]

Cut pattern

The garment is tailored and cut slim-fit (Fig. 5 and Tab. 2); it is narrow around the waist and below that point on both sides gussets have been added to make it wider around the knees. Additionally, the sides of the gores have been left open to a length of c. 40cm. The sleeves have been attached to the main fabric of the chest region; they are wider in the shoulder area than around the wrist. This was done by inserting a gusset at the armpit (on the back side of the garment). The shape of the neck opening is not quite clear because the garment is torn in that area. On the right side (shoulder region) there is a carefully sewn and hemmed flap attached which served to close the neck opening.

Measurements:
Length of the garment: c. 102cm
Arm length: c. 52cm

[20] To compare the influence of the fibre preparation and spinning on the working process and the final product see Hammarlund 2004.

[21] Watkins – Dunne 2015, 89–98.

Circumference at the wrist: 21cm (right sleeve).
Width at the shoulders: c. 52cm
Width at the waist: c. 52cm
Width at the bottom: c. 87cm
Width of the neck opening: c. 25cm (?); this is unclear because the neck part is torn badly.

Area	Type	Seam allowance	Sewing thread	Stitch distance
around the neck	trimming	3 mm	0.4 mm yarn	5-6 mm
waist area and main fabric/sleeves	top seam	4 mm	0.4 mm yarn	5-6 mm
main fabric/gusstes and sleeve sides	counter hem seam	4 mm	0.4 mm yarn	5-6 mm
garment bottom	hem	4 mm	0.4 mm yarn	5-6 mm
right shoulder	hem	2-3 mm	0.4 mm yarn	5-6 mm

Tab. 2 Chehrābād, tunic: technical details for seams and hems

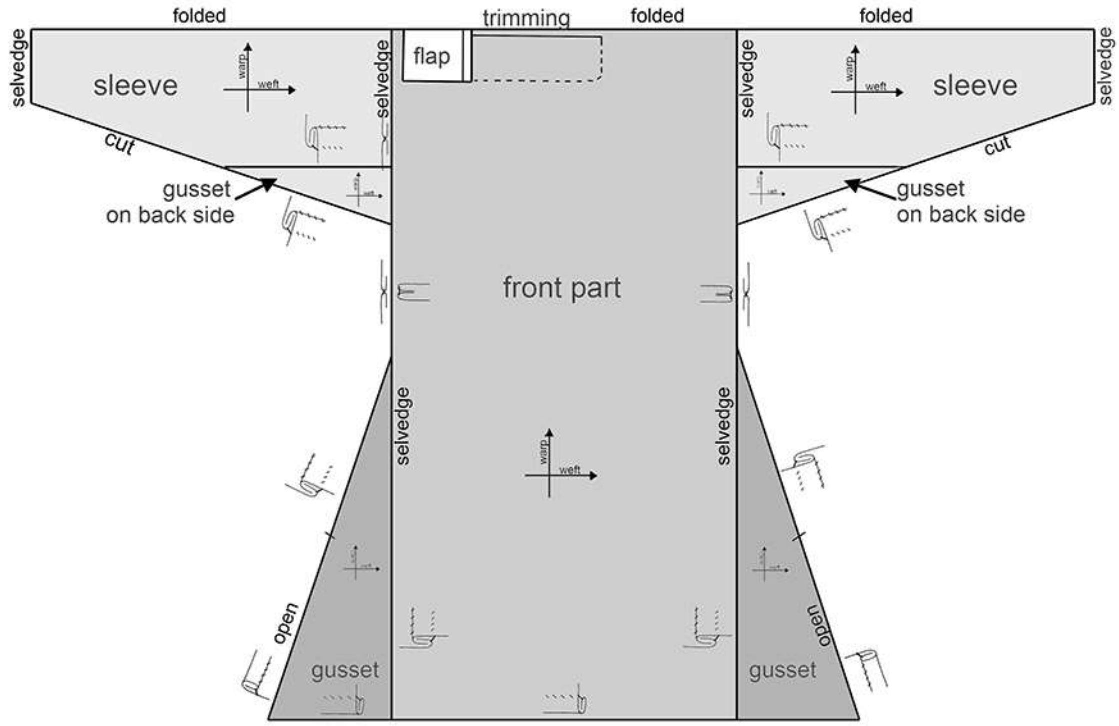

Fig. 5 Chehrābād, tunic: construction of the garment and sewing details (graphics: K. Grömer).

Around the neck a trimming was added (Fig. 6 left), consisting of a minimum 30cm long and c. 3cm wide piece of tabby, which was cut into a narrow strip on the grain of the fabric. This was folded around the cut edge of the fabric to prevent it from fraying. Then it was fixed with tiny stitches that can hardly be seen.

The seams on the waist area and between the sleeves and main fabric were top stitched (Fig. 6 center). The seams between the main fabric and the gussets are counter hem seams. The same counter hem seams were used for the side seams of the sleeves (Fig. 5).

The bottom end of the fabric is hemmed with a hemming stitch. This was done after the gussets were sewn on the sides (Fig. 6 right). The hem runs along the full width of the garment. For the hem, the fabric was folded inwards once (0.4cm) and then sewn with a fine hemming stitch that is not visible from the right side.

The flap on the right shoulder was hemmed at the part in the direction of the chest area. This was done to enlarge the neck opening so that the tunic could be put on. For the hem, the fabric was folded inwards once (0.2–0.3cm) and then sewn with a fine hemming stitch that is not visible from the right side.

Fig. 6 Chehrābād, tunic: details: left: neck opening with trimming and flap; center: gusset at the sleeve, back side; right: gusset at the bottom of the garment (photos: N. Kanani).

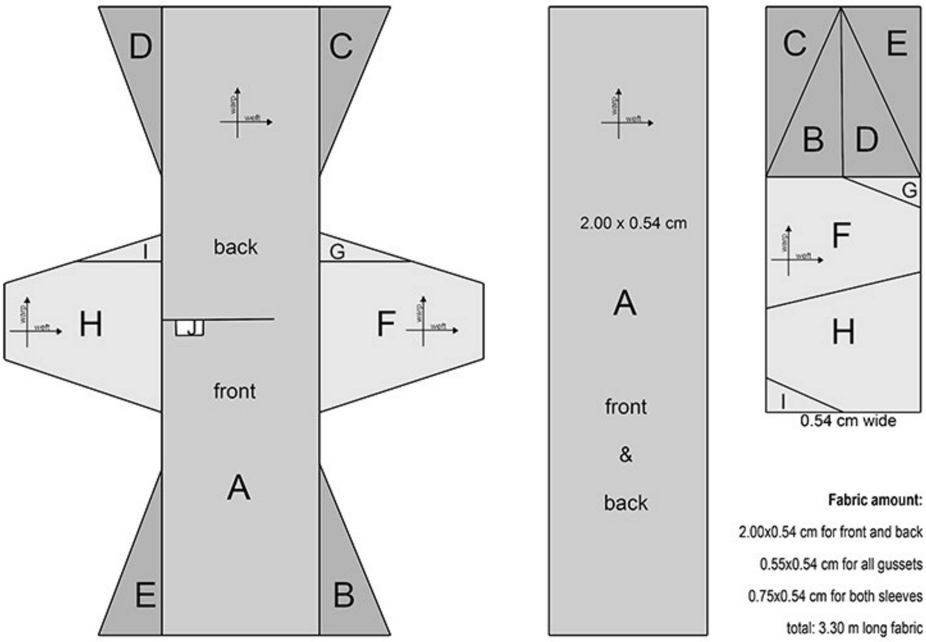

Fig. 7 Chehrābād, tunic: tailor pattern (graphics: K. Grömer).

A detailed analysis of the cut pattern offers some interesting facts: a fabric size of 0.54 x 3.30m in total was needed to make this garment (Fig.7). The garment represents very fine tailoring work; in making this garment a total of eleven tabby pieces were used to put this together: one long piece for the back and front, four triangular pieces for the gussets, two larger pieces and two triangles for the sleeves, one small rectangular piece for the flap on the shoulders and a long narrow strip for the neck trimming.

The tailor's pattern is very elaborate work and the fabric was used in a resource-efficient way. The tailor's overall pattern is a very sophisticated one, appearing to be an 'established' cut pattern. Therefore, we suggest that the tunic is the work of a specialised tailor.

Comparison: Sassanian Artwork and Textile Finds

What kinds of upper garments (focussing on tunics) comparable to the Chehrābād tunic do we know from textile finds and pictorial sources from the first half of the 1st millennium CE in the Near East? The earliest representations of Sassanian male dress date from the 3rd century CE and were found at Fīrūzābād, Naqš-e Rajab and Naqš-e Rostam in Iran. The king, his god and the accompanying courtiers are all clad in heavy, smooth tunics which fall to the knees over trousers.[22] The tunic was worn in slightly different forms throughout the Sassanian period and had a long tradition in Persia and western Asia,[23] e.g. in Palmyra, Syria.[24] Also from Achaemenid times, knee-long and long-sleeved tunics are known, e.g. from the eastern stairway facade at Persepolis.[25]In Sassanian art, there are also knee-length tunics with diagonal closings, which are depicted as a variant of the king's dress, e.g. on the relief of Šāpūr I at Naqš-e Rajab in Iran. The shirt, overlapping in front, was also worn in Parthia and the Kushan Empire in the 2nd and early 3rd centuries CE[26] and appears in early coin portraits in Sassanian Persia.[27] Complete examples of such tunics with diagonal closing in the front and gussets can be found more in the north and north-east of the Persian Empire, e.g. in Pazyryk, Kurgan 5[28] in the Altai Mountains or along the Silk Road in Xinjiang[29] in western China. In their general shape with gussets, they are comparable with the Chehrābād tunic, but our tunic has no front opening.

The main body of complete garments in this area and time period are known from Egypt.[30] They derive from graves and represent the knee-length or ankle-length tunic. Their cut differs from the Chehrābād tunic because the tunics from Egypt are very wide around the chest with cylindrical sleeves and do not have gussets. Among the tunics from Egypt and Syria, the specific shape of the Chehrābād tunic with gussets and truncated sleeves are rarely found, occasionally in children's garments, e.g. from Halebiyeh (Zenobia) in Syria[31] or Akhim (Panopolis) in Egypt.[32] This specific garment shape, which appears between the 3rd and 7th centuries CE, is seen by Annette Paetz gen. Schieck as deriving from the East and might be of Parthian origin.[33]

How the Chehrābād Tunic was used

The question about this object's intended use is more or less easy to answer: it was made to be worn by a person (at work?). But what does it tell us about gender – was it intended to be an upper garment for a male or female? For this, only contemporary pictorial sources would be of use. Here we see that 'normal' garments for a man in the New Persian Empire, in the Sassanian period, were trousers or leggings and a tunic.[34] There is scant evidence of clothing worn by Sassanian women of the lower ranks as most depictions are of queens or deities. Women[35] wore long tunics; veils were appropriate dress only for noblewomen and court musicians and dancers. So we know that the garment was intended to be worn by a man.

The context of the Chehrābād tunic tells us that it ended up as the garment of a miner – the length of the garment points to a male salt mine worker. So far, six mummies have been found in the salt mine, all of them are men. Are we able to deduce that all workers in the mine were of the male sex?

[22] Herrmann 1969, figs. 3–4, pls. II–IV.
[23] See, e.g., Ghirshman 1962, figs. 66, 119.
[24] Colledge 1976, pl. 22.
[25] Takht-e Jamshid, Apadāna. Shahbazi 2012, chapter „Male clothing".
[26] Ghirshman 1962, 86 fig. 98.
[27] Göbl 1971, pls. 2/21; 2/23; 3/36; 3/45.
[28] Late 4th – early 3rd century BCE: Rice 1957, 67, fig. 41, pls. 4, 12.
[29] Wieczorek – Lind 2007, 179, 236–237.
[30] Stauffer 1995; Falck – Lichtwark 1996, e.g., 270–276; Thomas 2016.
[31] Pfister 1951, 11 (cut pattern), nos. 4–6, 10, tabs. III, V.
[32] Thomas 2016, no. 16, figs. 2–4.1.
[33] See Paetz gen. Schieck 2015, 81, fig. 5.
[34] Peck 2012, chapter "Male dress".
[35] Ghirshman 1962, e.g. figs. 106, 181.

Interestingly, the tunic shows no traces of repair; no mending or darning could be detected. This is in contrast, e.g. to the upper garment of salt man 4 from Chehrābād, dating to the Achaemenid Period. On his tunic, numerous marks of darning could be detected, especially on the sleeves or the lower parts of the garment.[36] It seems as if the Sassanian tunic Find No. 180 was not a second-hand garment that was re-used as miners' gear. Perhaps it was made as an efficient working garment for the miner who used it.

Even if there are no traces of mending or darning, we have hints of the intensive use of the garment (Fig. 8). The fabric is soft and flat on the right side (outside: Fig. 8 left), but on the wrong side (inside: Fig. 8 center and right) where it was worn next to the body, there was pilling on the surface. On the inside of the tunic there are also some fatty traces that look like a mixture of sweat, adipose tissue and dirt. Those traces might derive from the person who wore the garment. At this point we are not sure if only one person used the garment or if there were a succession of people who wore the tunic.

Fig. 8 Chehrābād, tunic: surface structure of the chest part outside (left) and inside (center and right) (DinoLite microscope 50x and 200x) (photos: K. Grömer).

The Discarding of the Tunic in the Salt Mine

From the context information it is clear, what happened to the tunic – it was left behind in the salt mine; this part of the mine collapsed in Sassanian times and salt debris buried the tunic until it was recovered by archaeologists in 2004. Unlike other complete preserved garments from the Douzlakh salt mine, the garment was not in connection with a human body[37]; it was not being worn directly by a miner when it was covered by debris (as was the case with the tunic of salt man 4), but it had been taken off. The tunic was found in a torn state, some minor parts were missing – enough for it to no longer be useful as a garment.

Again questions remain: was it taken off because it was torn and then forgotten in the mine, or was it taken into the mine as a rag and, as a secondary function, used for purposes other than clothing? In a similar context, in the two salt mines in Austria[38] (Hallstatt and Dürrnberg, both 1st millennium BCE), there are hints of such recycling of waste textiles. Some pieces of cloth are torn into strips and knotted and, sometimes, two textiles are tied together with a knot. Among the textiles found in the salt mine of Chehrābād some items are knotted.[39]

This particular behaviour sheds an interesting light on the resource management of ancient miners because, as stated before, textile production is very time-consuming and thus expensive. The evidence of targeted recycling of waste textiles shows that textiles were much appreciated and fully exploited until the end of their life.

[36] Saltman 4, Achaemenid period: for general information see Aali – Stöllner 2015, 58, fig. 56; for marks of repair on his upper garment see Grömer et al. 2015a (unpublished report).

[37] Aali – Stöllner 2015.

[38] For Dürrnberg see Stöllner 2005, fig. 12.; for Hallstatt see Grömer 2016, 307–310.

[39] Archive Zanjan Museum unpublished.

Conclusions

The Sassanian tunic found at the Douzlakh salt mine near Chehrābād serves as an interesting example, from which can be gained an understanding of handcraft skills and the people involved both in the production process and the use and discard of the garment (Fig. 9).

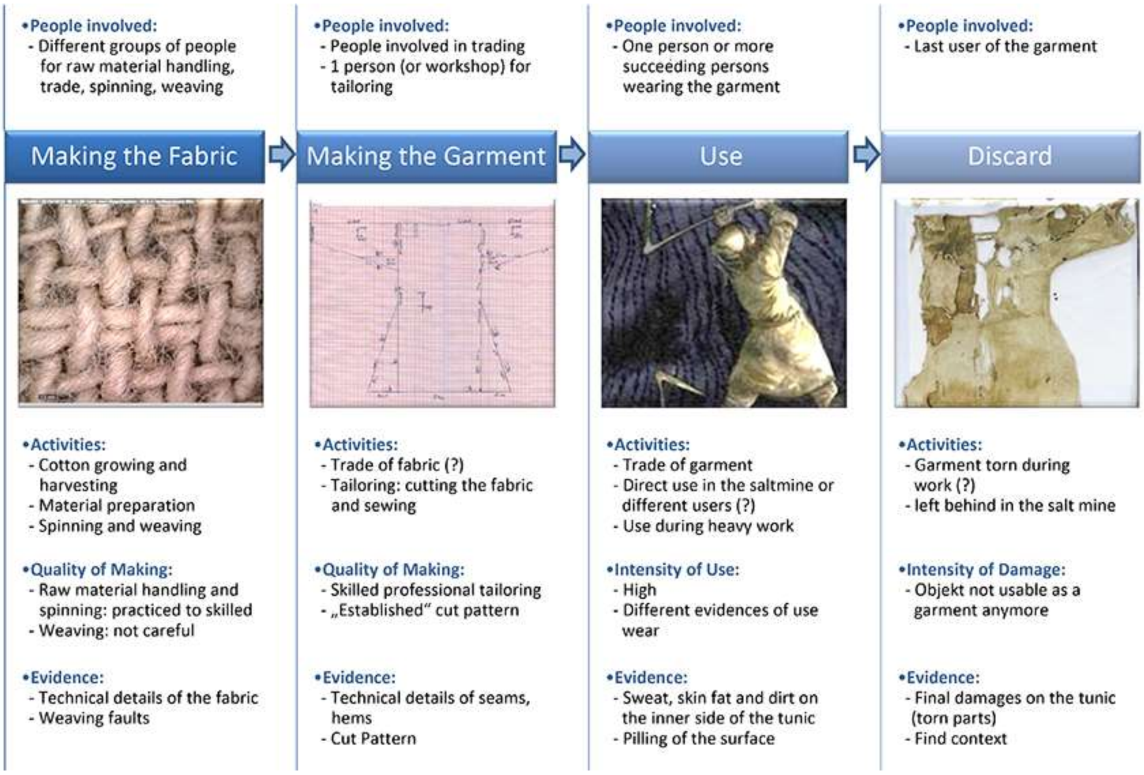

Fig. 9 Object biography of the Sassanian tunic (graphics: K. Grömer).

The degree of skills and technique used in the different activities involved in the making of the garment can be traced by the technical evidence on the fabric, such as the quality of the threads and the weave. It seems as if the spinning was done by one or more persons with skills ranging from practised to expert, while the weaving faults point to a less skilful or perhaps just a less careful textile worker.

In contrast to the weaver's work, the tailor's pattern and the quality of the seams and hems of the whole garment represent examples of specialised tailoring. The person who made this was very experienced and had a specific dressmaking pattern in mind which was perhaps a well-established one at that time. It seems as if a professional tailor has been at work here.

How did the garment then end up in a salt mine in a rural area? Working in a salt mine implies trading activities: there is a commodity produced in this place – salt – that is intended to be used far away. There must have been a lot of connections and transfer of commodities between local, regional and interregional markets and trading places.

Because the tunic was found in the mine, it was unquestionably used as miners' gear. Contemporary pictorial sources demonstrate that a tunic of this shape was a well-established garment type of this period and region and it does not represent a specific working cloth. In the salt mine the garment was used during heavy work, indicated by adipose tissue and dirt as well as use wear such as surface pilling in the chest area. The final damage to the tunic rendered it useless as a garment. Perhaps the garment was torn during work in the mine and discarded where it was. It is also possible that it was brought into the mine as a rag to serve some 'recycling' purpose.

The biographical approach to an archaeological find offers interesting new insights, but there is much more to explore. Isotopic tracing can bring more insights into the origin of the raw material of the item and can present another stepping stone to our understanding of exchange and trade networks. It is the aim to also apply such detailed technical and interdisciplinary analysis to other textiles from Chehrābād.

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5. Economic aspects of textile production

5.1. Textile products, consumers and producers in the Hallstatt Culture

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TEXTILE PRODUCTS, CONSUMERS AND PRODUCERS IN THE HALLSTATT CULTURE

Karina Grömer*

ABSTRACT – *This paper presents an overview of textile production in the Hallstatt Culture. "The people behind", i.e. textile producers and consumers, can be studied using the evidence from the settlements where they lived and worked. Spindle whorls, loom weights and needles found in graves may also indicate that their owners were textile workers, but they also demonstrate their special status. Iconographic sources help us to envision the people involved not only in the production of textiles but also their consumption. Textiles and textile tools can give us a first indication of the level of production, starting from the household production during the Neolithic and Bronze Ages and culminating in the more specialised level of production in the Hallstatt Culture.*

KEYWORDS – Hallstatt Culture, textile production, consumers, producers.

RIASSUNTO – Il presente contributo offre uno sguardo sulla produzione tessile della cultura di Hallstatt. "La gente dietro", cioè i produttori di tessuti e i consumatori, può essere studiata usando le evidenze archeologiche dagli insediamenti in cui vivevano e lavoravano. Le fuseruole, i pesi da telaio e gli aghi trovati nelle tombe possono indicare che i loro proprietari erano coinvolti nella produzione tessile, ma mostrano anche il loro status specifico. Le fonti iconografiche aiutano poi a immaginare le persone coinvolte non solo nella produzione di tessuti ma anche nel loro consumo. I tessuti e gli strumenti tessili possono darci una prima indicazione del livello di produzione, a partire dalla produzione domestica durante il periodo Neolitico e del Bronzo e culminare nel livello più specializzato di produzione nella fase della cultura Hallstatt.

PAROLE CHIAVE – *Cultura di Hallstatt, produzione tessile, consumatori, produttori.*

INTRODUCTION

Research into Iron Age textile production in Central Europe usually focuses on the group of archaeological finds which are most common: textile tools like spindle whorls and loom weights, their context and distribution. Over the last decades, textiles themselves started to appear in academic discussions, as the finds from graves and salt mines are recorded and published more systematically (*e.g.* Banck-Burgess 1999; Belanová-Štolcová 2012; Gleba 2008; Grömer *et alii* 2013; Rast-Eicher 2008). More recently, the importance of looking behind the actual finds to discover the producers and consumers of textiles has been tackled by international research projects such as DressID (Tellenbach 2009) and PROCON (Gleba 2015). This contribution adds to the discussion of the interplay between the textile products, the consumers and the producers by focusing on the Central European Hallstatt Culture.

CONTEXT: THE HALLSTATT CULTURE

The Hallstatt Culture (fig. 1), spreading from France over the Alps to western Hungary, was the predominant Central European culture in the first half of the 1st millennium BC (Carpenter 2010; Koch 2006; Kristiansen 2000). It developed from the Late Bronze Age Urnfield Culture and was followed in much of Central Europe by the La Tène Culture associated with the Celts. It is named for its type site, Hallstatt, a lakeside village in the Austrian Salzkammergut southeast of Salzburg (Kern *et alii* 2009).

There are culturally distinct areas of the Hallstatt Culture (Müller-Scheeßel 2000): The western zone comprises northeast France, northern Switzerland, southern Germany, western Czech Republic and western Austria, whereas the eastern zone is covered by modern eastern Austria, eastern Czech Republic, Slovakia and western Hungary. The approximate division line between the western and eastern zone runs from north to south through central Bohemia and Austria, and then traces the eastern and southern rim of the Alps to eastern and southern Tyrol. The south-eastern part of the Hallstatt Culture (southeast Austria, eastern Slovenia, northern Croatia) in some respects has to be differentiated as well.

The main distinction is in the burial rite and grave goods: in the western zone, members of the elite were buried with a sword (HaC) or a dagger (HaD), while in the eastern zone they were given an axe. The western zone has chariot burials, among which well known are Hochdorf and Vix. In the eastern zone, rich equipment with pottery and tools appear, while in the south-eastern zone, warriors often have an axe and two spears; the richest among them are buried in full armour with helmets, in exceptional cases with swords.

In the phase HaC, between 800-600 BC, inhumation and cremation burials co-occur, whereas in HaD burials, from 600-400 BC, inhumations predominate. In the central Hallstatt regions toward the end of the period, very rich graves of high-status individuals under large tumuli are found near the remains of fortified hilltop settlements.

The Hallstatt Culture settlements are generally situated on hilltops and are fortified. They frequently included bronze workshops, more rarely silver, and gold workshops. Other types of settlements are smaller villages and single farmsteads. In the western zone, proto-urban centres have been identified, such as the Heuneburg on the upper Danube surrounded by 90 still visible very large grave tumuli, including Hohmichele (Fernández-Götz 2015), and Mont Lassois in eastern France near Châtillon-sur-Seine with, at its foot, the very rich grave at Vix (Chaume, Grübel 2004).

In the eastern zone, among the most prominent sites are the fortified hillfort at Smolenice-Molpír in Slovakia (Stegmann-Rajtár 1998), Stična in Slovenia and the settlement at the Burgstallkogel in the central Sulm valley (west of Leibnitz, Austria), which was a major centre during the Hallstatt C period (Dobiat 1990). Parts of a large necropolis, which originally consisted of more than 1,100 tumuli surrounding this settlement have also been excavated.

The site of Hallstatt (Kern *et alii* 2009) holds a particular place as an economic hotspot of its time. Here, the exploitation

Fig. 1 – Map of the Hallstatt Culture and find spots mentioned in the text (map after Wikimedia commons; image: © Grömer-Mrazek).

of the salt mines and salt trade made its population wealthy as demonstrated by the grave goods of ca. 2000 burials excavated at the Hallstatt cemetery. They include many personal goods such as jewellery, large bronze vessels, as well as imported materials and objects such as amber. Unfortunately, the Early Iron Age settlement at Hallstatt has not been identified to date.

The material culture of Hallstatt Culture was apparently sufficient to provide a stable social and economic equilibrium (Fernández-Götz 2015). The early phases saw an influence from the Villanovan Culture of Italy across the Alps. The founding of Massilia (Marseille) and the contact with the Greek and Etruscan cultures after ca. 600 BC, resulted in long-distance trade relationships up the Rhone valley which triggered social and cultural transformations in the Hallstatt settlements north of the Alps. Trade with Greece is attested by finds of Attic black-figure pottery in the elite graves of the late Hallstatt period. It was probably imported via Massilia (Marseille). Other imported luxuries include amber and ivory (Hallstatt: Kern *et alii* 2009, 131-133). Red dye identified in Hochdorf and Hallstatt textiles was imported from the south as well (Hofmann-de Keijzer 2016, fig. 84).

The latter is leading to the topic that is of interest here: textile production in the

Hallstatt Culture. Different sources provide us with information about textile products, about who produced the textiles and for whom. There are numerous textile tools such as spindle whorls or loom weights. They were found in grave as well as in settlement contexts and we can learn a lot about the organisation and sociology of textile production by studying their distribution (see *e.g.* Grömer 2016: 262-290). Other tools like sewing needles are also sometimes identified. Iconography plays a major role in our understanding of textile craft in Central Europe. The Hallstatt Culture has left a variety of iconographic sources (Huth 2003). There are incised anthropomorphic decorations on pottery, mainly in the Eastern Hallstatt zone, while in the Western Hallstatt zone we have monumental statues. The Situla Art (Lucke, Frey 1962; Turk 2005) on the other hand consists of bronze sheet objects such as situlae, belts and weapon scabbards with incised images depicting processions and feasts in which the situlae themselves figure, as well as hunt or war. The Situla Art spread between the 6th and 4th century BC in the Eastern and South-eastern Hallstatt zone. It is seen as a translation and transmission of Greek-derived motifs from the Etruscans throughout the regions to the north to the late Hallstatt Culture and emerging Celts.

In comparison with other finds, the textiles themselves are scarce, but we can find them mineralised on metal objects in graves, where they offer important insights into the quality of cloth as well as burial rites (Banck-Burgess 1999; Belanová-Štolcová 2012; Rast-Eicher 2008). In very rare cases we also have textile remains in settlements or even sanctuaries. For example, textile imprints on pots are known from the settlement Kalenderberg near Mödling in Austria (Grömer 2014: 193), while charred textiles have been found at the sanctuary Býčí skála (Rast-Eicher 1995). A very particular context is the salt mine of Hallstatt, where textiles were left as waste material (Grömer *et alii* 2013). The textiles were used for working in the mine, and some might have been especially made for that purpose (e.g. as clothes), but we find also recycled material from every day life, which was subsequently used in the mine for binding, cleaning etc. (Reschreiter *et alii* 2009: 312-314).

TEXTILE PRODUCTS

The term "textile products" here comprises goods that are of interest for further trade, as gifts, offerings or as dowry. Usually there is a tendency to think that in a Bronze and Iron Age context of Central Europe, textile products of such interest are only the end products, for example the garments. Nevertheless, there are different products of different stages of the *chaîne opératoire* (fig. 2), that could have been used for further trade or even as gift, burial goods or as offering to the gods:

- Half-finished materials: processed fibres, balls of yarn;
- Dyed products: dyed fleece, dyed yarn or dyed cloth;
- Half-finished woven products: raw cloth;
- Finished goods: ready-woven objects and tailored items;

In the following, some Hallstatt period finds will be used to exemplify the different half-finished and finished goods and their use in ritual context as well as for trade and other purposes.

Fig. 2 – Textile production stages, including needed tools and resulting products (Image: K. Grömer).

The Býčí skála Cave (Bull Rock Cave) near Brno in the Czech Republic (Parzinger *et alii* 1995) is one of Europe's most mysterious prehistoric sites. In the Hallstatt period, the cave has been used as a cult place. The cave contained human, animal and material culture offerings: Skeletons of 40 people, a ceremonial chariot, jewelry, weapons, sheet-metal vessels, animal bones and a bronze figure of a bull were discovered there. Among the gifts to the gods were also spindles (from which the spindle whorls survived), basketry, felt and balls of yarn (Rast-Eicher 1995) (fig. 3). The threads of the yarn balls are of 0.5-0.8 mm in diameter, indicating a valuable offering that can be seen in connection with the spindle whorls, which are mostly between 10 g and 40 g weight.

Dyed textiles are not commonly identified in graves, as the mineralised state of the textiles often does not allow dyestuff analysis. The salt mine finds from Hallstatt on the other hand are in an excellent preservation state, and their colours can still be seen and analysed (Hofmann-de Keijzer 2016: 150-163). More than half of the Iron Age textiles from Hallstatt have dye traces. Various dye plants like weld (*Reseda luteola*), or scentless chamomile (*Tripleurospermum indorum*) were used to obtain yellow shades. Red was obtained with madder (*Rubia tinctorum*), but also insect dyes like Polish cochineal (*Porphyrophora polonica*) were identified. For dyeing blue, vat dyes of woad (*Isatis tinctoria*) were used. It is quite difficult to identify examples of trade in dyestuffs, dyed fleece or dyed yarn. The insect dyes are key finds in this respect: Kermes for example was found in textiles from Hochdorf (Walton Rogers 1999) and Glauberg (Balzer *et alii* 2014: 2-8) in Germany. Since kermes is native to the Mediterranean area, either the dye, the dyed yarn or the finished cloth must have been imported. In the case of Hochdorf, the weaving and patterning technique (twill and spin pattern) indicates local production. Therefore, it is the dye itself or dyed yarn that was likely imported.

The finds from the Early Iron Age Hallstatt (Grömer *et alii* 2013, catalogue Iron Age) provide us with a detailed picture of textile qualities and patterns available in the Hallstatt Culture. The

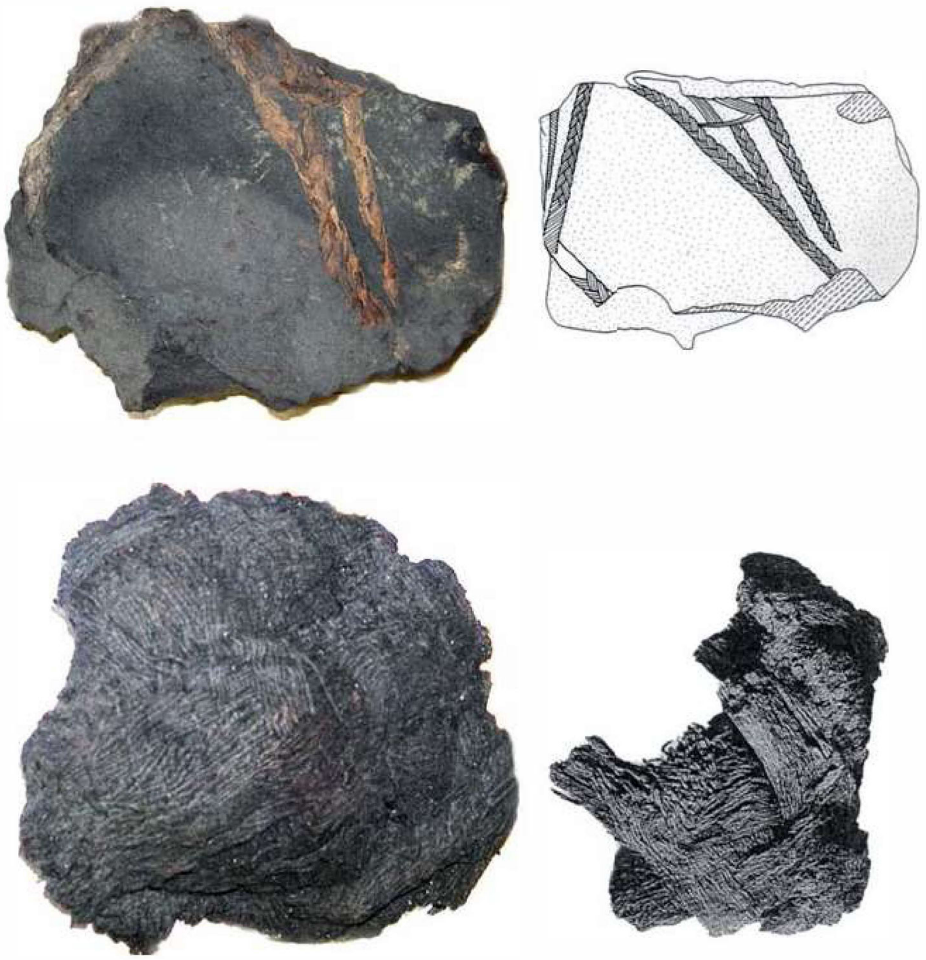

Fig. 3 – Býčí skála, Czech Republic, Early Iron Age: above - felt bundled with braided bast; below - balls of yarn (© Natural History Museum Vienna, photos: A Schumacher).

same types have been identified in contemporary graves of the Hallstatt Culture as well (see Bank-Burgess 1999, catalogue; Belanová-Štolcová 2012, 310-311; Grömer 2014, 192-206; Rast-Eicher 2008, 163-175). There are coarse and fine fabrics as well as different woven structures like simple tabbies, basket weave and twill variants (fig. 4). The fabrics were woven on the warp-weighted loom, with one or more shafts. In terms of patterns we usually identify decoration types that were made during weaving, such as colour stripes and checks of different kinds (fig. 5). Spin patterning, created by using repeated sets of s- and z- twisted yarn to create a striped or chequered tone-on-tone effect, was made while preparing the loom and weaving. For colour effect, Hallstatt populations also used different natural hues of sheep wool, but textiles were dyed as we saw above. Beside the large pieces of cloth, the Hallstatt material also displays decorated bands with chess-board or striped pattern. They are products of band looms, some with a rigid heddle or some other band weaving device. We also know of more complicated ribbons with

Fig. 4 – Hallstatt, Austria, Early Iron Age: different qualities of tabbies, basket weave and twill textiles. All fabrics are at the same scale (1 box = 2x2 cm) (© Natural History Museum Vienna, photos: A. Rausch).

Fig. 5 – Hallstatt, Austria, Early Iron Age: repp bands, tablet woven borders and striped and checkered large fabrics. All fabrics are on the same scale (small box = 2x2 cm) (© Natural History Museum Vienna, photos: A. Rausch).

meanders, triangles and filled lozenges, made by tablet weaving. Textiles from elite burials such as Hochdorf demonstrate particularly complicated tablet woven bands, decorated with swastika and different types of lozenges (Banck-Burgess 2012, 34-35, 52-53; Raeder Knudsen 1999). Many of these woven textile products could have been used by the producer for further processing or they served as trade goods, gifts or offerings.

Complete finds of finished products, particularly tailored items are rare in Central European Iron Age. In the Riesenferner glacier (Vedretta di Ries) at the Austrian/Italian border, complete pieces of clothing have been found at an altitude of 2.850 m in the Alps (Bazzanella *et alii* 2005). It is unclear, why these items were left behind in the mountains. The complementary articles of clothing comprise two pairs of wool leggings, a pair of wool inner shoes and many leather fragments which were probably the outer shoes. The radiocarbon dates place the textiles between the beginning of the 8th and the 5th century BC. The pass where these items were found is of great historical and geographical relevance for the exchange between north Italy and the Danube basin, along which important European east-west trading routes were established at least since the Neolithic.

Further hints for sewn items can be found in the Hallstatt salt mine (Rösel-Mautendorfer 2013), where many textiles with different kinds of seams and hems have been found. Since all of them are fragmentary, it is impossible to reconstruct the appearance of the complete objects. Nevertheless, the number of seams on Iron Age Hallstatt textiles shows that these garments were composed of separate pieces of fabric, which sometimes were even of a different weave type or colour. It is difficult to say to what extent this type of design represents a regional fashion. Some design features such as added borders and diagonal and curved hems seem to be an established characteristic, as they are also visible on images of the Situla Art (Rösel-Mautendorfer 2016: fig. 132).

In an overview of what textile products were used for, Margarita Gleba (2014) lists examples from ancient Greek, Etruscan and Roman cultures. There, clothes and other textile products served as traded commodities, gifts, dedications, elements of dowry, prizes, ransom and booty. Concerning the production of textiles as prestige goods destined for the elites, the finds from Verucchio especially the depictions on the wooden throne the Tomba del Trono (end of the 8th century BC) have to be mentioned (see von Eles 2002: 235-237). In the ancient Mediterranean, examples for textiles as gifts, dowry, trade goods etc. are also provided by the written sources (see *e.g.* Wagner-Hasel 2006: 257-269). In the case of the more or less contemporary Hallstatt Culture, the written evidence is lacking but textiles were certainly used as prestige goods for gift exchange between elites and offerings to the gods.

Situla Art provides images of sport activities such as chariot races or boxing, where the prizes for the winner include not only a precious bronze vessels, but sometimes also textiles (*e.g.* situla Este-Benvenuti and Providence: Eibner 2015: Taf. 5,h-l). This custom likely derives from the Mediterranean area. On the bucchero olpe from Tomb 2 at San Paolo in Cerveteri, dated to ca. 630 BC, a large cloth is depicted as such a prize (Rizzo 2001: 170-71).

CONSUMERS

While we are able to trace the textile products, it is much more challenging to attribute these products and textile types to specific consumers within the society of the Hallstatt Culture. The social system of the Hallstatt Culture was hierarchical. Iron Age elites at the top of the social pyramid tried to imitate the Mediterranean way of life by importing Greek household and luxury goods. Power and control over natural resources were concentrated in the hands of a few large families. As noted in the introduction, sumptuous burials in large mounds and large residences with fortifications were used for displaying status and prestige (Fernández-Götz 2015). For the elites, large burial mounds with stone chambers were erected within view of the princely settlements. In the Western zone of the Hallstatt Culture the dead were laid out on a four-wheeled wagon in the elite burials. Among these are the well-known princely tombs of Hohmichele and Hochdorf in Southern Germany and Mitterkirchen in Austria. It is easy to identify consumers of high quality textiles here, as they actually survive attached on the metal items (e.g. in Mitterkirchen: Grömer 2014: 198-200, Taf. 7). At Glauberg (Balzer, *et alii* 2014), Hohmichele (Hundt 1962) and Hochdorf (Banck-Burgess 1999), the textile finds are of high quality, have complex patterns and are decorated using imported precious dyestuffs (Hofmann-de Keijzer 2016: fig. 84). These finds provide us with information about the textiles used by the elites and we may assume that they were not only used for burial rites, but also during lifetime and for representation.

It is more difficult to specify the textile products used by the other parts of the population – beyond the elites. Some contemporary images of textiles and garments might be of help. The most detailed images of dressed persons are displayed by the Situla Art. It is thought that, through the medium of Situla Art, the elite of the society wanted to represent themselves. The depictions thus show the garments of the upper class people but also other, "serving" persons can be seen, as for example on the situlae from Vače in Slovenia (Turk 2005: fig. 52) and Kuffarn in Austria (Lucke, Frey 1962) (fig. 6). The types of cloth that can be identified do not differ much between the personages identified as "lords" and "servants". In the case of the Kuffarn situla, checkered pattern was used for everyone's clothing. The question arises whether the depicted garments and cloth types reflect Iron Age reality at all. However, there appear to be some connections between items used by the people in the Hallstatt zone and the items depicted. If we compare for example the head covers on the situlae with those found in the salt mines, we see that they are of the same types (Grömer 2016: fig. 230). The checkered patterns on the fabric and borders are also known from the salt mine Hallstatt (fig. 5). This is also the case with other items depicted, for example the vessels, tools or weapons: very similar shapes can be found in graves. So it appears that the garments and textile types depicted have their counterparts in real life.

Hallstatt salt mine is not an elite context like the princely graves and central settlements of the Western Hallstatt zone, but the site likely had a wealthy population (Kern *et alii* 2009). The salt trade made this place and its inhabitants an economic hotspot of its time. The textile qualities in the Hallstatt graves are comparable to those found in the salt mine. Maybe the

Fig. 6 – Kuffarn, Austria, 500-400 BC: Images on the situla (© Natural History Museum Vienna, photo: A Schumacher).

Fig. 7 – Reconstruction of Hallstatt clothing on the basis of grave and salt mine finds from Hallstatt (© Natural History Museum Vienna, photos: 7reasons).

costumes in Hallstatt looked like the dress depicted on the Situla Art (fig. 7).

Only burial finds allow us to know what kinds of fabrics were used by specific people (see *e.g.* Rast-Eicher 2008), or deduce what was important for the burial rites and what demonstrated the status of the families. A grave at Oberndorf in der Ebene dated to the beginning of the 4th century BC (Ramsl and Grömer in print) may serve as an example: simple tabbies were found on the back of the belts, therefore we can surmise that in the cases of poorer graves with few metal items a belted tabby garment was used.

Grave finds thus allow us to look at textiles consumed by the different strata of Hallstatt Culture society. However, if we look at the burials of the East and West Hallstatt Area in total, we can only get at this information about textiles in the cases of burials which include metal objects among the personal and grave furnishings. We do not have any idea about the garments of the poor part of the population, who had no metal items in their graves.

PRODUCERS

It is even more challenging to get information about the producers of the textiles and the places where they lived and worked. In the Early Iron Age graves of the Eastern Hallstatt zone, spindle whorls and loom weights are usually grave goods for women (examples in Grömer 2016: 270-273). Sometimes, we also have tool sets, as for example in the rich woman's grave A014 at Statzendorf (Rebay 2006: plate 14), where there are six spindle whorls, knives and a needle box (fig. 8). Iconographic sources also emphasize women carrying out textile work: The best known are from Sopron in the area of Hallstatt Culture (Eibner 1980: pl. 224-236), and from Bologna (Morigi Govi 1971) and Verucchio (Von Eles 2002, 235-237) in the Villanovan northern Italy. The tasks depicted are spinning, warping of the loom and weaving (fig. 9).

Nevertheless, using archaeological record from the graves and the depictions we can only be sure that spinning and weaving were done by women in the Hallstatt and Villanovan Cultures. We do not know who was occupied with the raw material management such as sheep breeding, flax harvesting or flax processing. We also do not know who was responsible for the post-preparation like dyeing, embellishment or sewing. The latter production steps might sometimes appear in graves in the form of knives, shears or needles, but they are found in both men's and women's graves (*e.g.* Rast-Eicher 2008, 156). We hence cannot associate these activities with specific gender. In the case of dyeing we have not even been able to identify specific tools in the area of the Hallstatt Culture.

Archaeological excavations of Iron Age settlements provide some hints as to where textile producers lived and worked. At nearly every settlement in the Hallstatt Culture area textile tools have been found (Grömer 2016: 280-288). Occasionally, there are specific situations like at the hillfort Smolenice-Molpír in Slovakia dated between the second half of 7th and beginning 6th centuries BC (Belanová-Štolcová 2012: 311-312). In this settlement more than 2,300 textile tools have been recorded, most of them spindle whorls, but also 200 loom weights. The finds indicate that Smolenice played the significant role as textile production centre in the Eastern Hallstatt Culture.

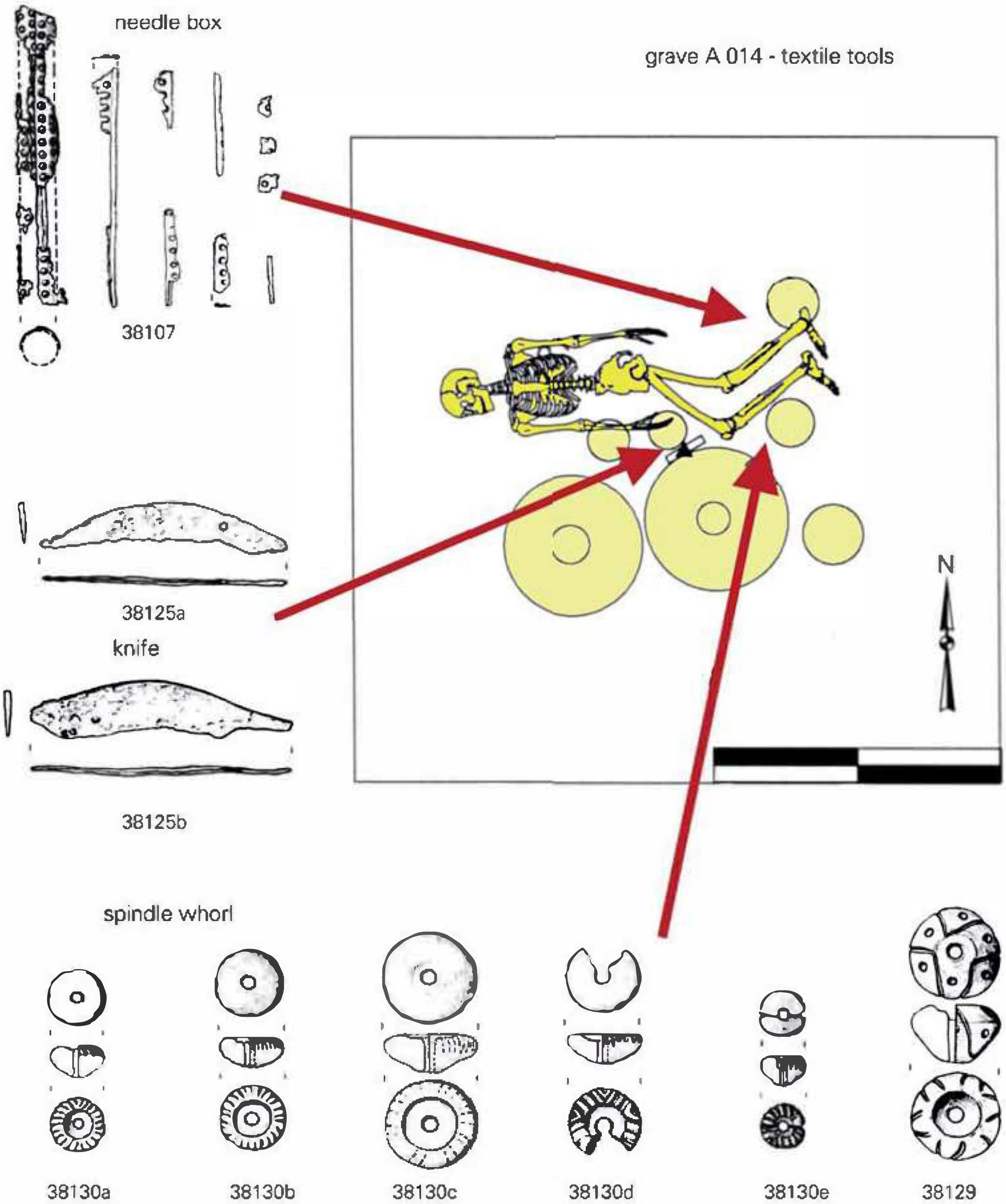

Fig. 8 – Statzendorf, Austria, 800-600 BC: textile-related artefacts from grave A014 (after Rebay 2006).

Considering all sources of textile production in the Hallstatt Culture, it is possible to make some observations about the organisation of textile craft, particularly whether we can consider only household production or more complex and specialised modes of production.

One definition of household's production is as following: The production more or less covers the household's own needs; the

Fig. 9 – Sopron, Hungary, 800-600 BC: Spinning and weaving women (© Natural History Museum Vienna, photo: A Schumacher).

knowledge and skills to do that are wide spread; the raw materials are commonly accessible (Andersson 2003: fig. 1). It is feasible, that household production was the production mode for a part of Iron Age textile production, especially in smaller villages and for the needs of the not so wealthy parts of society.

On the other hand, some of the textiles from the elite burials indicate specialist production. Precious materials like insect dyes used to obtain red shades (*e.g.* see list in Hofmann-de Keijzer 2016: fig. 84) were likely not available to everyone. Tablet weaving of complicated patterns might also have been a specialist technique. It should also be noted that very fine textile qualities require a lot of skill and time to produce, which might not be possible just in household work. Such, for example, are textiles with about 30-40 threads per cm, woven in fine basket weave or herringbone twill, as known from the salt mine Hallstatt, brought in as re-used good (Grömer *et alii* 2013: *e.g.* 330 (HallTex 12); 367 (HallTex 51), 552 (HallTex 278).

Specialist production can have different aspects. In terms of time involvement, specialisation can be carried out as full-time, part time or seasonal (Costin 1991: 4-43). Specialisation may include individuals, groups of people, villages or regions. These may provide special products of particular raw materials, local traditions or manual skills. Cathy Costin (2015: 1) also sees specialised production as "labour used to produce goods for extra-household exchange." Eva Andersson (2003: fig. 1) furthermore describes specialist production as following: "The production of better high quality products (as desirable gifts); craftsmen are supported by and dependent on a patron; the control of skills add to the power and status of the patrons. Goods produced in this way can also serve as precious gifts or for exchange."

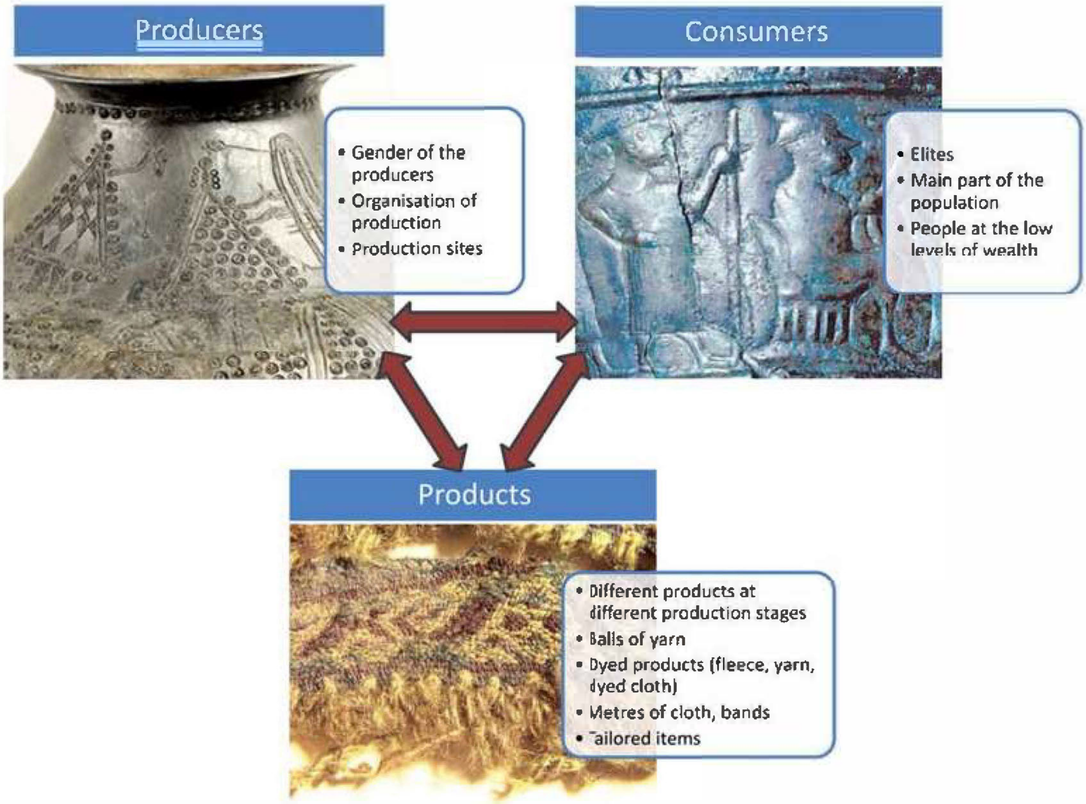

Fig. 10 – Producers – Consumers – Products (Image: K. Grömer).

If we follow the latter definition of specialist work and assume presence of a patron, for whom such specialist products were made, we might identify such patrons in the Hallstatt elite like the man buried in the Hochdorf grave. Were the women with many spindle whorls in their graves (*e.g.* Statzendorf) such specialists? Without written sources we can not be sure about that.

CONCLUSION

Material culture studies focusing on textile production in the Hallstatt Culture enable us to get a multi-focus insight thanks to the different sources of evidence available. We know textile tools from graves and settlements, as well as iconographic sources and textile finds. Different types of textile products have been made and distributed in the first half of the 1st millennium BC, e.g. balls of yarn, raw cloth and also half-finished goods such as ready-woven cloth and tailored items. Textiles from the Hallstatt Culture are quite diverse in terms of their visual aspects, dyes, patterns and even weaving techniques, which have been used in various ways to provide the consumers with a variety of textile qualities.

From grave finds, but also from pictorial sources we get an idea especially about the higher strata of the society, who have been the consumers of high quality textile products of the Hallstatt Culture. Without written sources, however, it is difficult to trace the habits of textile consumption of all strata of society, especially the poorer ones.

Textile production can be studied by means of textile tool distribution in settlements as well as in graves, which give us an idea about the identities of the producers. Also the level of production can be discussed: following the arguments above, there are indications of household production as well as specialist production for elites. In the Hallstatt Culture we consider an interesting interplay between the textile producers, their products and the consumers of the later (fig. 10). In household production these elements are related, but for specialist production, gift exchange or trade, the production, the products but also the consumption of items reach a higher level. The textile products of the Hallstatt Culture played an important role in the self-representation of the elites (Grömer 2016, 438-443). This can be observed in the textiles like those from Hochdorf, but also in the Situla Art. This phenomenon is well known from contemporary ancient Greece (Wagner-Hasel 2000: 152-163; 2006: 257-269) and Italy (see Gleba in this volume) where definition and the visualisation of social status was achieved through textiles and clothing. Textiles and garments have been an important factor in how a person was perceived. The Greek epics attest that the visual potency of a person's "*charis*" was also tied to their clothing.

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5.2. Discovering the People behind the Textiles: Iron Age Textile Producers and their Products in Austria

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3. Discovering the People behind the Textiles: Iron Age Textile Producers and their Products in Austria

Karina Grömer

Introduction

Textile production constituted an essential part of prehistoric life and was locked into the system of society at every level – social, economic and even religious. In order to build up a picture of the world of textiles in the prehistoric period, all small items of evidence from archaeological excavations have to be put together as in a puzzle. It is a delightful challenge to create a hypothesis about 'the people behind the textiles', i.e. textile producers. In this chapter, we deal with the Iron Age in Austria (Urban 2000, 225–370), which is divided into the Early Iron Age or Hallstatt period (800–450 BC) and the Late Iron Age or La Tène period (450–15 BC), associated with the Celtic Culture. Prehistory in the territory of modern Austria ends with the occupation by the Romans in 15 BC.

Evidence

In order to obtain an overview of Iron Age textile craft in Austria, we first have to deal with the different sources of evidence available.[1] Highly important sources are the textiles themselves, but also the various textile tools. From settlements we have information about workshops and workplaces. The craft workers, the producers of the textiles, appear in the graves and even on items of contemporary art. Regrettably, we do not have any relevant written sources for Iron Age Austria. Thus, we do not know the names of the people, their products or their professions. All the different sources offer various kinds of information, but also hold methodological problems which need to be addressed.

Textiles and Raw Materials

Cloth survives poorly in most of Europe because of the destructive effects of alternating wet and dry weather. In Iron Age Austria, however, we have the fortuitous

[1] For places mentioned in the text, See Map II.

circumstances of the textiles being preserved in excellent condition in the salt mines of Hallstatt and Dürrnberg (Fig. 3.1). Additionally, there are mineralised textiles in graves, which survived as corrosion products on metal jewellery or grave goods. The technological details of the textiles are crucial for understanding their production. All in all, about 1000 Iron Age textiles survive in Austria, most of which originate from the salt mines of Hallstatt and Dürrnberg (Grömer 2012).

For any interpretation of the material, it has to be kept in mind that we merely know of a tiny part of the textiles that existed in prehistory. Those fragments survived under specific conditions and belong to different archaeological contexts such as salt mines or graves. Additionally, the textiles served different purposes, which means that the extant items are far from being representative of the Iron Age textiles.

The raw material of woven textiles can be analysed from the existing cloth itself, but it can also be deduced indirectly from archaeobotanical and archaeozoological evidence in settlements (e.g. Belanová-Štolcová and Grömer 2010). Yet here, too, one must be cautious, because the evidence of, e.g. sheep or flax in a settlement is not complete proof that wool or linen textiles were produced there. Sheep were also kept for milk and dairy products as well as for meat. Different types of production can be ascertained on the basis of osteological evidence, in particular the slaughter patterns. The presence of older ewes and weathers is generally considered to indicate the production of wool. Flax can be utilised for the production of oil as well as for textile fibre. The archaeological evidence to determine the different uses is difficult to obtain.

Textile Tools

Various textile tools were made of clay, bone, stone or metal and so they are well known from different Iron Age sites, both settlements and graves (Belanová-Štolcová and Grömer 2010). These include spindle whorls, loom weights, distaffs, needles, shears, spools etc. However, certain tools were made of perishable organic materials such as wooden weaving swords, weft beaters, loom frames, heddle rods, tablets, spindles and

Fig. 3.1. Hallstatt, Upper Austria: organically preserved textile from the salt mine, left, and mineralised textile adhering to a bronze artefact from the graveyard, right. (© Natural History Museum Vienna, Prehistoric Department).

distaffs. This signifies that, even when textile tools appear to be common artefacts in the Iron Age, we only find the durable tools of selected activities such as spinning and weaving. There are, furthermore, many stages in the work-flow of textile production, which are done manually or with tools that we do not recover at all, or do so rarely, e.g. plucking wool, carding or dyeing (Grömer 2010, fig. 12). Modern excavations and analysis of settlements provide a great deal of information about where ancient people lived and worked. Together with the tools, we have archaeological evidence of workshops and places of work within the organisation of the settlements.

Burials

Burials and cemeteries are an important source of information about topics such as the chronological and regional distribution of artefacts, questions about gendered funerary gift assemblages or the social status of a person within a particular society. In special cases, we even find textiles in the graves, where they served different purposes such as parts of a garment, shrouds or even wrappings of grave goods. An excellent example for this is offered by the analysis of the princely tomb of Hochdorf by Johanna Banck-Burgess (1999).

When we concentrate on the Iron Age grave goods from Austria, the archaeological record holds evidence of spindle whorls, loom weights, needles and, sometimes, shears (from the La Tène period onwards) and knives in the burials. During the Hallstatt period, spindle whorls were typical artefacts in women's graves (e.g. Statzendorf: Rebay 2006). Yet, what does this signify (cf. e.g. Primas 2007, Eibner 1986, Gleba 2008, 171–174)? Does the presence of a spindle whorl in a grave indicate that this individual was involved in the craft of spinning, while others were not? In a prehistoric society, a whorl can be a symbol of a specific status – purely a symbol for womanhood in general (cf. Gleba in this volume) – or of a specific high or low status (depending on the number of spindle whorls). Perhaps the spindles deposed in graves do not reflect the daily reality, but have a ritual or religious significance, as can be suggested in the case of the depictions of textile workers.

Iconography

Iron Age art offers a more or less detailed impression of people, their garments, weapons and tools. Various activities, scenes and sometimes picture stories are depicted especially on Hallstatt period pottery (Dobiat 1982) and in Situla Art (Figs 3.2 and 3.7) (Turk 2005). The latter is an artistic style of the Late Hallstatt and Early La Tène periods (between 700–400/300 BC), which is known primarily in Alpine Austria, Slovenia and northern Italy. Examples of Situla Art are common to the (South-) Eastern Hallstatt Culture, as well as to the Palaeovenetic Culture of Este and the Villanovan Culture of Bologna. Objects of bronze sheet – vessels called *situlae*, lids, girdles, scabbards – were decorated with figural scenes illustrating the life of the Iron Age nobility. It is highly remarkable that the Situla Art and Early Iron Age pottery display scenes of feasting, horse riding, hunting, music-making, drinking – and textile

Fig. 3.2. Situla of Kuffarn, Lower Austria, Early La Tène period. (© Natural History Museum Vienna, Prehistoric Department).

work! There are no illustrations of a bronze smith, a wood worker or a potter whose products were as equally important in daily life as textiles.

Textile production is shown on the "urn" from Sopron (see Fig. 3.3), as well as the pendant of Bologna and the throne from Verucchio, Tomba del Trono (Morigi Govi 1971; Eibner 1986, cf. Gleba 2008, 28–30). There are more or less detailed depictions

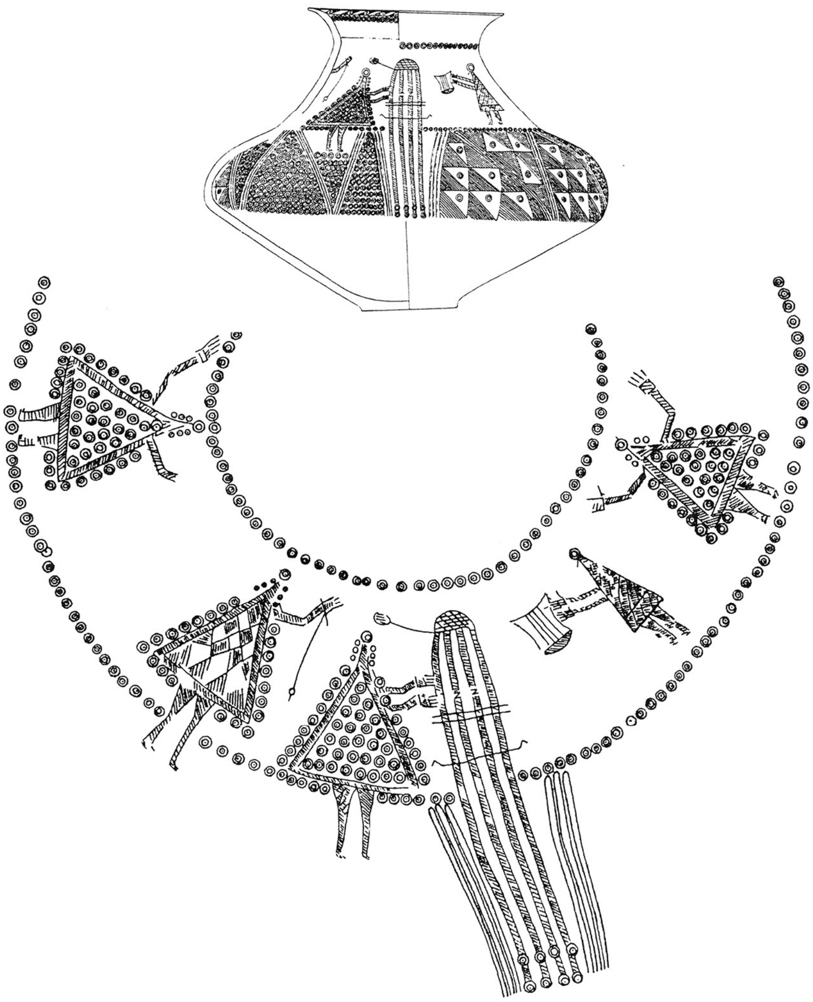


Fig. 3.3. Sopron, Western Hungary, tumulus 27: scene with women spinning and weaving, Hallstatt period. (After Eibner 1986, Taf. 1).

of various stages of production: spinning, warping, weaving. And, what is important in this case: only women are depicted being involved in the textile work.

Textile Production – Work Flow and Weaving Techniques in the Iron Age

The basic facts of textile production in the Iron Age can be deduced from the tools and the textiles. Textile production encompassed many different stages from preparing the raw material and spinning to weaving, finishing and sewing (Fig. 3.4; Grömer 2010, 43–220). For all these activities, various resources, tools and spaces are needed, such as

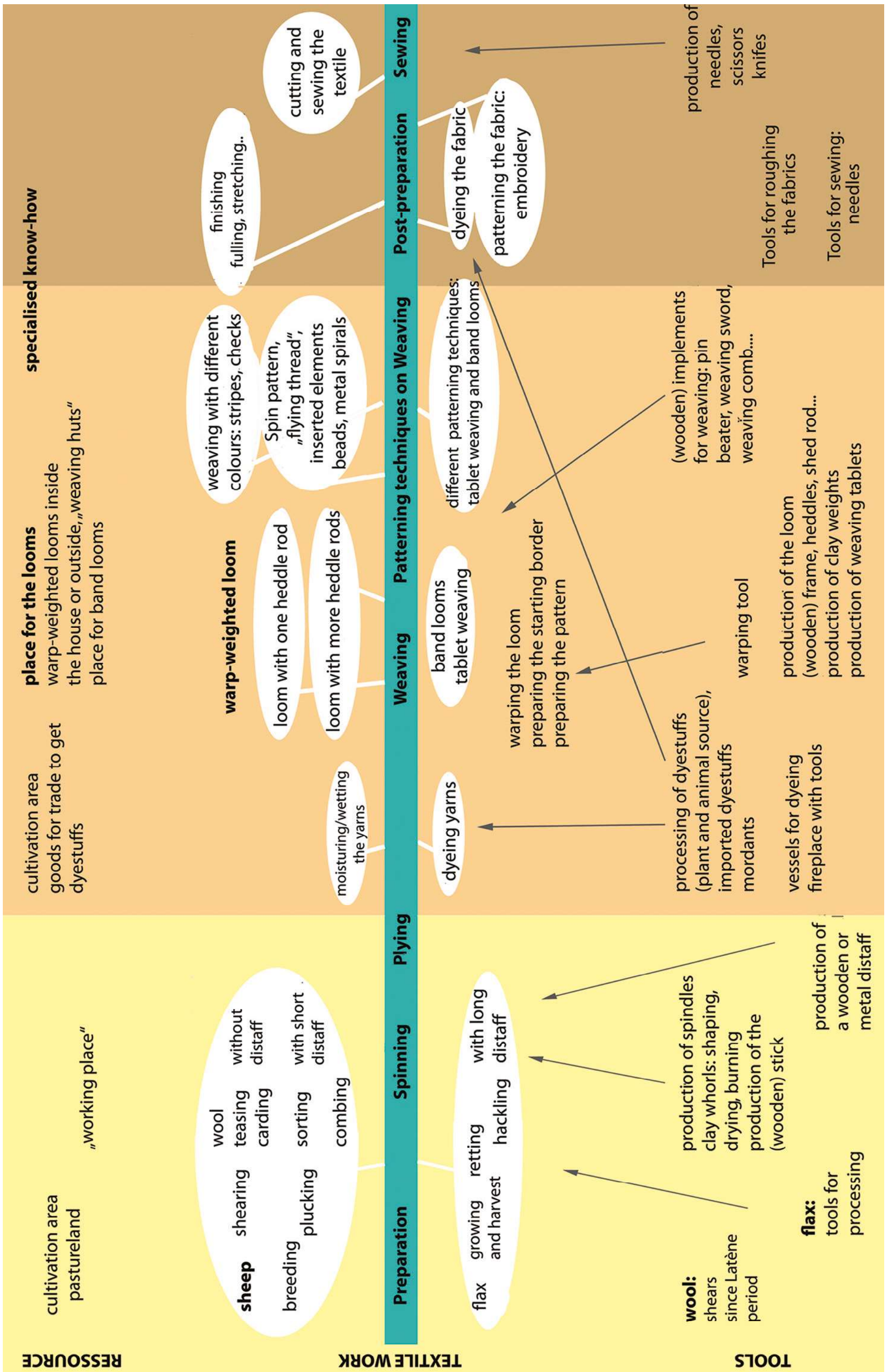


Fig. 3.4. Work-flow of textile production. (© Karina Grömer).

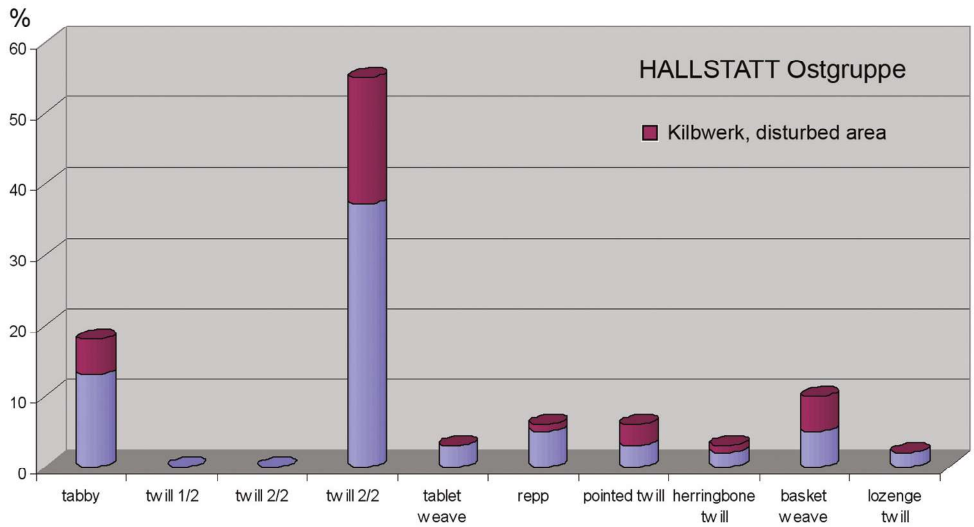
cultivation areas, places for looms or just a space somewhere to do a specific job of work. For some of these production stages, specialised know-how is required (Belanová-Štolcová and Grömer 2010).

For the Iron Age, we have many indications that the warp-weighted loom was perhaps the most common implement for creating a large piece of cloth. This type of loom can be traced by the presence of starting borders on the textiles from the Hallstatt salt mines (Grömer 2005), and from loom weights found in settlements and even in graves. These loom weights (which kept the warp threads taut on the loom) were made of less perishable clay, although most of the loom was composed of wood. It is noteworthy that, during the La Tène period in Austria, the number of loom weights decreases and therefore perhaps another loom type may have come into use (cf. Stöllner 2005). Since a two-beam loom or a ground loom is made entirely of wooden parts – which are seldom preserved and hard to recognise – it is difficult to learn much about its use. A Hallstatt period vessel from Rabensburg in Lower Austria possibly represents a ground loom (Franz 1927, fig. 1).

The warp-weighted loom enables the creation of a wide range of different weave structures and patterns (Fig. 3.5). Examples from the Early Iron Age areas of the Hallstatt salt mines (850–300 BC) include tabby, reps, basket and half-basket weave as well as different types of twill, namely zig-zag, herringbone and lozenge (Grömer 2010, figs 63 and 67). Twill and its variants are the most common weave types in the Early Iron Age. The spin pattern was very popular in the Hallstatt salt mine textiles as well as in the textiles from graves of the same period in the Eastern Hallstatt Culture (Bender Jørgensen 2005, 140–145). The colour patterning was done as stripes or checks during the weaving, using yarn in different natural shades or dyed in bright colours (Fig. 3.5). Many different dyes were used in the textiles from the Hallstatt salt mine (Hofmann-de Keijzer et al. 2005), including plant dyes like woad, weld or madder. There is also evidence of diverse dyeing techniques, including dyeing the fleece, the yarns and the woven cloth.

Besides the weaves made on a warp-weighted loom, there are various textiles made using band looms (Grömer 2005, plate 7). Among these are rep bands of 1–3 cm in width, which were perhaps made with heddle rods or a rigid heddle. Usually these ribbons are

Fig. 3.5. Hallstatt, Upper Austria: textiles from the Iron Age areas of the salt mine, varied scales. (© Natural History Museum Vienna, Prehistoric Department).



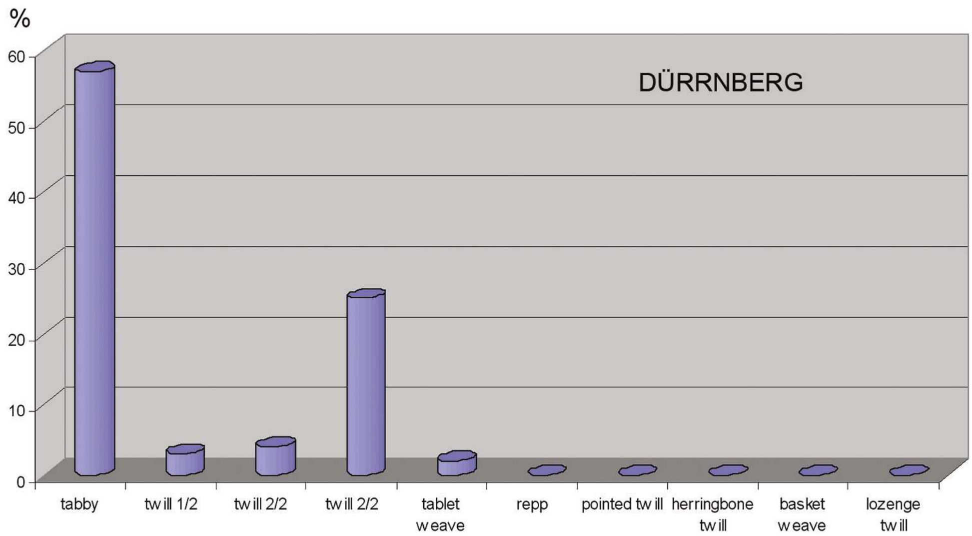


Fig. 3.6. Comparison between the weave types from Hallstatt (Eastern Group, primarily Hallstatt period), top, and Dürrnberg (primarily La Tène period), bottom. (© Karina Grömer, after Grömer 2005 and Stöllner 2005).

beautifully patterned by using different colours in the warp threads to create stripes and checks. Other band weaves are tablet-woven ribbons of 1–2 cm in width (Grömer 2001). Their patterns are made in a highly sophisticated manner, showing designs known from contemporary pottery. In addition to the narrow bands, we find in the Hallstatt salt mines broader bands of 5–15 cm in width, woven in tabby, rep, basket

Fig. 3.7. Situla from Certosa, Northern Italy, scan of the frieze, Late Hallstatt period. (© 7reasons).

weave or even twill. They are usually monochrome, with the exception of a find of a black band with dark red checks woven with brocade warp threads (Hundt 1959, abb. 12–13, taf. 10; Grömer 2005, fig. 11, pl. 7/6).

A great deal is known about different seams and hems from Hallstatt (Mautendorfer 2005), and – more importantly – items that show intentional tailoring have been recovered. This signifies that the cloth was cut to shape and sewn together, like the example from the Ender Werk in Hallstatt (Hundt 1960, taf. 20–21). These hints of tailoring are intriguing, as usually in the Mediterranean (classical Graeco-Roman) tradition, most garments were woven to shape (Pekridou-Gorecki 1989, fig. 46–67). At Hallstatt, we thus know of a different tradition of how to construct an item of clothing.

Textile production in the Hallstatt period thus demonstrates a flourishing creativity with a wide range of patterns, structures, thread counts and yarn diameters (Grömer 2005, figs 14–15; 2012). Some textiles seem to be the products of specialists: complicated patterns in tablet weaving, very fine spun yarns, and patterns with floating threads require considerable time and specialised knowledge (see Grömer 2010, 223–239).

In the La Tène period, some changes can be recognised. In Austria, some hundred textiles from Late Iron Age Dürrnberg (Fig. 3.6) and a few textiles from graves of the same period are known. The main weave type encountered here is tabby, while basket weave and twill occur only seldom (Stöllner 2005, fig. 6). The textile corpus has a much more reduced repertoire, and the majority of textiles are more simple, although still of high quality. Rather, the textiles look standardised, even in thread count and yarn diameter. This suggests that, during the La Tène period, the organisation of textile production shifted to become more efficient and produce a maximum output (von Kurzynski 1996, 36). Such a conclusion is further confirmed by the more standardised spindle whorls in the La Tène period and the reuse of pottery sherds to make whorls, indicating that it was their function that was of importance, and not their design. Late La Tène grave textiles (containing shrouds, garments and wrappings) continue this development with tabby as the main type (Grömer 2012).

The People behind the Textiles

As mentioned above, there are few pictorial sources depicting people involved in the activity of producing textiles in the Central European Iron Age. On the Sopron Urn, dated to the Early Iron Age, various human figures are incised (Fig. 3.8). As is typical for the iconography on Hallstatt period pottery, women are usually depicted wearing big triangular dresses, while men have trousers or smaller triangles (Dobiat 1982). On the Sopron Urn we see one woman spinning and another weaving on a large warp-weighted loom, with the loom weights hanging low in a pit (see Fig. 3.3; Eibner 1986). They are accompanied by two other women with their hands above their heads as though they were dancing. A fifth, shorter figure (male?) is holding a stringed instrument which could be a lyre.

The bronze pendant (*tintinnabulum*) from Bologna (Morigi Govi 1971; Eibner 1986; cf. Gleba 2008, 28–30), dated about 630 BC, shows on both sides detailed scenes with women involved in textile work – here more parts of the whole process are depicted: on one side of the pendant there are two females preparing the fleece by dressing the distaff for spinning. On the upper section, stands a woman, holding a distaff and spindle. On the reverse side of the pendant we see several activities concerning weaving. On the bottom scene, two women are working together to make the warp – the foundation of the cloth. The scene above shows a woman sitting on a throne weaving on a probably two-storied warp-weighted loom, while another woman is handing her a vessel (with wool in it?). All the depicted persons involved in the textile work are female.

Another indication of the gender of the textile producers may be found in graves. In this connection, a useful case study is Statzendorf (Rebay 2006), a typical cemetery of the Hallstatt period Kalenderberg Culture in a rural periphery. The graveyard contains 373 burials, most of which (90%) are cremation graves, dated to HaC and HaD1 (800–600 BC). The dead were usually equipped with a number of vessels, some of which constituted parts of a drinking and dining set. Animal bones represent the remains of meat, frequently found together with knives. Personal objects recovered are fibulae, pins, bracelets, belt plates and beads of glass and bronze. Tools and equipment such as spindle whorls, needles, knives and whetstones were found, as well as weapons such as axes and lances. About 12% of the graves at Statzendorf contain textile tools (see Fig. 3.9). The skeletal remains in these graves that could be analysed by anthropologists proved to be female. Katharina Rebay calculated a social index (seen as the social status within a given society, as shown in the value of grave goods) by quantifying the value of both grave goods and types as well as burial type, materials used for the grave goods and metal weight (Rebay 2006). Based on this, it is clear that spindle whorls and needles were found in both poor and very rich graves (index 100) (see Fig. 3.10). Thus, it can be suggested that the question of differences in social or economic status in terms of textile-related activity does not appear to be pertinent here.

The cremation graves at Uttendorf im Pinzgau, which are dated to the 8th century BC (HaC) is another example from the Hallstatt period (Moosleitner 1992). There are ten rich female graves with spindle whorls and a set of loom weights as grave goods (see Fig. 3.11). Some of the loom weights were even made of stone and elaborately decorated. The surface of these textile tools usually has traces of secondary burning,

Fig. 3.8. Sopron-Warischberg, Western Hungary, tumulus 3: ceramic vessel with incised depiction of a woman, Hallstatt period. (© Natural History Museum Vienna, Prehistoric Department).

which suggests that they were cremated together with the deceased and then deposed in the grave next to the urn (Fritz Moosleitner, pers. comm. August 2007).

In the Hallstatt period cemetery at Frög, Carinthia, spindle whorls, loom weights, spools and – something rare for Iron Age Austria – distaffs were found (Tomedi 2002, 159–162). Thus, in the Early Iron Age, textile tools are common grave goods, especially in female graves, and both in inhumations and cremations. In the Late La Tène period, textile tools occur less frequently in cemeteries than in the Hallstatt period. La Tène period graves with textile tools such as needles, spindle whorls and loom weights are known from Pottenbrunn in Lower Austria (Ramsl 2002) or Kundl in Tyrol (Lang 1998, 144f). On rare occasions, spindle whorls have been found in graves which have been anthropologically determined to be male. For example, in Pottenbrunn Grave 565, a 55-to-60 year-old man was buried with a spindle whorl and bronze and silver finger rings (Ramsl 2002).

In inhumation graves, spindle whorls were usually found near the hands, e.g. in Statzendorf Graves A014 and A089 (Rebay 2006) or in the cemetery at Hallstatt-Salzbergtal (Kromer 1959, Kern et al. 2009, 114ff). From the recent excavations, a girl's grave (Hallstatt, No. 33, new excavations by Anton Kern) was found with a whorl next to her left hand and a knife next to her right hand. Sometimes, needles or whorls were placed on the upper body or next to the feet (A. Kern, pers. comm.).

Statzendorf grave Nr.	type	social index	spindle whorl	needle	knife
A002	cremation	14	2		1
A003	cremation	11	1		1
A009	cremation	44	3		1
A013	cremation	78	1	1	2
A014	inhumation	100	6	needle box	2
A018	cremation	30		1	1
A019	cremation	39	1		1
A022	cremation	19	1		1
A032	cremation	27	1		
A037	cremation	60	1		2
A039	cremation	33	1		
A047	cremation	52	1		1
A055	cremation	34	1		1
A061	inhumation	71	1	1	
A068	cremation	39	2		1
A076	cremation	61	2		
A079	inhumation	33	1		
A089	inhumation	22	4		
A092	cremation	22	1		
A104	cremation	63	2		
A108	cremation	32	2		3
B032	cremation	28		1	
B037	cremation	25		1	
B102	cremation	19	1		
B134	cremation	22	5		
B142	inhumation	39	1		
B144	cremation	22	1		1
C009	cremation	25	1		1
C010	cremation	32	1		
C014	cremation	49	1		
C021	cremation	44	2		
C027	cremation	22	1		1
C054	cremation	22	1		1
C067	cremation	34	1		1
GD01	?		1		
GD02	?		1		
GD04	?		1		
GD16	?		2		

Fig. 3.9. Statzendorf, Lower Austria: Hallstatt period graves with textile tools. (© Karina Grömer, data after Rebay 2006).

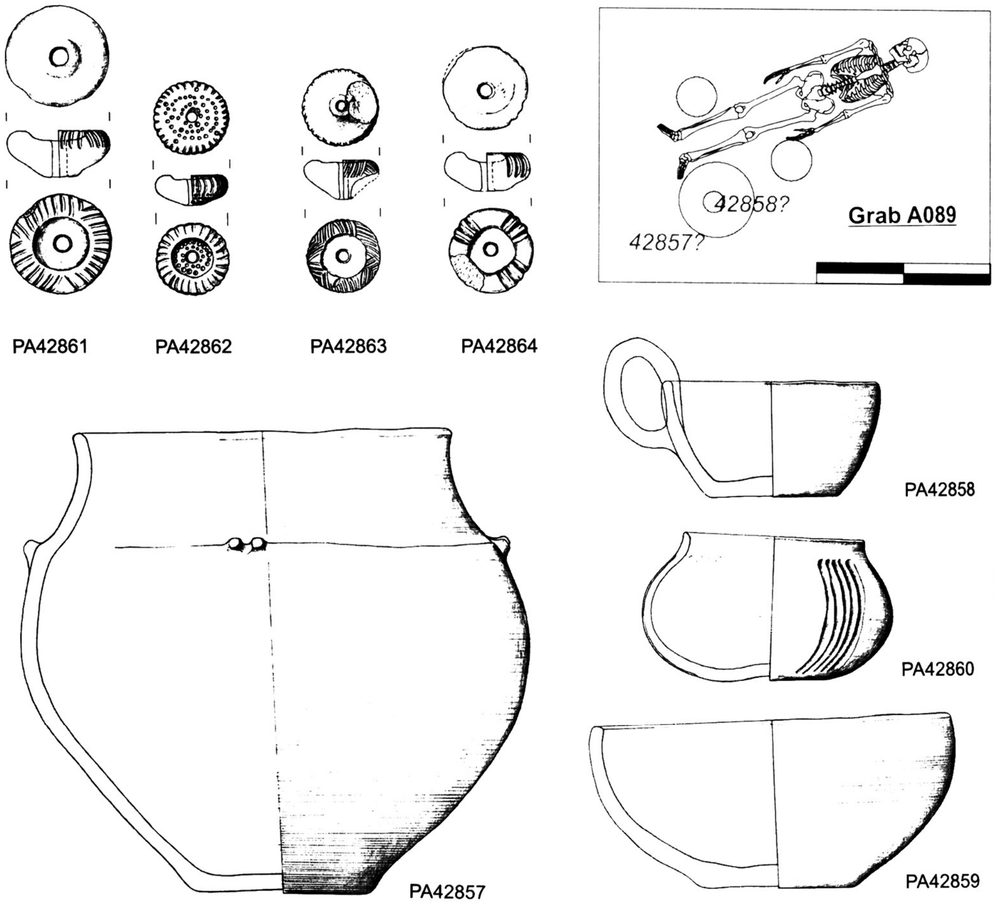


Fig. 3.10. Statzendorf, Lower Austria: "Poor" grave A089 with four spindle whorls. (After Rebay 2006, taf. 62).

Thus, the iconographic evidence and grave assemblages provide evidence of female producers involved in spinning and weaving. Other textile production activities, such as processing flax, combing wool, dyeing, cutting cloth and sewing are not found in the iconographic depictions, while in burials, besides spindle whorls and loom weights, only needles, knives and shears can be noted as tools useful in textile production. However, they are very rare in the graves. Furthermore, needles and shears appear in the graves of both sexes (e.g. at Pottenbrunn: Ramsl 2002, 87; needle and needle box in the male grave 28/1939 at Hallstatt: Kromer 1959, 198) and these tools could have been utilised for leather work or other functions. Therefore, we have no direct evidence regarding the gender of the craftspeople who processed the raw material, and dyed or sewed textile products.

Organisation of Production – Division of Labour?

The question of the gender of the textile workers is related to our understanding of the craft organisation. It is possible that all stages of production were in the hands of women, and that there were separate groups of workers involved in the various stages of textile production. Generally, textile work involves a great deal of manual work, some of which is rather time-consuming. The processing of fibres and especially spinning takes weeks, while the weaving of a piece of cloth from the spun yarn can be accomplished more quickly, but this too can take days (Andersson 2003, 46–48). Cutting and sewing a garment is the last stage of production and can be accomplished very fast compared with the length of time spent on spinning.

Additionally, there are stages within the workflow which require specialised know-how such as special patterns, tablet weaving or dyeing techniques, while others could even be done by children, such as plucking wool. Various sources of evidence at our disposal like the grave finds, the textiles or the workplaces may tell us how many peope worked together or if there were specialised workers just for one stage of production.

In this respect, of great interest are the 'sets' of tools found in graves. For example Uttendorf Grave 56, which is a very richly furnished female burial as indicated by pottery and exquisite jewellery including six fibulae, some finger- and armrings, a necklace, a bronze belt buckle and glass beads, contained a set of tools consisting of seven stone loom weights, a spindle whorl and an iron knife (Moosleitner 1992, 42). Another example is Grave 1 in Tumulus 159 at Frög, which contained a spindle and four spools (Tomedi 2002, taf. 76).

At the cemetery in Hallstatt, spindle whorls have been found together with needles or knives (see Fig. 3.12; Kromer 1959). A knife could be used for various purposes, including the cutting of wool, yarn or textiles, but also in leather work or cooking.

In the graves of the above-mentioned cemetery in Statzendorf (Rebay 2006), many sets of tools were clearly recognisable (see Fig. 3.9): usually spindle whorls were excavated in the graves together with knives, sometimes with needles. In the very rich female grave A014 from Statzendorf (see Fig. 3.13), six whorls and a needle box were found next to the legs and a knife next to the right hand of the deceased.

Some conclusions can be drawn from the presence and composition of these tool sets with respect to the craft organisation. If in one grave we find tools for spinning, weaving and sewing (i.e. tools relating to different stages of production), then it is plausible that all production stages were in the hands of one person – perhaps though only in this particular case.

Another indication of work organisation is provided by the textiles themselves. Textiles from the salt mines of Hallstatt may serve as an example, although we are unable to ascertain at present if they were locally produced or came from the surrounding villages. Their technical details may reveal indications of their production processes. Thus, many woven fragments with seams and other traces of sewing have survived. Some of the sewing threads are made with the identical wool as the weave (Rösel-Mautendorfer 2011). This may perhaps indicate that the weaving and sewing

Fig. 3.11. Uttendorf im Pinzgau, Salzburg, Austria: Hallstatt period cremation grave 303 with loom weights. (After Moosleitner 1992, Abb. 11).

was done by the same person. Alternatively, the yarn for the seam may have been taken from the textile itself, in which case, the spinner/weaver and sewer of the cloth may not have been one and the same person. The same can be said for the textiles in which the sewing threads are different from the woven fabric.

When we consider the tools and workplaces used for textile production in the Iron Age, it is apparent that, at least in some cases, some sort of cooperation must have existed. For instance, several individuals would have been required to work together as a team on 3–4 m wide looms, such as illustrated by depictions on Greek vases (Pekridou-Gorecki 1989, fig. 2). Thus in the case of the 3.70 m wide loom from Kleinklein (Dobiat 1990, 50–58), the warp threads would have been attached to 107 loom weights collectively weighing 118 kg. Handling such a large loom and moving

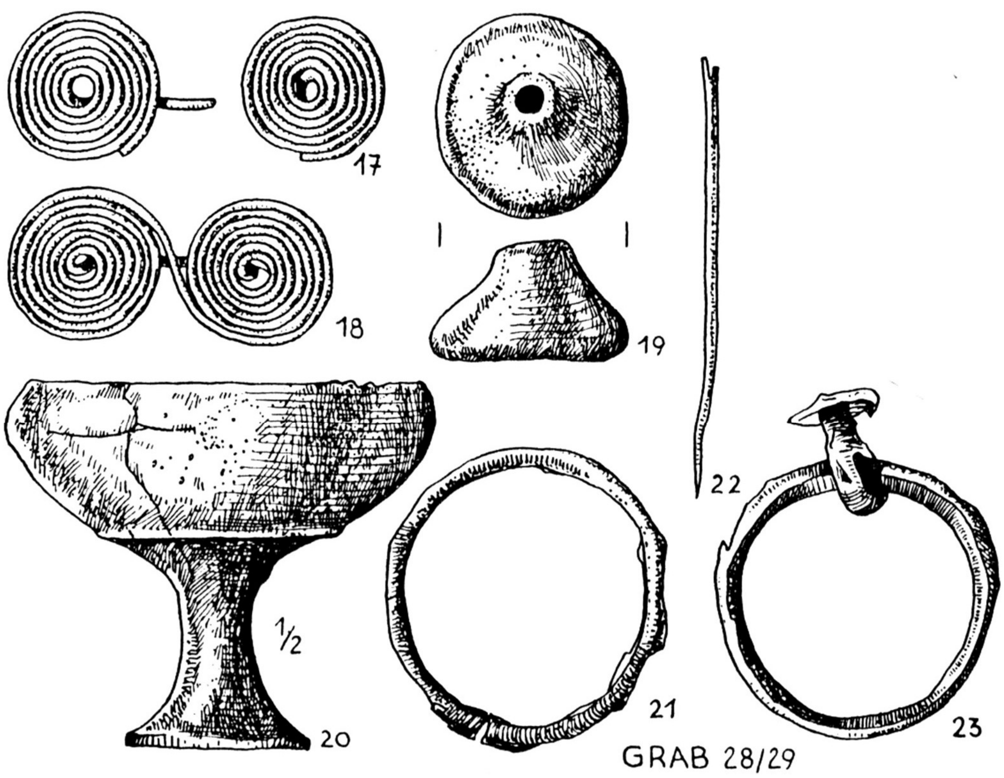


Fig. 3.12. Hallstatt, Upper Austria: Grave 28/29 with a tool set of spindle whorl and sewing needle. (After Kromer 1959, taf. 1).

the heddle bars with such a weight on, is hard physical work and requires cooperation. Even handling the weft threads of a cloth over 3 m in width is easier when undertaken by more than one person, if efficient and quick work is required. The weft threads in the Danish Iron Age textiles from bogs (Hald 1980, 152, fig. 139) cross each other at more or less regular intervals, suggesting that several weft bobbins were in use at once, and that two or several women had been weaving simultaneously – passing the bobbins to each other as they met in the middle and then changing the shed. Unfortunately, we have yet to recover a complete Iron Age cloth in Central Europe that would provide the evidence of the same practice.

Research on the division of labour is related to the question of the craft organisation: whether it was done as household work or in workshops, which is typical for the later Roman period (cf. Gostenčnik in this volume). The earliest evidence for specialised textile workers in Austria is known from the Roman period, consisting of the lead *tesserae* (Martijnse 1993; cf. Gostenčnik and Radman-Livaja in this volume) with job titles such as *fullo* or *excisor* (see Fig. 3.14). There is no written indication that the division of textile work in Austria had its roots in the Iron Age, but it is likely, based on the large looms and specialised and high quality items (e.g. tablet-woven bands).

Social Status of the Textile Producers

As has been seen hitherto, only women are depicted spinning and weaving, and textile tools are predominantly found in female graves. Who were these women? According to Alexandrine Eibner (1986; 2000–01), the study of iconographical data of the Early Iron Age in comparison with written and pictorial sources from ancient Greece, suggests that there are two different levels of understanding the pictures. On the one hand, the spindle and textile work has a symbolic-ritual value, as it is not only an attribute of the mistress of the house but also of female goddesses. The scene on the famous urn from Sopron perhaps refers to similar symbolic aspects. On the other hand, perhaps the depictions simply inform us that spinning and weaving were the major occupations of women in the Hallstatt period. In keeping with their role as housewives and mothers, they are illustrated at their domestic work with spindle and loom.

Although female graves contain spindle whorls, loom weights, needles as well as sometimes spools and distaffs, these tools are not recovered from every single female grave. Does this indicate a special social status of the women whose graves contain them (cf. Gleba 2008, 174–175)?

It is possible that a spindle or a loom weight in such a rich grave like Uttendorf symbolises that this woman was a mistress of the house or the head of the household (see Eibner 2000–01, 108ff). In acient Greece, such high-status women held the responsibility for caring for and controlling the textile production in their household. Producing goods for their own household needs as well as the specific luxury items required for the representation of rich families and for rites of hospitality were important duties entrusted to these high-status women (Wagner-Hasel 2000, 105ff). I suggest that a similar situation could be argued for the Hallstatt Culture as well. The Early Iron Age textiles in central Europe (e.g. Hallstatt: higly decorated tablet weaves, extra fine basket weaves, textiles dyed with insect dyes), as well as the jewellery in the graves illustrate that the representation and demonstration of power and status of a person was not only expressed by luxurious jewellery and weapons, but also by precious, elaborate, highly patterned and fine clothing.

It is noteworthy that in the Hallstatt period in Austria, ‘poor’ as well as ‘very rich’ women (based on their jewellery and other non-perishable grave goods such as pottery) have textile tools in their graves (e.g. see Fig. 3.10). The spindles in ‘poor’ graves as in Statzendorf are perhaps merely a symbol of ‘womanhood’, a symbol of a woman’s contribution to the community as a female person spinning and weaving for her own family’s needs (cf. Gleba 2008). In an Early Iron Age society, it is also possible that she even spun and wove for trading in the market.

Where did the Textile Producers Live and Work?

In the Iron Age Austria, we know of various types of settlements: small villages, lowland settlements in rural areas and hilltop settlements, which when fortified served as the centres for its region. A quick overview of the Iron Age sites in Austria shows that, in nearly every settlement where larger parts have been excavated, textile tools such as spindle whorls and loom weights were recovered. Needles or shears are also recorded. The recently excavated and well-analysed settlement of Göttlesbrunn in Lower Austria (Griebl 2004) may serve as an example. The site was occupied during the 7th and 6th centuries BC and belongs to the Kalenderberg-Gruppe, a regional group of the Hallstatt Culture located in Lower Austria and Burgenland. In this settlement, dwellings and outbuildings have been identified. In some of them – although not all – textile tools were discovered (Fig. 3.15). In some cases, loom weights were found in a row demonstrating that the loom was in use when the house was destroyed.

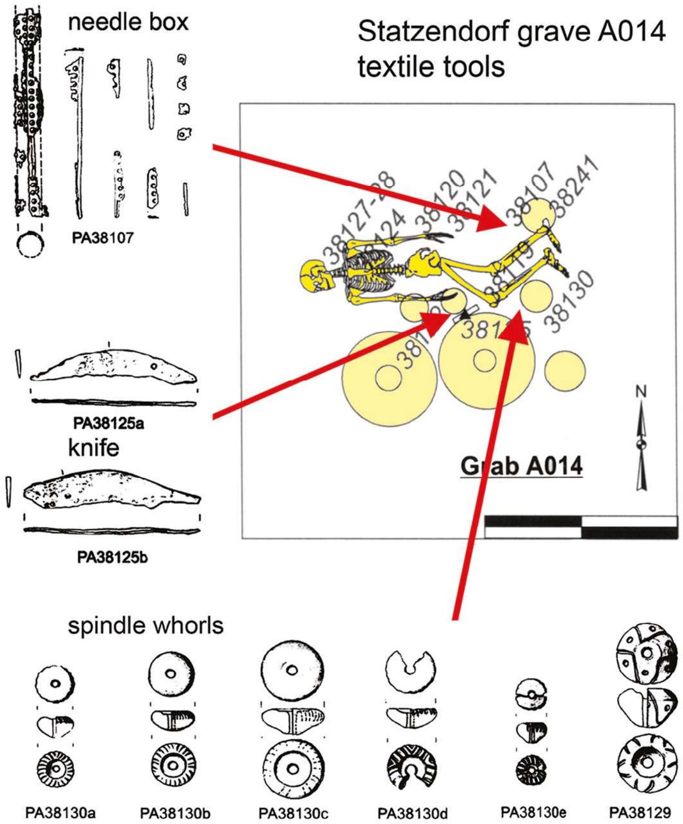


Fig. 3.13. Statzendorf, Lower Austria: "Rich" grave A014. Shown are only the textile tools and their position: 6 spindle whorls, 2 knives and 1 needle box. Not shown: bronze sheet girdle, bracelets, rings, fibulae, amber beads and vessels. (After Rebay 2006, taf. 14).

There is also a Hallstatt period weavers' hut found at the lowland settlement of Michelstetten (Lauermann 2000). Throughout the entire settlement, over 100 spindle whorls were found. Moreover, on a fortified hilltop settlement Salzburg-Hellbrunnerberg (Hallstatt period), a great number of spindle whorls and needles were recovered (Stöllner 2002a, 110; 1996, 101, taf. 88).

Is there a difference in textile tools among the lowland settlements, smaller villages and large fortified settlements? When the 3.70 m wide loom was discovered at Kleinklein (Dobiat 1990), it was considered that a special loom of this size was connected to the prominence of the large hilltop settlement. Kleinklein was an important regional centre and the *Fürstensitz* (princely residence) of the noblemen buried in the huge burials nearby. Thus, it was thought that the big loom indicated a special, elite textile production there. However, later discoveries proved that such exceedingly wide looms are not only associated with fortified hilltop settlements, but can also be found in smaller lowland sites (Fig. 3.16) like Hafnerbach (Preinfalk 2003, fig. 12).

As far as the archaeological evidence is concerned, in terms of textile tools no great difference between smaller villages and hilltop settlements in Iron Age Austria has thus far been discerned. The evidence of textile tools in the settlement indicates that textiles were produced everywhere on a household level, primarily for domestic purposes. Yet, the textiles from the Hallstatt period are sometimes very fine and attest to complicated production techniques; therefore, sometimes specialised production could be suggested (see Grömer 2010, 232–235).

In the following section, two case studies are presented – Hallstatt and Dürrnberg. Both of these sites were economic centres of their time, based on mining and trading salt. They demonstrate how different geographic circumstances resulted in different solutions to the logistics and maintenance of daily life.

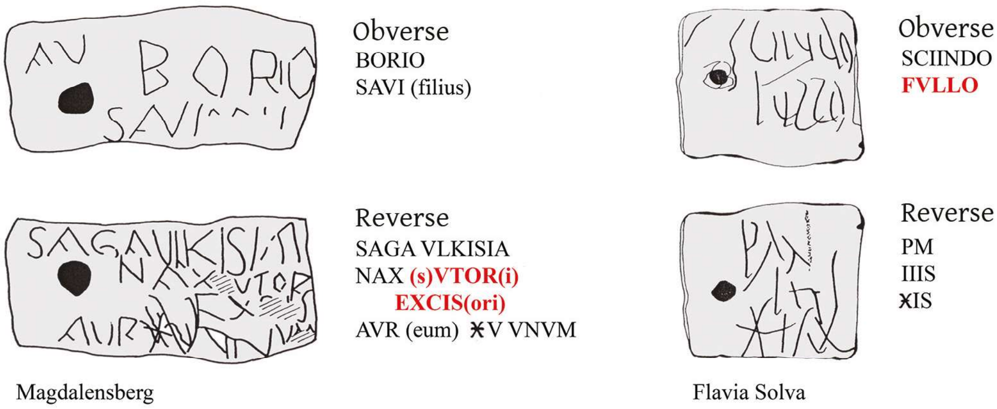


Fig. 3.14. Magdalensberg, Carinthia and Flavia Solva, Styria, Austria: lead tesserae *with job titles, Roman period. (After Martijnse 1993).*

Case Study 1: Hallstatt

Hallstatt (Fig. 3.17; for an overview of the site see Kern, et al. 2009) has given its name to an era of European prehistory, the Early Iron Age from 800–400 BC known as the Hallstatt period. The site of Hallstatt comprises three different prehistoric mining areas. The entire complex of prehistoric salt mines was exploited from the Bronze Age to the Roman period. Due to impregnation with salt, organic materials including textiles survive extremely well here and span a time period from the 15th to the 4th centuries BC. There are over 550 single fragments which date to the Hallstatt period.

Hallstatt period textiles present a wide range of well-preserved textiles with different weaves, patterns, colours and qualities. Moreover, in the Hallstatt cemetery, some mineralised textiles on metal objects were found. They are comparable with the finds from the salt mines. Regrettably, we did not find the corresponding Hallstatt period settlement. There are only a few textile tools from Hallstatt, for example from the La Tène period settlement at Dammwiese (Grömer 2010, fig. 27) situated at a height of 1357 m. The question arises as to where in the narrow Salzberg Valley at Hallstatt were the places needed for textile production and – more importantly – the human resources situated?

About 1500 graves have been excavated to date in the cemetery of Hallstatt, most of them dating to the Early Iron Age (Kern et al. 2009, 124f). Typically, spindle whorls are

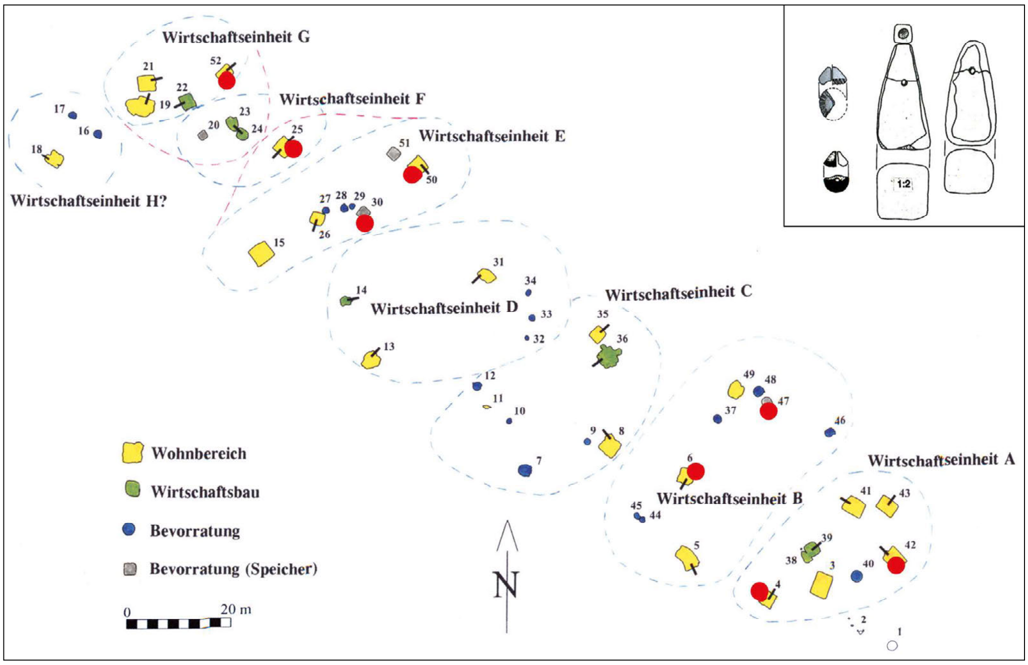


Fig. 3.15. Göttlesbrunn, Lower Austria: Hallstatt period settlement with textile tools in the houses. (After Griebl 2004, fig. 74).

found in contemporary female graves throughout Central Europe, perhaps indicating that the deceased had participated in textile production. At Hallstatt however, the picture is different. Out of the 1500 graves, only 31 (Fig. 3.18) contained textile tools such as spindle whorls, needles or loom weights (which is 1.5% of the total number of graves)! That is a very low number, compared with other contemporary cemeteries elsewhere. Can we presume that those whose graves contained spindles produced textiles, and others did not? If this is correct, given how time-consuming textile work is, this number of people involved in textile production would be too low to furnish the entire community with the textiles they needed.

It has been suggested that the entire population living in the Salzbergtal (men, women and children) were employed in the salt-mining activities (Reschreiter 2005, 14). Women's and children's shoes found in the salt mine support this hypothesis, as does the osteological analysis of the skeletons from the recently excavated graves. It appears that men hauled the salt up and the women carried it out of the mine (Pany 2008, 136–141). Furthermore, there is not much space in the narrow Salzberg Valley for resources needed to produce items of daily use such as food, pots and textiles for such a large community (cf. Kowarik 2009). This carries with it the implication that the inhabitants of this area would have had to import many goods from outside their village in Hallstatt.

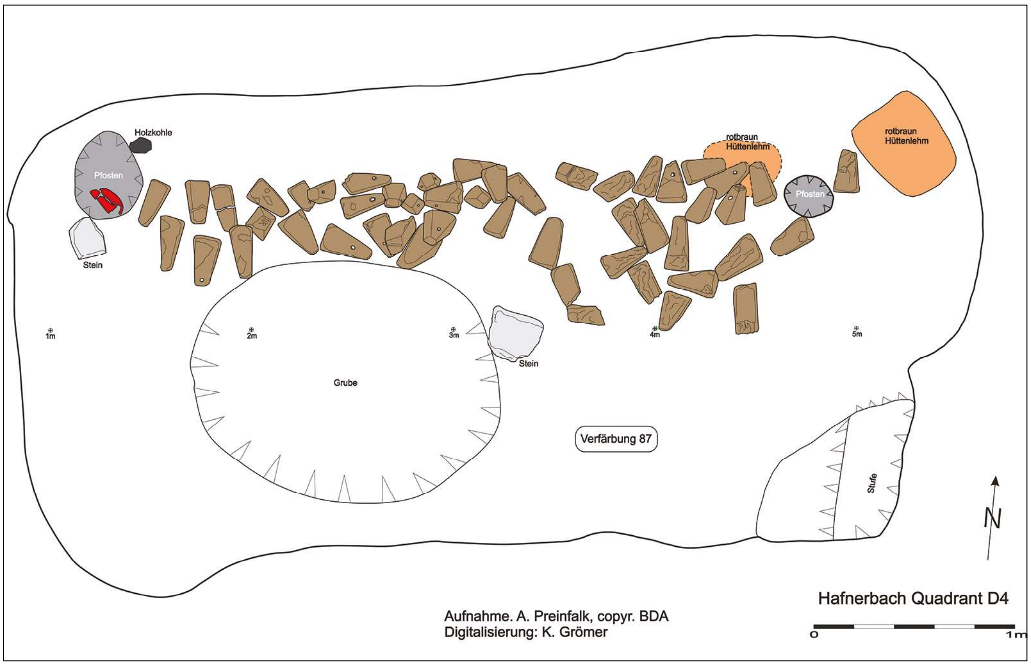


Fig. 3.16. Hafnerbach, Lower Austria: in situ find of 4 m wide loom with over 50 loom weights. (After Preinfalk 2003, fig. 12, © Bundesdenkmalamt, Austria; Drawing: Karina Grömer).

In recent years, a multidisciplinary research team has been working on subjects such as the economy of Hallstatt. For example in 2008, a pottery-analysis was published, showing that some of the pots were made in Hallstatt itself, i.e. they were not imported as previously assumed (Herold 2008, 144–147). This new research requires the revision of previous hypotheses and it is no longer certain whether the producers of the textiles lived in the Salzberg Valley of Hallstatt or if the textiles were imported/traded to the site. Some sort of exchange to obtain items for daily life is likely. In the northern flat hinterland of Hallstatt (Äußeres Salzkammergut, the region around Gmunden, and the lakes of Atter- and Mondsee, as well as the Alpenvorland), we find the resources that are necessary for extensive textile production. This includes cultivation areas for plants (fibre dyestuffs), pastureland and human resources which are not involved with salt-mining. In this area, some settlements were excavated, and in all of them spindle whorls and loom weights were found, sometimes in large quantities, for example at the hilltop settlement of Buchberg next to the present village of Attersee (Eibner 1975, fig. 3), or at Waschenberg near Wimsbach-Neydharting (Pertlwieser 1970), Ansfelden (Trebsche 2008, 156–158) and Asten (Leskovar 1996). All of these settlements are situated near the river Traun, which is a very important trade route from Hallstatt north towards the Danube. Perhaps some of the textiles found at Hallstatt came from that region.

The Hallstatt textiles themselves can provide some indications of their origin through an analysis of their weaving techniques and subsequent comparison fragments from Hallstatt with textiles from other regions, in terms of the patterns and details like the use of single or plied yarns, preference of different weave structures etc. Twills with a spin pattern, made of single yarn (Vače Type: Bender Jørgensen 1989, 144ff) are well known in the Eastern Hallstatt region (Austria, Hungary, Czech Republic, Slovenia), while wool twills with plied yarns (twill Sz/z) are characteristic for the Western Hallstatt region (south Germany, France, Switzerland). The latter type is rare in Hallstatt. The main corpus of the woven fabrics from the salt mines belongs to the textile repertoire of the Eastern Hallstatt region, and the patterns on the tablet-woven ribbons are similar to those found on the pottery of this area.

Thus, the current research suggests that the textiles found in the salt mines of Hallstatt may perhaps have come from outside the Salzberg Valley, as there are few resources to produce them there. Technical details provide us with a hint that the producers of the textiles could have lived in the Hallstatt hinterland, like Alpenvorland or somewhere else in the Eastern Hallstatt region.

Case Study 2: Dürrnberg

Dürrnberg near Hallein (Stöllner 2002b; 2005) was a flourishing mining, workshop- and trade centre, which was partly contemporaneous with Hallstatt and followed it as the economic centre of its time. Like Hallstatt during the Bronze and Early Iron Ages, Dürrnberg was a leading salt producer in the La Tène period. It was primarily occupied between the 6th and 1st centuries BC, continuing into the Roman period. Most finds from the site, including the main corpus of textiles, derive from the early La Tène period.

Many different areas of salt mining and a great number of rich graves have been excavated. In contrast to Hallstatt, the settlement areas at Dürrnberg are also very well preserved. The prehistoric settlement sites were examined systematically by Cordula Brand (1995) for the site organisation, workshop- and production areas. The settlements date from Ha D to LT C. The cemeteries were situated around the peripheries of the settlements.

Besides salt mining, which was the main economic activity on Dürrnberg, various other crafts are attested on the site by specific tools and the remains of workshop debris (Brand 1995). There is evidence for the production of some luxury goods, such as sapropelite and metal jewellery (e.g. fibulae), production and processing of food, wood as well as metal working, pottery production – and of course – textile production. The salt trade on a local and interregional basis favoured long-lasting contacts with Bavaria and the neighbouring regions to the north-west, to the south-east Alpine area and – in later times – to Bohemia and central Germany.

Different sources thus provide information about the identity of textile producers. Over 600 textiles have been recovered from the salt mines of Dürrnberg (Stöllner 2002b; 2005). Rich burials contained remarkable jewellery, belts and fibulae, which sometimes preserve textiles on them. Burials have also produced textile tools, such as spindle whorls and shears, in higher quantities in comparison to the Hallstatt cemetery (Penninger 1972, e.g. taf. 2, 3, 11, 14). The settlement areas, such as Dürrnberg-Ramsaukopf yielded spindle whorls, loom weights, needles and shears (Fig. 3.19; Irlinger 1995, taf. 76–81).

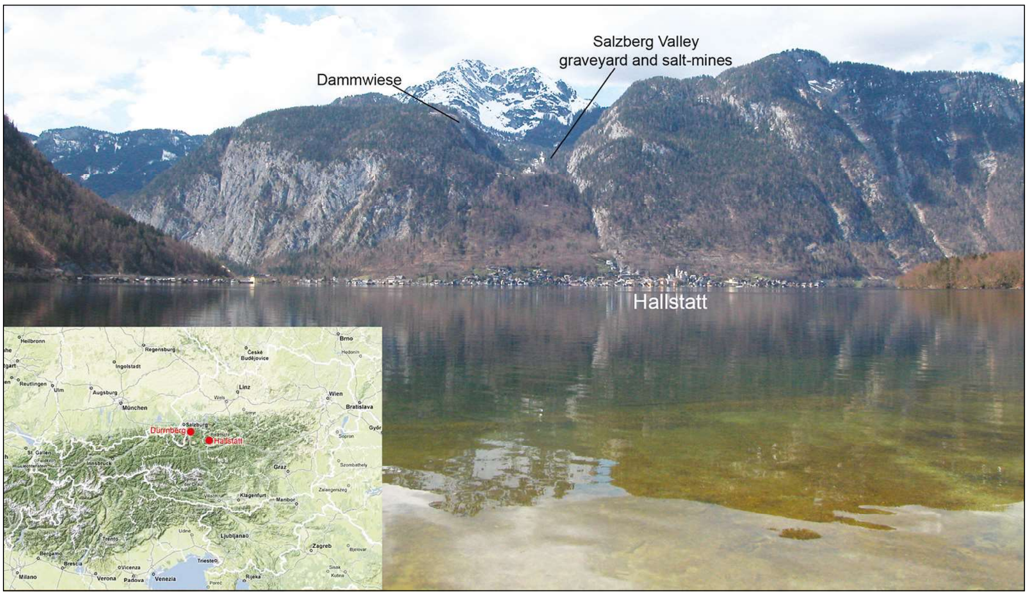


Fig. 3.17. Hallstatt, Upper Austria: overview to the site, in front the Hallstättersee. (© Natural History Museum Vienna, Prehistoric Department).

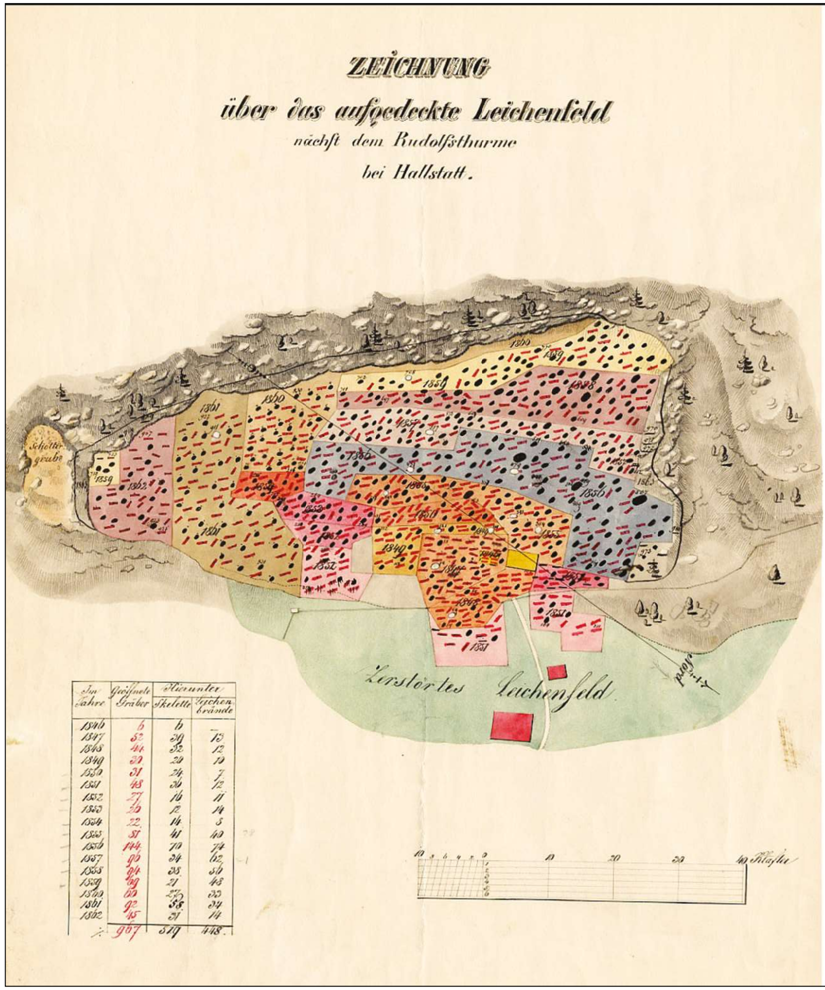
Interestingly, in contrast to the specialised workshops which occupied specific areas in the settlement, textile production took place throughout the settlement and in nearly every house, as suggested by the distribution of textile tools (see Fig. 3.20). At first sight, this might indicate that textiles were only produced at household level. An examination of the technical details of the Dürrnberg textiles, however, informs us that – in contrast to the creative textile products of the Hallstatt period – now there is a predominance of standardised and easily producible goods. As Katharina von Kurzynski (1996, 36) suggested, the quality of the Dürrnberg textiles is indicative of mass production. According to her, it is possible that this large-scale textile production was organised on a household level or as workshop production for trade. The one fact that we are sure of is that the Dürrnberg settlement attests to the presence of textile producers, perhaps even textile traders and – certainly – consumers.

Conclusion

We are indebted to various sources for our knowledge of the pre-Roman Iron Age textile production on the territory of Austria, such as well-preserved textiles, grave finds, textile tools, archaeological evidence in settlements and depictions of textile producers and their products.

We can find evidence of their activities in each settlement, where they lived and worked. Spindle whorls, loom weights and needles in graves may indicate that the deceased who were accompanied by these tools were textile workers, and furthermore, point to a special social status these persons occupied in their communities. Particularly during the Early Iron Age, predominantly women have textile tools in their graves, sometimes even being accompanied by tool sets (e.g. spindles and knives or spindles and needles). Depictions of textile work, such as on the Sopron Urn and the Bologna *tintinnabulum*, illustrate different stages of the textile production process from spinning to weaving.

The two case studies of Hallstatt and Dürrnberg demonstrate that textile production in Iron Age Austria was organised in various ways, providing diverse archaeological evidence concerning the producers, consumers and traders of textiles. Textile production and trade in the Iron Age in general can be thought of as highly multi-faceted, depending on the geographical position and size of the settlement, the status of its inhabitants, as well as their economic circumstances. It is important to underline that, from the Hallstatt period onwards, there is evidence of a highly developed textile art and a well-organised textile production – at a household level and, perhaps, even the first mass production in workshops. The textiles and tools clearly demonstrate that there is a continuous development from the beginning of the Iron Age to the Roman era, when the territory of Austria was incorporated into the Roman Empire as the provinces of Noricum, Raetia and part of Pannonia (cf. Gostenčnik in this volume).



grave Nr.	type, wealth status	spindle-whorl	needle	loom weight	knife
11	medium, skeleton		1		
25	poor, skeleton		1		
28/29	medium, cremation	1	1		
46	rich, cremation	1			
49	medium, cremation	1			
58	medium, cremation	1			
67	medium, cremation	2			
84	rich, skeleton	1			
87	rich, cremation	2			1
127	poor, skeleton	1			1
136	rich	1			
179	poor, skeleton		1		
380	medium, cremation	1			
382	medium, skeleton		1		
388	medium, skeleton	1			
436	medium, skeleton		1		
480	medium, cremation		1		
527	medium, skeleton	1			
711	rich, cremation	1			
763	poor, cremation	1			
927	rich, skeleton	1			
Gr. I (Stapf)	medium, skeleton			1	
11/1939	rich, skeleton	1			
28/1939	medium, cremation		1		
55-Linz	medium, cremation	1			
68-Linz	rich, skeleton	1			
110-Linz	medium, cremation	1			
136-Linz	?			1	
15 (Kern)	rich, cremation	2 (3?)			1
33 (Kern)	medium, skeleton	1			1
42 (Kern)	medium, cremation	1			1

Fig. 3.18. Hallstatt cemetery, Upper Austria: left – water colour of the excavations in the 19th century by Johann Georg Ramsauer; right – list of graves with textile tools. (© Natural History Museum Vienna, Prehistoric Department and Karina Grömer).

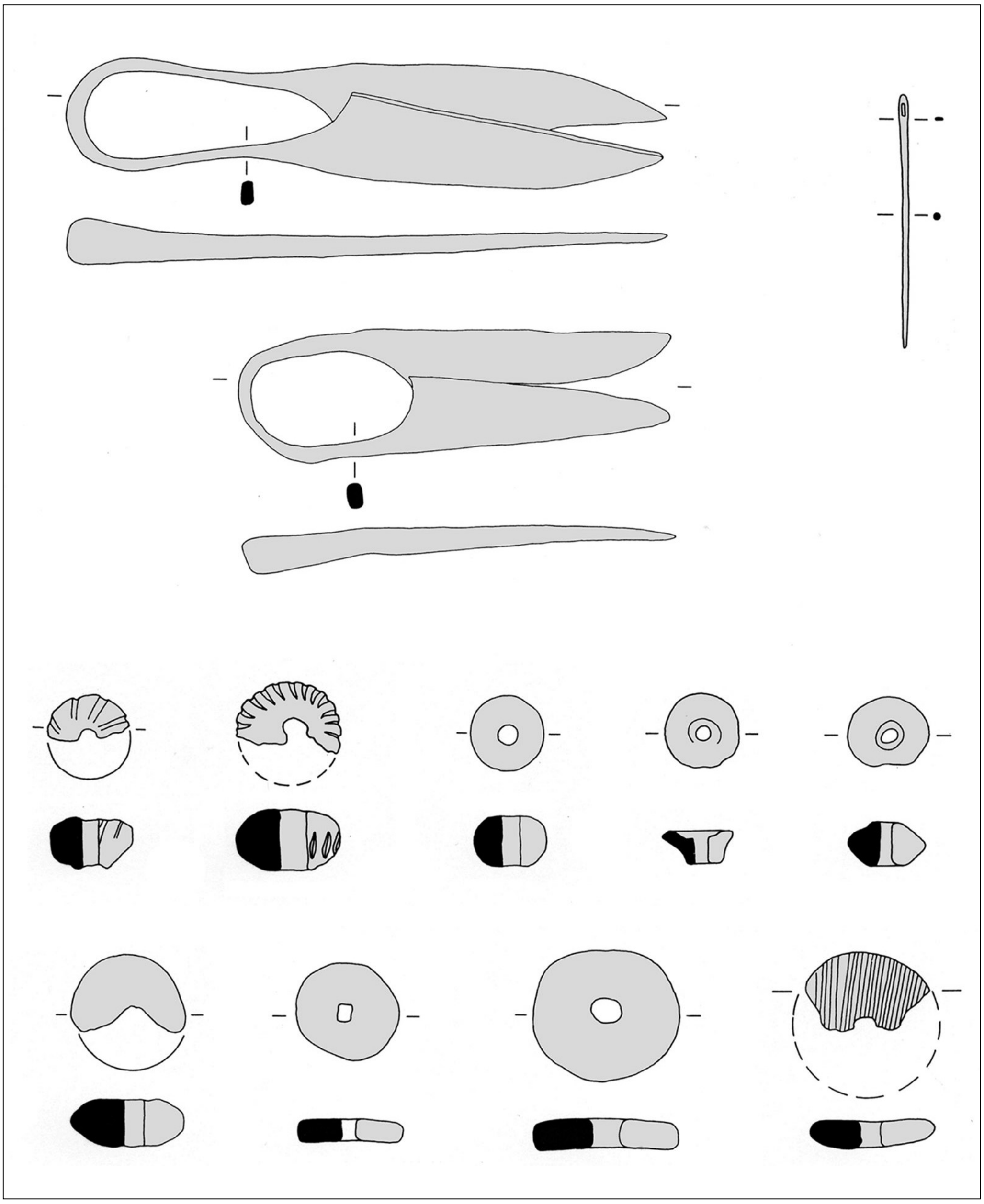


Fig. 3.19. Dürrnberg, Salzburg, Austria: textile tools from the settlement on the Ramsaukopf, La Tène period. (After Irlinger 1995, taf. 76–78).

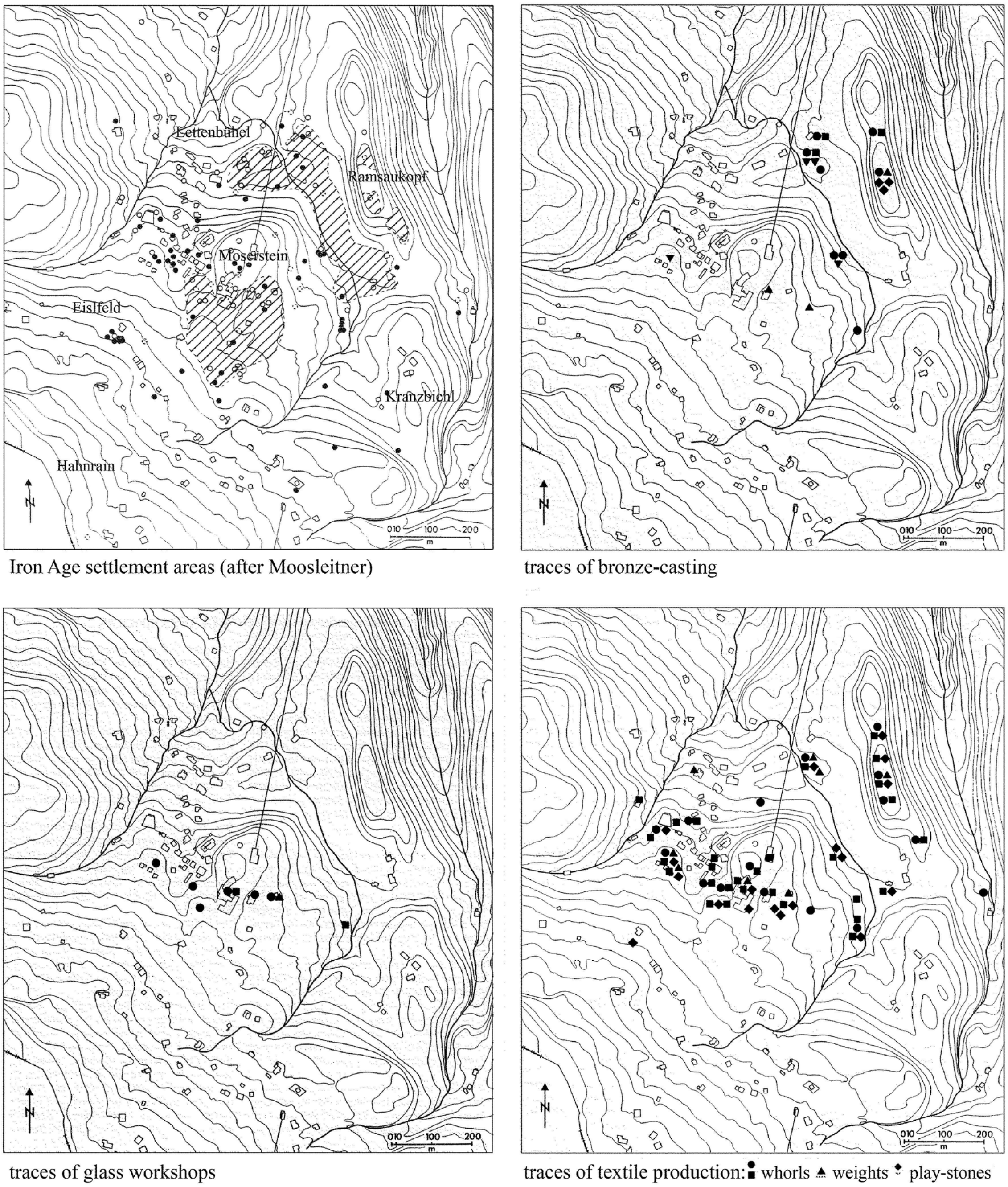


Fig. 3.20. Dürrnberg, Salzburg, Austria: settlement areas and distribution of bronze casting areas, glass workshops and textile tools. (After Brand 1995).

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5.3. Textile craft in prehistory – 1 Levels of production: household, specialised and mass production

chapter of a monography

GRÖMER, K. (2016): Textile craft in prehistory – 1 Levels of production: household, specialised and mass production. In: The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe. Veröffentlichungen der Prähistorischen Abteilung 5, Verlag des Naturhistorischen Museums Wien, Vienna 2016, 241–261.

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C Textile craft in prehistory

Textile hand craft, which was an important part of the daily workload for thousands of years, has become completely irrelevant to modern life. Today, textiles for clothing or other purposes are produced by the mechanisms of global market economy in low-wage countries, and textile craft in Central Europe is only carried out in the high-priced segment of the arts and crafts or exercised by individuals purely as a hobby.

Only in the rarest cases is a larger part of the work process accomplished by a modern person in the Western World. A jumper may be knitted from purchased yarns, or perhaps wool fleece is felted creatively. Only very few people spin, dye, or weave and have the capability to produce everyday objects. Typically, clothing and textiles today are bought cheap and disposed of quickly. This has become possible by the dramatic loss of value that textiles have experienced. This detachment of textile from craft work stands in stark contrast to the situation in earlier times.

In the depths of history, it quickly becomes apparent that textile production shaped the lives of people in the past. Even today, proverbs and figures of speech provide a window into the past, in which textile production was omnipresent. For instance, we refer to '*the distaff side of the family*' or a '*dyed-in-the-wool*' conservative, a drunken man '*weaves his way down the road*' and '*shuttles back and forth*'.[535] Let us track back 2000 years.

We are well informed about Roman textile production[536], thanks to written records. Textiles were already produced *en masse*, and a specialized craft profession had emerged, including fullers, tailors, weavers, *etc*. Textiles were produced at home, or in workshops such as dyeing and fulling mills, and distribution and sale were undertaken by cloth merchants. The Igel Column[537] provides interesting data on the latter. Through papyri, we even know about apprentice contracts,[538] wages and prices. In an ancient version of a 'global market economy', textiles could be manufactured in Egypt, for instance, and delivered across the Roman Empire to Judea, Central Anatolia (Cappadocia) or even to the province of Britannia for the military. Clothing, soft furnishing, yarn and prepared raw materials

[535] Kind comment by John Peter Wild, Manchester, Great Britain, Jan. 2014. German examples include *e.g.* „*der Geduldsfaden reißt*", „*der Handlungsfaden einer Geschichte wird weiter gesponnen*" or „*man macht blau*".

[536] *Cf.* Droß-Krüpe 2011. – Gleba and Pásztókai-Szeőke 2013. – Wild 1970.

[537] *E.g.* Bender Jørgensen 1992, 132–133, figs. 160–165.

[538] Droß-Krüpe 2011.

were traded and exchanged into every corner of the Roman Empire, and even as far as India and Central Asia.[539]

Valuable written sources such as these are much sparser for the centuries before the Roman occupation in Central Europe. The Roman writer Livy (Liv., 21.31.8) indicates that the Gallic tribe of the Allobroges, residents of eastern France, supplied the army of Hannibal with warm clothes during the Second Punic War (218 – 201 BC).[540]

How was the textile production in Central Europe organized all those millennia ago, from the Stone Age to the Iron Age? Were textiles produced at home, or were there craft specialists, and what do we know about the people who worked in the textile trade, about the places in which they produced and lived?

1 Levels of production: household, specialised and mass production

The development of agriculture and animal husbandry at the beginning of the Neolithic period revolutionized many technological and social developments. In relation to textile craft, during the Neolithic the technological and material bases were created which in principle remained valid until today[541]. Wool and flax still play an important role today, even after the invention of synthetic fibres. The spindle and the mechanics of the loom were, in all simplicity, already perfectly designed in the Neolithic, and most spinning and weaving machines still work according to the same basic principles. In the Neolithic, we have the first evidence for weaving on the warp-weighted loom. Since this is large, heavy, and not an easy device to transport, especially in its mounted state, its use seemed to depend on permanent settlements. For the nomadic lifestyle of the Palaeolithic

539 See Droß-Krüpe 2013.

540 After Timpe 1981, 54.

541 The basic spinning procedure as well as the basic weave types still exist today, even the main sewing techniques.

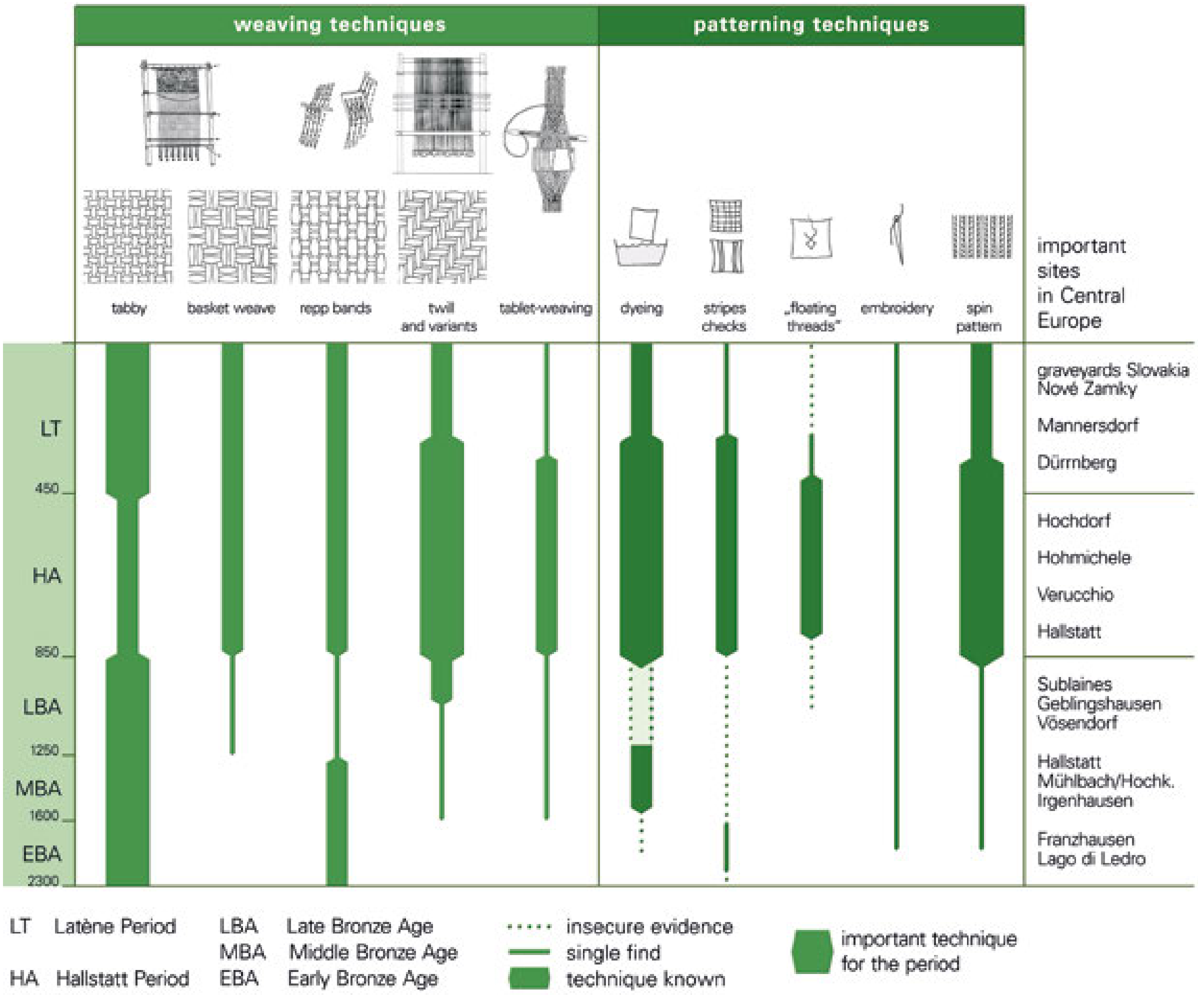
and Mesolithic, the warp-weighted loom made little sense, and neither did the cultivated fibre plant flax (*Linnum usitatissimum)*. Flax is a demanding and high maintenance crop and already presupposes developed agriculture. In principle, however, the processing of plant fibres – especially grass and bast – originated long before the Neolithic[542]. The nomadic hunters and gatherers of Central Europe already knew the various technologies of basketry, braiding, knotting, twining and netting. During the Neolithic and the Bronze Age, the long fibres of flax were worked into fine fabrics, but methods of working wool with its shorter fibres developed especially in the course of the Bronze Age. In the Early Iron Age, extremely fine yarns were spun and further processed. This change has to be seen in connection with successes in sheep breeding[543].

In the Neolithic and Early Bronze Age weaving of large-scale fabrics on the warp-weighted loom included just simple tabby weave and its variants like repp. In addition to looms for large textiles, equipment for weaving bands can be found from the Neolithic period. In contrast to the loom, which was fixed in place, the weaving of bands is mostly a mobile technique that can be carried out at different locations if necessary. Most band weaving techniques are based on the principle of raising and lowering thread systems similar to the manufacturing principles on the warp-weighted loom. It is unknown whether ribbon weaving first developed and the system was then further developed for large-scale fabrics or vice versa. Tablet weaving emerged in Central Europe in the Middle Bronze Age – a technique that made complex patterns possible and that experienced its first heyday in the Hallstatt period.

After the invention of weaving in the Neolithic period, different methods were used to decorate fabrics. A creative repertoire of applying and inserting decorative elements was developed. Sewing on elements and designs with floating weft threads are techniques that had already been applied in the Late Neolithic and the Bronze Age. A special fondness for striped and checked fabrics can be observed in the Iron Age. Even sophisticated

542 *Cf.* Bender Jørgensen 2013b. – Rast-Eicher 2005. – Soffer *et al.* 2000.

543 *Cf.* Rast-Eicher and Bender Jørgensen 2013. – Ryder 1982; 1992.



techniques such as spin patterns were very popular with creative Hallstatt Period craftspeople. In Central Europe, these patterning techniques have their roots in the Bronze Age, as does both dyeing and twill. First experiments to expand the loom with multiple shafts for the manufacture of twill are known from Middle Bronze Age finds in the salt mines of Hallstatt. Complicated weaves on multi-shaft looms were particularly popular in the Hallstatt period to produce high quality fabrics with ever finer yarns. At the end of the Iron Age, tabby became popular again, woven on simple, single-shaft looms. Compared to the Hallstatt period the number of loom weights in the settlements decreases, probably due to the introduction of a new type of loom in Central Europe – the two-beam loom.

Fig. 140. General development of weaving and decoration techniques from the Bronze to the Iron Ages in Central Europe.

Noticeable improvements in preparing the raw material and in spinning itself – especially in the yarn qualities achieved – went hand in hand with the refinement of weaving techniques from the Neolithic to the Iron Age. In the Bronze Age, wool fleece was taken from primitive sheep and usually processed complete with kemp and woolly hair. Yarns made of well prepared wool fleece can be observed in the Hallstatt period. The fine, well-sorted and combed fibres lie parallel like a combed top (*Kammzug*) and thus give the yarn a certain shine. Only with thread material of such fine quality could spin- or shadow patterns be produced in the Hallstatt period.

This brief overview of prehistoric textile craft (Fig. 140) shows that we need to move away from a primitivist perspective. Was it only the lonely textile worker in her dark cabin who created all these products, or can we paint a different picture of the craftspeople involved in textile production? How was textile craft organized?

Following a general theoretical model by Eva Andersson-Strand from the Centre for Textile Research in Copenhagen, the level of textile production (Fig. 141)[544] can be seen as developing from household production in its simplest form over various stages of specialization until mass production began. Household production, however, never lost its importance. The following considers, whether this theory can also be applied to the prehistory of Central Europe. For this purpose, the definition of Andersson-Strand will be cited in the introduction of each section, followed by a discussion of the level of development considered possible for the prehistory of the study area.

In the absence of written sources, only a synopsis of the various archaeological sources, the finds from settlements and graves in Central Europe as well as our knowledge about the social organization at the time, can provide information on this subject. The textiles themselves provide important information on the state of development of textile craft.

[544] For definitions of *household production*, *household industry*, *attached specialist production* and *workshop production for trade*, see Andersson 2003a, fig. 1.

Household Production	Household Industry
• Production solely covers the household's own needs • Household members possess knowledge and skills needed • Raw materials commonly accessible • Knowledge of manufacturing processes widespread	• Production scale beyond needs of producers • Organized at household level • Surplus used for trade, exchange or tax • Production when spare time is available • Work not full time occupation
Attached Specialist Production	**Workshop Production for Trade**
• Production by specialists • Craftsmen supported by and dependent on patron • Work main occupation on full time basis • Specialist's skills anhanced by full time occupation • Better quality products • High quality products as desirable gifts • Control of skills add to patron's power	• Direct production for market • Items practical and standardised • Production volume high • Great demand for products • Work full time occupation • Time costs per item reduced to minimum

Fig. 141. Characteristics of household production, household industry, specialization and mass production from Eva Andersson-Strand.

1.1 Household production

As defined by Eva Andersson-Strand household production is characterized by the fact that goods are primarily produced for domestic requirements (Fig. 141). The demand for raw materials is ensured by home production or trade with near neighbours. Household production also assumes that craft knowledge and skills are widespread within the community. Textile craft was probably organized as household production in the rural village communities of Stone and Bronze Age Central Europe[545]. Textile tools appear on a regular basis in households of the Linear Pottery Culture by *c.* 5000 BC. Bronze Age settlements in Switzerland were examined in detail and the location of textile tools such as spindle whorls, loom weights or needles was mapped. In the Late Bronze Age villages of Greifensee-Böschen, Eschenz-Insel Werd and Zug-Sumpf, several houses with loom weights were detected. Researchers interpret these findings to mean that this kind of work took place in a domestic setting and there are no signs yet of a significant specialization in weaving[546].

545 *Cf.* Médard 2012, 370.

546 After Rast-Eicher and Reinhard 1998, 286.

The rather simple textiles of the Stone and Bronze Age, many of which were made in tabby weave, suggest that these basic techniques have been commonly mastered and practiced. Like other things in daily demand – food sourcing, making and repairing tools *etc.* – textiles were probably mostly made by those persons or households who needed the products. The farmhouses and village communities were essentially self-sufficient in those early periods. Economic models could be developed based on outstanding research on Swiss lake dwellings from the Stone and Bronze Age, which show how the annual work of farmers might have looked and how self-sufficiency worked[547].

Household production in the sense defined above was, of course, widely distributed throughout prehistory, the Middle Ages and the modern era, especially in rural areas, in addition to other forms of production.

1.2 Household industry

Household industry is a further stage of production (Fig. 141). According to Andersson-Strand, household industry is still organized at the level of a household, but a surplus is produced that goes beyond mere subsistence. The additional goods emerging from household industry can then be used for exchange and trade. Craft production is not conducted on a full-time basis, but production is slotted in when time can be spared. How can this model be applied to craft production in prehistory? Economic and social data emerging from certain prehistoric societies are important: from the Bronze Age in Central Europe at the latest, trade and exchange with a range of different goods is attested. There are various gradations of trade and exchange, from barter trade within the neighbourhood to long-distance trade[548]. Especially in terms of bronze and its components copper and tin, as well as in terms of the metal products produced from it, 'real' trade is conceivable, that is the exchange of standardized goods, which can be ensured by casting bronze products. The Early Bronze Age ring

[547] See Schibler *et al.* 1997.

[548] See theories and models in Lang and Salač 2002.

and rib ingots (Fig. 142) such as the ones from Perschling in Lower Austria[549] are frequently found in large numbers – up to several hundred items in a single find. These appear in identical forms all over Central Europe and a kind of weight standardization could even be detected. From an economic point of view is therefore possible to speak of a means of payment before money. Traders, who moved from village to village with their goods, were probably a common sight from the Early Bronze Age onwards. Archaeologists are even able to reconstruct trade routes.

Societies became more and more stratified during the Bronze Age, although the roots of this social development can be traced back to the Copper Age. From the Early Bronze Age onwards, craftspeople, farmers and warriors can be clearly differentiated in Central Europe[550], since specific objects were found in their graves. Traders, for example, can be indirectly inferred through trade goods, such as Baltic amber. According to these economic and socio-political considerations, it is quite conceivable that Bronze Age textiles produced in household indus-

Fig. 142. Hoard of ring ingots from the Early Bronze Age settlement of Perschling, Austria. The approximately 250 bronze ring ingots weigh 51 kg altogether.

549 Krenn-Leeb 2006, fig. 6–7.

550 For the social structure of the Bronze Age and the economic factor bronze, see Kristiansen and Larsson 2005. – Urban 2000, 140–142. – Vandkilde 2007.

try were traded via a bartering system[551]. The clearest evidence for this assumption comes from the site Hallstatt in Austria's Salzkammergut region. Salt mining is attested in Hallstatt[552] from the 15th century BC, the Middle Bronze Age, at the latest. It is the oldest salt mine in Europe, and operates to this day. The intensive research on mining (see pages 304–307) brought clear evidence that the entire mining process was highly organized, and that a strict division of labour prevailed. For example, there were miners specialized in breaking salt and others for transporting it out of the mines. The current state of research suggests that at the salt mining centre of Hallstatt, large parts of the population were directly involved in the mining operation and thus their working capacity for the manufacture of other everyday products was probably minimal during the Bronze and Iron Ages. In addition, space for arable land is limited by the topographic position of the site in an alpine area at a lake surrounded by steep slopes (Fig. 143).

It is therefore to be expected that food and everyday goods that were manufactured in other contemporary settlements, as well as some of the mining equipment, was traded in and brought to Hallstatt from the surrounding areas in exchange for salt. For the time period between the 15th and 12th century BC, there is evidence that wooden handles of picks used in the Hallstatt salt mine Christian-von-Tuschwerk came from outside the valley or region[553]. Wood analysis demonstrates that the commonly used knee-wood handles (*Knieholzschäftungen*) were made of oak wood derived from the northern Alpine foreland (with a southern border along the north shores of Traunsee and Attersee lakes), a distance of at least 40 km to Hallstatt.

It is also quite conceivable that many of the excellently preserved textiles found in the salt mines were not produced in Hallstatt itself, but were imported instead. The manufacturing sites may have been located in the Upper Austrian Alpine foot-

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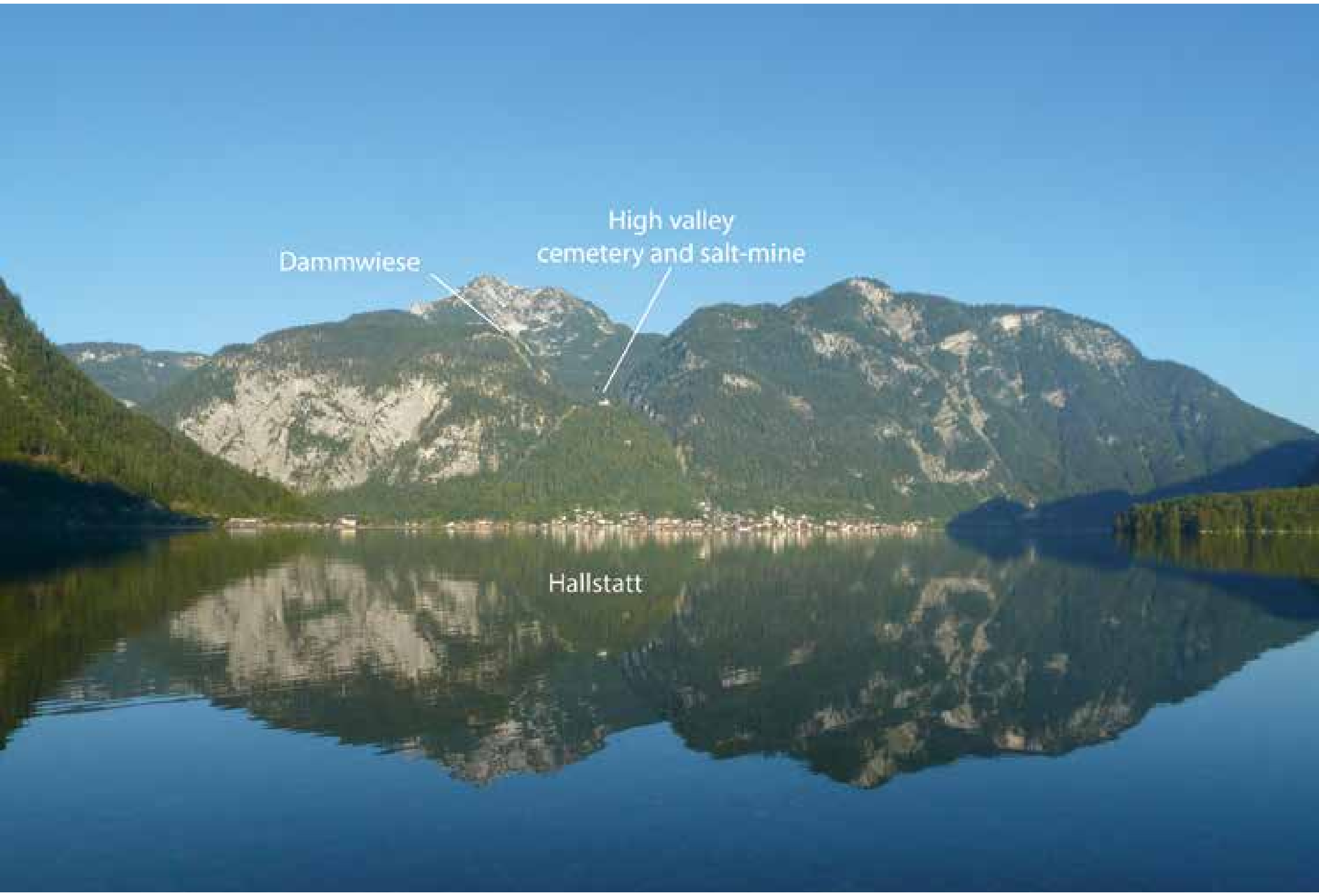
551 Intensive textile industry including trade is known in the Mediterranean region at the same time, for instance the palace economy at Knossos, Greece. *Cf.* Harris 2012. – Killen 2007. – Militello 2007.

552 For a comprehensive discussion, see Kern *et al.* 2009a. – Kowarik and Reschreiter 2011.

553 Grabner *et al.* 2007.



hills. Plenty of resource-rich areas with pastures for sheep or arable land for growing flax and dye plants are located there. In the future, isotope analysis of wool[554] may substantiate evidence for the circulation of textiles and the raw materials used in their making. Household industry is the most likely production level, in particular for the Bronze Age.

Fig. 143. Hallstatt in Austria, topographic position of the salt mines and the cemetery.

[554] For finds from Denmark and methods of analysing, *cf.* Frei *et al.* 2009. – von Holstein 2013. – Frei 2013.

1.3 Attached specialist production

The next level of production is specialization, of which there are different forms. Specialization may include individuals, groups of people, villages or regions. These may provide special products based on particular raw materials, local conditions or manual skills. Specialization can be carried out part-time or on full-time basis, throughout the year or seasonally[555].

Eva Andersson-Strand defines specialist production for textiles as follows (Fig. 141): The work of the specialist is done on a full-time basis, and technical skills and knowledge are extended in order to create higher quality products. The persons involved in specialist production are often dependent on a patron, who feeds and supplies them. Goods produced in this way can now also serve as precious gifts or for exchange. A further feature of this production level is the complete control and authority over the craftsmen the patron exercises, including their expertise and the training of further specialists working for him.

In the Mediterranean area, the available written sources attest to such specialization from quite early on. Administrative records of the Mycenaean kingdoms of Crete and the Greek mainland (15th to 12th centuries BC), written in Linear B script on clay tablets[556], yield information on two broad categories of textiles. First are fine cloths produced in specialist weaving workshops, made with high levels of labour division within the workforce. Second are domestically produced textiles, acquired by the palaces through taxation. Similar systems were also in use in archaic Greece, where within the household (*oikos*), the residence of an aristocrat, high status women and their female servants (*amphipoloi*) were responsible for weaving[557]. Textile production of a household played an important representative role for aristocrats, but clothing was also a valuable asset for gift-giving and

555 For theoretical considerations on the different forms of specialization, see Costin 1991, 4–43.

556 *E.g.* from Pylos: *pe-ki-ti-ra* 'combers of wool'; *ri-ne-ja* 'linen workers'; *a-ke-ti-ri-ja* 'decorators of cloth'; *a-pu-ko-wo-ko* 'head band makers'; *ra-pi-ti-ra* 'sewing woman'; Del Freo *et al.* 2010. – Killen 1985; 2007. – Militello 2007. – Rougemont 2007, 48.

557 For considerations on the *oikos* economy in archaic Greece and the importance of textiles, see Barber 1991, 283–298, Wagner-Hasel 2000, 105–107 (textiles as mementos and duties), 141–148 (weaving duty).

votive offerings to the gods. High levels of specialization in the area of the Villanovan and Etruscan civilizations can be inferred from various finds and features. These include the textiles of Verucchio[558], the special grave goods such as spindles and distaffs made from precious materials such as bronze, silver, amber and glass, as well as depictions of textile work, exemplified by the *tintinnabulum* (bronze sheet rattle) from Bologna (Fig. 147) or the wooden throne from Verucchio. These finds substantiate the idea that women with high social status were practicing textile craft (and had the permission to do so)[559]. Such developments occurred under the patronage of elites and were motivated by the need to produce status markers and prestige goods like textiles. The display of luxury goods as seen in the archaeological record is closely mirrored in the behaviour of warrior aristocracies in the Homeric poems, reflecting the ideological system underlying the behaviour, beliefs and values of Orientalizing Mediterranean elites. In Italy between the 10th and the 7th century BC, part of the textile production shifted from making subsistence products to the manufacture of non-essential, luxury and surplus goods.

What was the situation in Central Europe? Is it possible to assume a higher production level than household production or household industry in pre-Roman times? Consulting the archaeological material, finds and findings of the Early Iron Age in Central Europe appear more than striking[560]. In contrast to the Bronze Age, elaborately produced fabrics are now preferred over simpler weaves. These are high-quality fabrics, made with large expenditure of time and employing special skills. Sometimes they are very complicated pieces whose production exceeded the abilities of the average craftsperson and required a specialist. Examples include the textiles in the princely grave of Hochdorf or those from the Early Iron Age parts of the Hallstatt salt mines[561]. One can find an incredible creativity, reflected by the use of different patterns, weaves (see chapter

[558] *Cf.* von Eles 2002, 192–234. – Stauffer 2012.

[559] *Cf.* Gleba 2007; 2008a, 190–194; 2013, 2–3, 9–11.

[560] *Cf.* papers in Gleba and Mannering 2012. – Grömer 2012. – Smolenice-Molpír: Belanová-Štolcová 2012, 312.

[561] Hochdorf: Banck-Burgess 1999, 2012a. – Hallstatt: Grömer 2013, 81–87.

B) and colours. We know complicated tablet-weaves, complex weave types such as diamond twill, dyeing with imported dye-stuffs such as insect dyes. The fineness achieved in the yarns and fabric density evidence an enormous amount of work. This picture of Hallstatt textiles leads one to think of a specialized form of production, because the production of such pieces requires persons who had the time, skills and know how to create these representative products. The precious textiles must have been valued and appreciated within the community, but in addition, resources to produce them must have existed (especially a surplus of work time, but also other expenses for imported dyes, *etc*.). However, this can only be seen in the context of a complex social development that allowed or encouraged this more elaborate work on the production of textiles.

For the Central European prehistory, the following scenario is possible: the Early Iron Age was marked by great social changes[562], caused, in part, by the availability of a new material – iron. Not only were the various craft technologies affected by the changes, but the entire social fabric of the time. The society was hierarchically structured even more than before. Those at the top of the hierarchy can be traced in 'princely tombs' and represented themselves by an extravagant lifestyle. This is likely to have favoured the splendour of the textile art of the Hallstatt Culture, which has to be interpreted in the context of the contemporary culture of representation. Again, the precious textiles from the princely grave of Hochdorf can be quoted as an example. Perhaps status definition and the visualization of social status was achieved through textiles and clothing. Contemporary archaic Greek epics attest that the visual potency of a person '*charis*' is also tied to their clothing[563].

It is therefore quite possible that in the Central European Hallstatt period we see for the first time the products of specialists in the textile crafts, even if this is supported only by the textiles themselves, and not by written sources. The patrons mentioned in the definition of specialization given by Andersson-Strand, for which such quality products were made, could have been

562 Kristiansen 1991, 19–20. – Urban 2000, 227–229. – Vandkilde 2007.

563 Wagner-Hasel 2000, 152–163; 2006.

members of the Hallstatt period nobility. Therefore, we can suggest a specialized textile production, especially for the Early Iron Age elite, and possibly for the wealthy as well[564]. To what extent an exchange of products and labour took place within the community, or whether a supra-regional resource exchange existed, is not clearly ascertainable for the textile sector. Nor do we know whether the relevant specialists were completely exempt from every-day activities and other duties within the community. However, the complex textile products are a clear indication that a non-negligible expenditure of working time, highly specialized knowledge and expertise was invested in their production in the Hallstatt Culture.

It is also possible that some of those products were made in the surrounding countryside, while others had to be imported over long distances (which may be verified by the use of exotic raw materials such as dyestuffs or exotic weaving or patterning techniques and designs). Textiles circulated not only through trade but were also an important part of the gift exchange system and formed an essential part of the dowry[565]. Gift exchange was practiced among the elite members of communities and involved luxury items, including textiles, garments and jewellery, as well as implements that held symbolic values, such as spindles and distaffs. Unfortunately, it is not possible to estimate the quantity of production that was the work of specialists and the quantity that was carried out in household production. Both modes of production developed alongside each other. There is little doubt that textile manufacture was practiced at all levels of society and was one of the most labour-intensive occupations.

[564] See also Rast-Eicher 2008, 190.

[565] For exchange, textile trade and gift giving see Gleba 2013, 12–14. – Mauss 1954. – Wagner-Hasel 2006.

1.4 Workshop production and large-scale industry for trade

The last stage of specialization conceivable for prehistory is workshop production for trade and large-scale industry for trade. According to Andersson-Strand (Fig. 141), the modes of workshop production turn out standardized, simple and mass-produced goods quickly and directly for the market. This is based on a developed economy with solid customer circles. The goal is a large output of goods produced with the cost per unit reduced to a minimum by production efficiency. For the next step in textile production, large-scale industry for trade, production takes place on a full-time basis and exclusively for sale. It requires capital investment and extensive product distribution.

Certainly, the latter production form is attested in the Roman period[566]. Earlier evidence for workshop production is known from the Mediterranean world. The textile production in the Mycenaean Palaces of the 14th and 13th centuries BC seems to have been state-controlled. In the Linear B tablets of Crete, flocks of hundreds of ewes, rams and wethers are mentioned, with a calculated amount of 100,000 animals under palatial control. This means a total of about 10,300 units of wool per year, *i.e.* 52,000 kg, processed by thousands of workers, and a production of about 5,000–7,000 pieces of cloth, 10 kg each.[567]

Is there evidence for workshop production in prehistoric Central Europe? In Austria, we know of more than 600 textiles from the La Tène period salt mines at Dürrnberg near Hallein[568], plus other finds from graves at various sites[569]. The research on salt mine textiles from Dürrnberg revealed that the fabrics differ greatly from those of Early Iron Age Hallstatt.

The Dürrnberg textiles no longer show that exuberant creativity of fabric qualities, weave types and patterns that characterize

566 *Cf.* Bender Jørgensen 1992, 130–133. – Wild 2003.

567 See Killen 1985, 108.

568 Von Kurzynski 1996 and catalogue in Stöllner 2002. – See von Kurzynski 1996, 35–36, for notes on standardization.

569 Grömer 2012.

the textiles from Hallstatt. Simpler, clearer forms now prevail: patterns are mostly stripes (vertical warp stripes), fabric structures include tabby weaves, basket weaves and, less frequently, simple variants of twill[570]. Even with the thread diameters and weave densities, a certain standardization can be noted. These are still high quality products, but compared with the textiles of the Hallstatt period they can be produced faster and more easily. A loom for weaving tabby is set up more quickly than one for weaving twill, and weaving tabby is faster, as the specific sequence of lifting and lowering the heddle rods does not have to be considered. The same is true for the patterns: vertical stripes arise during weaving without further action when the warp yarns are defined and set accordingly. When producing checked patterns, the weft yarns have to be counted and groups alternated. The differences in the textiles are remarkable, as the finds from Hallstatt and Dürrnberg originate from the same region (they are 55 km apart from each other as the crow flies), and the settlements and salt mines from Dürrnberg are just slightly younger than those of Hallstatt and also partly overlap in terms of chronology. In addition, at both localities, the same preservation conditions are present in the refuse layers of the salt mining operation. Wealthy communities who were heavily involved in the European trade and maintained cultural contacts in all geographic directions inhabited both sites.

It is apparent from the Dürrnberg textiles that an efficient production with a maximum output was desired, although a few specially decorated pieces are amongst the finds, too. The special structure of the Dürrnberg production and trade centre[571] has probably favoured this mode of production. The Dürrnberg encompassed, apart from a well-organized mining industry, separate workshops for various products (*e.g.* wood and bronze objects, glass and iron goods, jet arm rings *etc.*) in the settlements. An extensive net of economic connections enabled the distribution of the goods produced. If one compares all of the recorded textiles of the Late Iron Age from Austria, Moravia and Slovakia[572] to the research results from Dürrnberg, the result is a uni-

570 Stöllner 2005, fig. 6.

571 Brand 1995. – Stöllner *et al.* 2003, 123–126, 152–155.

572 Belanová 2005; 2007; 2012. – Grömer 2012.

form impression, despite different contexts and different uses of individual pieces. This development towards standardized mass-produced goods with only a few different types of weaves (usually simple tabby weave, standardized weave densities and thread sizes) is also observed in the La Tène grave finds of the area. A similar picture emerges from the textiles found in Switzerland dating to the middle La Tène period[573].

Furthermore, standardization and functionalization are both apparent from the work equipment. From the La Tène period onwards, more and more spindle whorls were made from broken pieces of pottery that were rounded and pierced (Fig. 39). The individual, creative forming and ornamentation of a whorl is no longer important. Instead, the purely functional aspect of the spindle is emphasized, and this is a further indication of mass production. Standardization of tools indicates that they were produced on a larger scale than before (and less carefully). This corresponds to the intensification of textile making activities and a demand for the appropriate equipment. In addition to the standardization of the old implements, certain new tools make their appearance during the La Tène period, indicating new techniques. Iron shears are one example, revolutionizing the way raw material was collected, maybe hand in hand with the development of sheep breeds with non-shedding fleece[574].

Similar dynamics are noticeable in other material groups or crafts of the La Tène period. Pottery, for example, which like the textile industry is usually considered a conservative craft, was also produced within the household from the Stone Age onwards. Archaeological ceramic analysis targets various elements such as the shape of the vessels, the mode of decoration and the production technique. These analyses form the common 'tool-kit' for archaeologists, as ceramics are, at least numerically, the most significant finds in Central European prehistory. Pottery production in the Hallstatt period in Austria and its neighbouring countries can be described as labour-intensive individual production, which, in comparison to Bronze Age pottery production, looks slightly cluttered and 'baroque' in both shape and or-

573 Rast-Eicher 2008; 2012.

574 *Cf.* Gleba 2013, 6. – Ryder 1992, 137.

Fig. 144. Ceramics of the Early Iron Age (1, hand-made) and the Late Iron Age (2, wheel-thrown).

namentation, but also of high quality[575]. The potter's wheel was introduced from the middle of the La Tène period,[576] and the mode of production shifted from household to mass production. This had notable repercussions on pottery forms and decoration (Fig. 144). Vessel forms that could be quickly and easily fabricated using the potter's wheel were now preferred. Decoration is limited to grooves, lines and ridges that were worked into the surface whilst turning the wheel. The vessels were thus standardized and functional, and especially in the case of fine goods, of excellent quality. A similar development can also be observed for the ancient art of wood craft, as woodturning comes up in the La Tène period.

Is this a manifestation typical of the Late Iron Age period? Had society developed so far, have crafts become so specialized, that even traditional household techniques like pottery and textile manufacture had changed to mass production?[577] The full transition to mass production would mean the separation into different professions with full-time employment in the various sectors, specialized workshops, *etc*. The archaeological sources can provide no certainty, but it is conceivable that in the La Tène

575 For a short introduction to the pottery of the Hallstatt period, see Nebelsick *et al.* 1997, 65–70. For representative pottery, see 116–122. – Urban 2000, *e.g.* 281, fig. on 271.

576 *Cf.* Neugebauer 1992, 94–98.

577 See also the reflections in Rast-Eicher 2008, 188–189. – For specialization and mass production in pre-Roman Italy, see Gleba 2007, 75.

period in Central Europe the first manifestations of workshop production for trade emerged besides the household industry. The Romans expanded this mode of production towards a large-scale industry for trade as they expanded their Empire around the turn to the Common Era[578].

The Roman trading outpost at Magdalensberg in Austria (*c.* 50 BC to 50 AD)[579] is located at the interface of the Central European Iron Age and the Roman advance towards the Danube in what later became the province of Noricum. Here, merchandise was sold in wholesale quantities from all over the Mediterranean. In addition, workshops organized by the merchants' staff, or at least in close cooperation with the workshop owners, were occupied with the manufacturing of different goods. The textile tools and lead tags (*tesserae plumbeae*) found at the site give a good glimpse of the textile workshop production and trade in this period. There is a very extensive collection of textile implements from the site, which represents virtually every aspect of manufacture. The large level of the production can also be seen by the total amount of tools, *e.g.* 1,070 spinning implements (including spindle whorls, hooks, distaffs and complete spindles), about 200 loom weights and 373 needles. As sewing or mending was one of the main activities in the Magdalensberg textile business, shears were also needed for tailoring; the presence of tailors is confirmed by graffiti on the walls of a warehouse and on lead tags (*e.g.* the term *sutor* on graffiti with reference to cloaks). As suggested by Kordula Gostenčnik the number of textile tools implies that many of the inhabitants on the Magdalensberg must have earned their living working in the textile business.

In the Roman Empire, mass production can be found in all the provinces, with special products of each region for the Roman market. For the province of Noricum, today in Austria, different wool fabrics and high quality iron products are mentioned in written documents. According to Diocletian's Edict on Maximum Prices[580], dating to AD 301, various wool garments were exported from Noricum; specified are *birrus Noricus den. decem*

578 *Cf.* Gostenčnik 2012. – Möller-Wiering and Subbert 2012, 169–170. – Wild 1970.

579 *Cf.* Gostenčnik 2013, 62–66, fig. 4.2–4.5.

580 Lauffer 1971.

milibus; banata Norica duplex den. viginti milibus; fedox Noricus optimus den. decem milibus; singilio Noricus den. mille quingentis (Ed. Diocl. 19, 47.55.59; 33,24). In listing the enigmatic *banata* and *fedox*, the Edict echoes old regional traditions of clothing.

For the Iron Age of course we do not know, what percentage of the required textiles were made by specialists or in mass production. Here it can only be said that in addition to the household industry attested in prehistory, higher levels of production are also conceivable.

To sum up, textile crafts were focused on the domestic sphere in the Neolithic and Bronze Age. As items of consumption, textiles ranged from the necessary to the luxurious. The production of staple goods was localized in household production from the Neolithic to the Iron Age. An interesting aspect is the production of luxury items for status display and gift exchange (maybe long-distance) between elites[581]. This led to the development of highly specialized and skilled craftsmanship and an exchange network, which included resources and object circulation (*e.g.* special dyestuffs such as insect dyes, tablet woven items, fine qualities and patterned items). Hallstatt period textiles such as examples from Hallstatt or Hochdorf have to be seen as the work of specialists. In the Late Iron Age, the demand for goods by a growing population in large centralized settlements led to a development of more organized modes of production, such as workshop production, and trade in these necessary products[582].

[581] Wagner-Hasel 2000 and 2006.

[582] *Cf.* Gleba 2013, 1.

6. FUNCTIONAL ASPECTS OF TEXTILES

6.1. bekleiden – verdecken – verhüllen. Kontextualisierung und Theoriebildung zu eisenzeitlichen Grabtextilien

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bekleiden – verdecken – verhüllen

Kontextualisierung und Theoriebildung zu eisenzeitlichen Grabtextilien

Karina Grömer

Zusammenfassung

Die Interpretation von Textilien aus eisenzeitlichen Gräbern ist teils komplex, da die Funde verschiedene Deponierungsumstände widerspiegeln. Es können funktionale, repräsentative wie auch rituell/sakrale Gründe genannt werden. Wenn ein Textil funktionaler Teil eines anderen Artefakts (z. B. Textilinnenfutter einer Schwertscheide oder Unterfütterung eines Blechgürtels) ist, dann wurde es nicht bewusst als Textil im Grab niedergelegt. Selbiges gilt auch für die textilen Füllungen der Hohlarmreife. Andererseits wurden Textilien auch zur Ausschmückung der Grabkammer verwendet, wie das bekannte Beispiel von Hochdorf zeigt. Körpergräber wiederum können wesentliche Hinweise zur Kleidung der Verstorbenen geben, wobei hier jedoch diskutiert werden muss, ob dies ein spezielles Totengewand repräsentiert, oder Kleidung, die auch von den Lebenden getragen wurde.

Textilien können in Gräbern auch eine rituell/sakrale Bedeutung haben. Gewebe dienten als Grabbeigabe, in ihrer Wertigkeit wohl gleichbedeutend mit Bronzegefäßen oder Waffen. In der Eisenzeit können wir einen speziellen Ritus fassen, das Umwickeln von Grabbeigaben und/oder des Leichnams bzw. der Überreste einer Brandbestattung. In diesem Beitrag werden auch verschiedene Theorien diskutiert, die sich auf diese Funde beziehen. Dennoch ist es wesentlich zu betonen, dass die religiösen Vorstellungen und Weltbilder, die hinter diesen Riten stehen, aufgrund des Fehlens schriftlicher Quellen wohl nicht endgültig entschlüsselt werden können.

Summary

Interpreting textiles from Iron Age graves is a challenging task. The finds reflect different reasons why woven fabrics can be found in a burial. Namely these can be functional, representative as well as ritual. Firstly, if a textile is a functional part of another object (e.g. a lining of a scabbard or a textile lining of a belt), it was not placed intentionally in the grave. The same can be said for the textile filling of hollow anklets. On the other hand, textiles were used to decorate the burial chambers, as we know from the example from the princely tomb at Hochdorf. Inhumation burials provide us with indications of garments worn by the deceased. Therein it is important to discuss, whether the garments are specific burial garments or if they were worn in daily life as well.

Textiles in graves can also have a ritual meaning. Textiles served as burial gifts as well, side by side with other precious grave goods such as bronze vessels or weapons. For Iron Age contexts, a specific ritual could be identified, namely the wrapping of grave goods and/or the deceased or the cremated bones. Various theories will be discussed to explain this kind of archaeological evidence. After all, it is difficult to explain the religious system behind those customs due to the lack of written sources.

Im Fahrwasser der spektakulären Textilfunde aus dem berühmten Fürstengrab von Eberdingen-Hochdorf (Banck-Burgess 1999) richtet sich seit nunmehr fast 20 Jahren der Blick der mitteleuropäischen Forschung auch immer mehr auf die unscheinbaren Textilreste aus Grabkontexten. Stoffe finden sich nicht nur anhaftend an metallenen Trachtbestandteilen, sondern auch an Beigaben, an Bronzegefäßen, aber vor allem auch an Schwertern oder Messern. Die Textilien konnten sich dabei durch die Metallkorrosion erhalten, sind jedoch nur sehr kleinstückig und meist ist die Farbinformation verloren. Der Zustand der Textilien reicht von organischer Erhaltung mit gut erkennbarer Faserstruktur bis zu fast vollständig vergangenen Geweben, bei denen nur noch ein Abdruck in der Rosthülle des Metallobjektes sichtbar ist. Es können jedoch auch in diesen Fällen noch wertvolle Informationen gewonnen werden (Mitschke 2001: 32–46).

In der österreichischen Textilforschung sind für die Eisenzeit vor allem die Gewebefunde aus den Salzbergwerken Hallstatt (Grömer et al. 2013) und Dürrnberg (von Kurzynski 1996) sehr prominent, weniger bekannt ist noch immer, dass auch in eisenzeitlichen Gräbern (Grömer 2014: Katalog 192–220; Müllauer, Ramsl 2007) etliche Textilreste entdeckt wurden, die unser Verständnis zur textilen Kultur Mitteleuropas wesentlich ergänzen.

Die Textilforschung bedient sich heute zahlreicher Untersuchungsmethoden mittels Rasterelektronenmikroskop, Mikrostratigrafie, Wollfeinheitsmessungen, 3D-CT etc., um Textilreste zu analysieren. Diese modernen wissenschaftlichen Analysemethoden erlauben dabei tiefere Einblicke, als dies noch vor einigen Jahrzehnten möglich war – als selbst Faseranalytik an mineralisierten Objekten nicht durchgeführt werden konnte. Die wichtigsten Daten, die auch an mineralisierten Textilien erhoben werden können, sind etwa die Bindung, Gewebedichte, Fadenstärke, Garndrehung etc. (siehe Grömer 2014: 9–16; Walton, Eastwood 1988).

Kontextualisierung

Derartige technische Daten wurden bereits in den 1980er und 1990er Jahren immer wieder aufgenommen und dann als Analysereport relativ unreflektiert als Anhang in wissenschaftlichen Arbeiten beigefügt (z. B. Textilien aus dem Gräbern vom Dürrnberg: Hundt 1974). Vor allem der Fund von Hochdorf, aber auch die Forschungen an frühmittelalterlichen Gräberfeldern Süddeutschlands gaben den Ausschlag, diese textiltechnischen Daten auch mit dem Gesamtkontext zu verbinden. Vor allem die Blockbergungen kompletter Gräber (z. B. Nowak-Böck, von Looz 2013; Peek 2013) bringen dabei erstaunliche neue Erkenntnisse zum Grabbrauch und zur Bedeutung der organischen Materialien wie Textil, Leder, Holz, Fell etc., die eine wichtige Erweiterung unserer Kenntnis

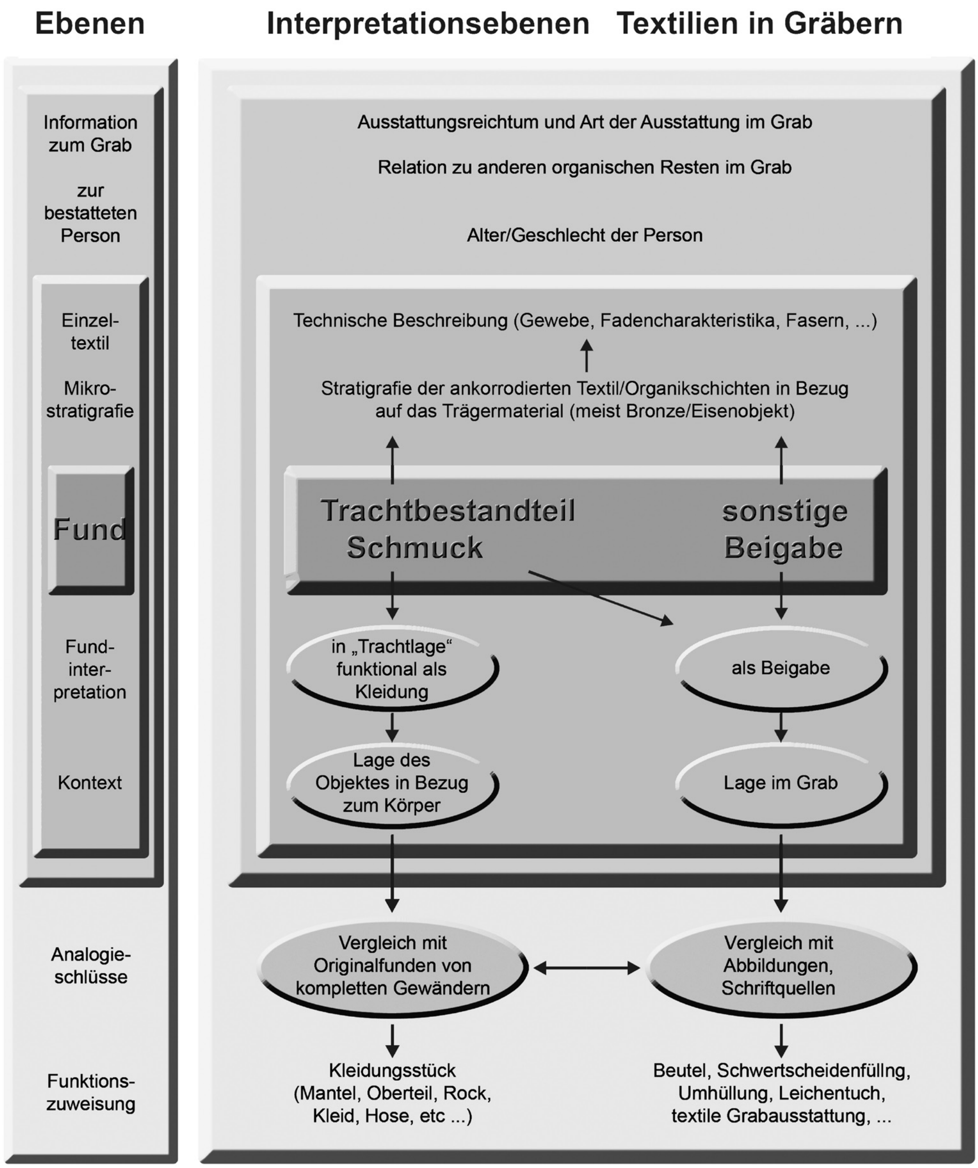

Abb. 1: Schema zur Kontextualisierung von Grabfunden (nach Grömer 2014).

der materiellen Kultur der Ur- und Frühgeschichte darstellen.

Bei den eisenzeitlichen Grabfunden mit Textilien aus Österreich, die im letzten Jahrzehnt untersucht wurden, handelt es sich großteils um Altfunde, was für die Kontextualisierung eine Herausforderung darstellt. Auch bei neuen Ausgrabungen wurden in Ostösterreich bisher aus logistischen Gründen keine Blockbergungen vorgenommen, daher wird hier vom Einzelfund ausgegangen, um Textilfunde aus Gräbern in nachvollziehbarer Weise zu kontextualisieren.

Kontextualisierungsmethodik bei österreichischen Funden

Die Methodik, nach der hier gearbeitet wird (Grömer 2014: Abb. 66), hat einen pyramidalen Aufbau (Abb. 1). An dessen Spitze steht der Einzelfund, also ein Schmuckstück, ein Trachtbestandteil oder eine sonstige Grabbeigabe (z. B. Messer, Bronzegefäß etc.), vom dem aus sich alle

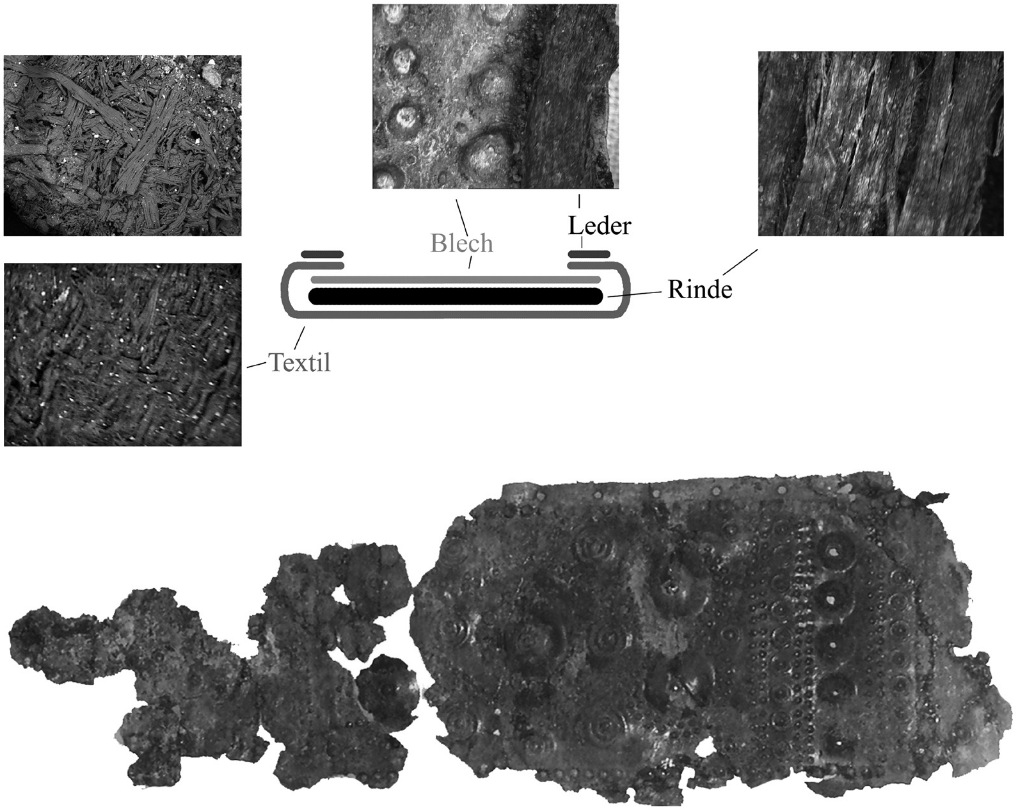

Abb. 2: Berg/Attergau: Mikrostratigrafie der organischen Reste beim Blechgürtel (Grafik: K. Grömer, © BDA).

weiteren Analyse- und Interpretationsebenen aufbauen. Diese Ebene – der Fund – ist der einzige wirklich objektive Level.

Der nächste Schritt ist die Analyse, die technische Beschreibung, Faseranalyse und Mikrostratigrafie. Es ist hier wichtig zu betonen, dass dies bereits eine erste Interpretation darstellt. Manche Gegebenheiten können unter Umständen von verschiedenen Wissenschaftlern unterschiedlich gesehen werden (etwa die Stellen, die man auswählt, um die Fadenstärke oder Gewebedichte zu messen).

Auf derselben Ebene muss der Kontext beachtet werden. Als Beispiel möge eine Fibel oder Gürtelschließe dienen: wesentlich ist die Beobachtung, ob diese in funktionaler Trachtlage im Grab am Körper des Bestatteten liegt oder nicht. Wurde eine Gürtelschließe etwa bei den Beinen abgelegt, sollte diese als Grabbeigabe betrachtet werden. Anhaftende Gewebereste sind dann nicht automatisch zur Kleidung zu zählen, sondern können ggf. auch Umhüllungen dieses Gegenstandes sein. Zudem ist es wichtig, die Positionierung zum Körper des Bestatteten zu beachten, ob das Textil an der dem Körper zu- oder abgewandten Position anhaftet.

Im nächsten Schritt sollten alle Beobachtungen in Informationen zum Grab und zur bestatteten Person eingebettet werden: zu Sozialstatus, Geschlecht, Alter etc.

Erst zuletzt – um die einzelne Arbeitsschritte methodisch sauber voneinander zu trennen – können Vergleiche mit bildlichen, möglicherweise schriftlichen Quellen sowie mit komplett erhaltenen Gewändern angestellt werden, um so eine Interpretation der ehemaligen Funktion des Textilrestes zu erhalten.

Die pyramidenförmige Struktur des Schemas soll auch die Tatsache demonstrieren, dass, je weiter man sich von der Spitze (also vom Fund selbst) wegbewegt, desto mehr Diskussion geführt werden muss, um die Entscheidungen zu erklären, die zu einer Interpretation der Funde führen.

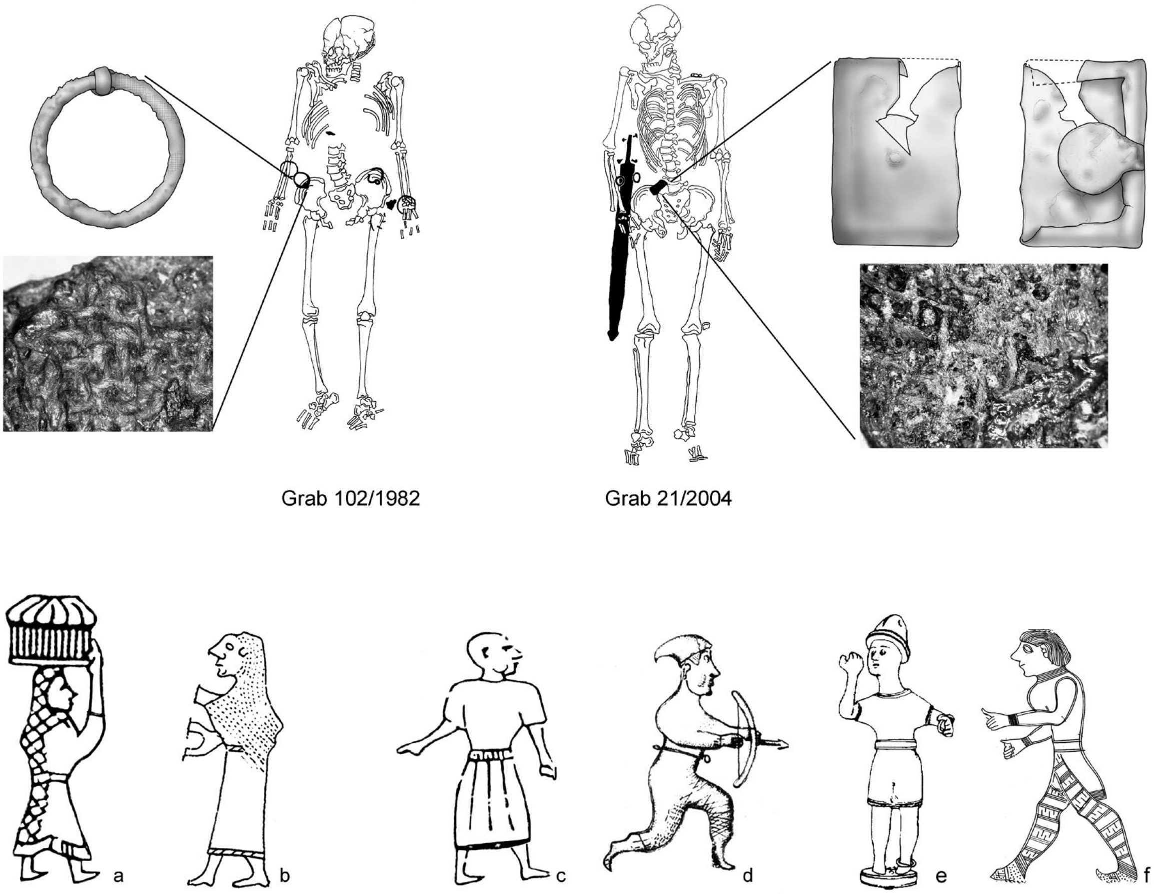

Abb. 3: Gräber aus Oberndorf in der Ebene mit Textilanhaftungen (nach Grömer, Ramsl in Vorb.). Untere Reihe: Bildliche Darstellungen der Späthallstatt/Frühlatènezeit: a, c Certosa, b Magdalenska Gora, d Molnik, e Idria pri Baci, f Hallstatt (Verweise siehe Text).

Beispiel für Mikrostratigrafie

Die Mikrostratigrafie beschreibt die Schichtung verschiedener organischer Materialien (Hägg 1989: 431–435), die sich in einem Grabkontext meist an Metallobjekten erhalten haben. Da sie aneinander korrodieren, bildet sich dadurch der Zustand bei der Grablege ab.

Als Beispiel mit einer derartigen Schichtung sei hier ein Fund aus einem reichen hallstattzeitlichen Brandgrab aus Berg/Attergau in Oberösterreich (Trebsche et al. 2007) genannt. Es wurden im Bereich eines Blechgürtels interessante organische Lagen geborgen, die Einblick in den funktionalen Aufbau des Gürtels geben (Abb. 2). Direkt unter dem Blech wurde Baumrinde entdeckt, dann noch mehrere Schichten Textil, sowie an der Gürtelvorderseite an den Rändern Textilreste, Lederstreifen und Holznägelchen. Der Gürtel war also mit Rinde gepolstert, hatte dann zum Körper hin eine mehrfache textile Innenfütterung, die über den Rand geschlagen und dann mit Lederstreifen und Holzstiften an der Vorderseite fixiert wurde.

Themenbereich „bekleiden"

Bei der Kontextualisierung spielen vor allem auch Funde aus Körpergräbern eine wichtige Rolle. Trachtbestandteile, die sich in „Trachtlage" und funktional am Körper des Bestatteten befinden, können wohl als Überreste der Kleidung angesehen werden. Textilreste an derartigen Trachtbestandteilen müssen nach ihrer Lage in Bezug auf den Körper beurteilt werden.

So konnten, um ein simples Beispiel zu nennen, bei der LtA-zeitlichen Gräbergruppe von Oberndorf in der Ebene, Niederösterreich, an manchen Gürtelbestandteilen Textilreste festgestellt werden (Abb. 3, oben) (Grömer, Ramsl in Vorb.). Beim erwachsenen Mann aus Grab

21/2004 fand sich mittelfeines Leinen. Das Gewebe der Frau aus Grab 102/1982 weicht etwas davon ab, indem es in einer Fadenrichtung feinere Fäden und eine größere Gewebedichte aufweist. Die leinwandbindigen Textilreste fanden sich jeweils an körpernaher Position, also zwischen Gürtelbestandteil und Skelett – es handelt sich demnach, deduziert man, dass der Gürtel angelegt war, um ein gegürtetes Gewand.

Das gegürtete Gewand war wohl nicht dasselbe bei beiden Geschlechtern. Nach zeittypischer Ikonografie (Abb. 3 unten) der an der Schwelle zwischen Hallstatt- und Latènezeit stehenden Situlenkunst finden sich etwa bei Frauen lange gegürtete Gewänder, die meist mit einem Schleier kombiniert wurden (z. B. Certosa in Italien oder Magdalenska Gora in Slowenien: Lucke und Frey 1962). Gewänder ähnlicher Silhouette, jedoch als kurzärmeliger, knielanger Kittel ausgeprägt, sind zwar auch auf Darstellungen von Männern erkennbar (z. B. Situla Certosa, Statuette von Idria pri Baci in Slowenien: Lucke und Frey 1962; Grömer 2010: Abb. 190), es gibt hier aber mehr Varianz. Gegürtet ist auch das Oberteil mit verlängerten Schößen von der Schwertscheide aus Hallstatt, Grab 994 (Egg et al. 2006). Ob die auch von Darstellungen bekannte Hose (Bronzeblech Molnik in Slowenien: Turk 2005: Abb. 87) ebenso mit einem Gürtel gehalten wurde, kann nicht gesagt werden.

Man kann also immer nur Annäherungen geben, mit Gewissheit wird das einstige Gewand nicht zu rekonstruieren sein (kritisch dazu auch Rast-Eicher 2008: 177–178) – es können jedoch Aussagen dazu gemacht werden, welche Gewebequalität, Rohmaterial etc. das gegürtete Kleidungsstück bei der Frau und dem Mann in Oberndorf gehabt hat.

Überlegungen zur Kleidung der Toten

Kritische Betrachtung der Quellenlage erfordert es, zum Thema „bekleiden“ noch eine weitere Überlegung anzuführen: Glaubt man nun, ein Gewand identifiziert zu haben – handelt es sich dabei um eine spezielle Totenkleidung, oder um eine auch zu Lebzeiten getragene oder Alltags-, eventuell sogar eine Repräsentativtracht (siehe dazu auch Grömer 2014: 117–120)? Nach völkerkundlichen Hinweisen ist hierbei festzuhalten, dass bei fast allen Ethnien Menschen nicht in der (Alltags-)Kleidung bestattet werden, in der sie versterben. Zwischen Tod und Bestattung werden fast ausnahmslos Riten durchgeführt, die Teil des in der Ethnologie als „*rites de passages*“ (van Gennep 1986 [1909]: 142–144) genannten Systems sind, das die einzelnen Abschnitte des menschlichen Lebenszyklus (v. a. Geburt – Übergang ins Erwachsenenalter – Heirat – Tod) begleitet.

Diese Übergangsriten sind zwar kulturell unterschiedlich ausgestaltet, enthalten jedoch im Umgang mit dem toten Menschen jeweils, dass der Leichnam gewaschen und auch nach den Regeln der Gesellschaft wieder bekleidet bzw. verhüllt wird. Wird dem Verstorbenen Kleidung angelegt, so drückt diese dann spezifisch das aus, was die bestattende Gemeinschaft über diesen Menschen oder seine Familie mitteilen möchte – über Geschlecht, Alter, Status, Kultzugehörigkeit etc. Das bedeutet also, dass die Kleidung, die wir im Grab an den Bestatteten finden, eine bewusste Auswahl darstellt, eventuell eben auch eine Botschaft, etwa zur Identität des Toten.

Auch in Anbetracht dessen verbleibt die Frage, ob die Totenkleidung separat für die Grablege angefertigt wurde, oder ob es sich um Gewänder handelt, die von der Person auch zu Lebzeiten benützt wurde. Bei der Prähistorie werden besonders Gebrauchsspuren an Trachtbestandteilen herangezogen, um sich diesem Problem zu nähern. Bei einer Studie an den Schmuckstücken aus mittelbronzezeitlichen Frauengräbern konnte etwa festgestellt werden, dass der Ringschmuck starke Abnutzungserscheinungen aufwies. Dies wurde dahingehend interpretiert, dass es sich in diesen Fällen um eine dauerhaft tradierte „Lebendtracht“ handelt (z. B. Wiegel 1994: 165).

In diesem Rahmen kann jedoch noch ein weiteres interessantes Detail vorgestellt werden, das zwar selten vorkommt, jedoch dieses Problem von einer anderen Perspektive angeht: *pediculus humanus corporis* – die Kleiderlaus. Dieser Parasit lebt direkt an der Kleidung des Menschen, ist in seinem Lebensraum an diesen gebunden. Kleiderläuse sind in Grabkontexten zwar selten, konnten aber schon beobachtet werden. Aus Österreich kann mit dem Fundort Göttweig (Abb. 4) ein römisches Beispiel angegeben werden (Grömer 2014: 231–232, Kat. Nr. Rö-18): In einem Kindergrab wurde an einem Metallarmreif an der Innenseite ein feines leinwandbindiges Textil entdeckt. Im römischen Kontext kann es sich dabei nur um eine *tunica manicata* handeln, also eine langärmelige Tunika, über deren Ärmel der Armreif geschoben wurde. An dem Stoff fand sich auch eine Kleiderlaus, die ein

Abb. 4: Römisches Kindergrab aus Göttweig mit Kleiderlaus an einem Textil (unten rechts) (Fotos: A. Schumacher, NHM; REM Aufnahme S. Mitschke).

wichtiges Detail für obige Fragestellung nach Toten- versus Alltagstracht darstellt. Da das natürliche Habitat von Kleiderläusen der lebende Mensch ist, bedeutet dies, dass diese *tunica manicata* auch zu Lebzeiten getragen wurde – es war also kein speziell für die Grablege angefertigtes Totengewand.

Obigen Hinweisen sei entgegengehalten, dass etwa im Fall des Fürstengrabes von Eberdingen-Hochdorf (Banck-Burgess 1999: 124–126) alles darauf hinweist, dass die im Grab befindliche textile Ausstattung speziell für das Grab angefertigt wurde – wenn wir hier auch keine Kleidung vor uns haben.

Man wird also immer wieder von Fall zu Fall entscheiden müssen, ob es sich um Alltags- oder reine Totentracht handelt.

Themenbereich „bedecken – verhüllen"

Die Kontextualisierung der Grabfunde deutet immer wieder darauf hin, dass mit Textilien auch Objekte in Gräbern verhüllt wurden. Prominentestes Beispiel ist hier das Fürstengrab von Eberdingen-Hochdorf. Dies war einer der ersten Funde, bei dem dieses Phänomen näher beschrieben und auch umfassend diskutiert wurde. In ihrer zusammenfassenden Publikation stellte Johanna Banck-Burgess (1999) auch fest, dass es sich um einen sehr gängigen Ritus in der Eisenzeit handelt. Sie stellte viele Beispiele aus Gräbern in Mitteleuropa zusammen (für die Schweiz siehe auch Rast-Eicher 2008: bes. 178–180). Auch in Österreich finden sich Umhüllungen, vor allem an Messern, Schwertern und Schwertscheiden (Grömer 2014: Katalog 192–220). Ab dem 7. Jh. gibt es in Österreich – und nicht nur dort, einige Nachweise dafür, dass die Klingen von Schwertern mit ca. 5–8 cm breiten Bändern umwickelt wurden. Vor allem ein paar Stücke aus Hallstatt (Abb. 5) zeigen eine sehr sorgfältige Umwicklung (siehe auch Kern 2005: Abb. 10).

In der Frühlatènezeit ändert sich die Sitte dahingehend, indem nun nicht die blanken Klingen, sondern die in den Schwertscheiden steckenden Schwerter umhüllt werden

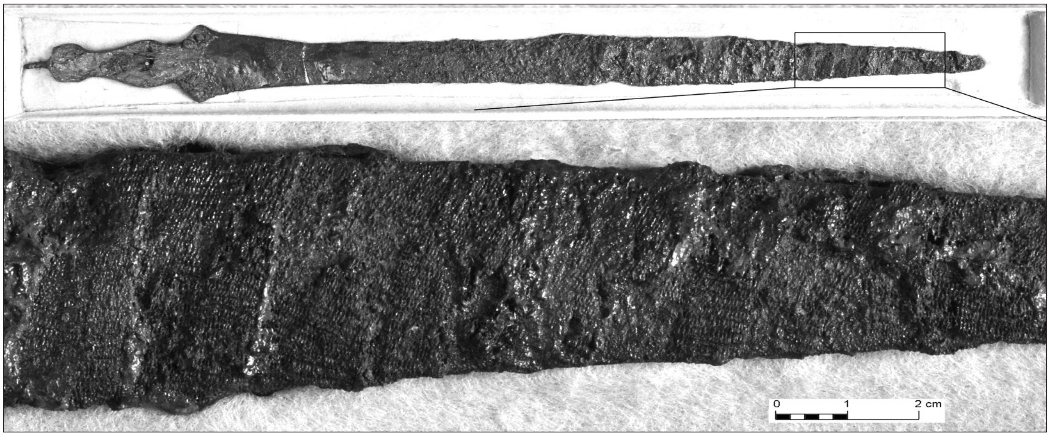

Abb. 5: Mit Bändern umwickelte Schwertklinge aus dem Gräberfeld Hallstatt (Foto: A. Rausch, © NHM).

(Abb. 6; z. B: Hallstatt Gr. 994: Egg et al. 2006: 182–183, Abb. bes. Beilage 1; Franzhausen, Grab 295 und 768: Neugebauer 1996: Abb. 9–10).

Repräsentativ ist ein frühlatènezeitliches Schwert aus einem keltischen Kriegergrab (LtA1) aus Gemeinlebarn (Preinfalk, Preinfalk 2014), ausgegraben und restauriert in den letzten Jahren (Heimel 2013). Auf der beim rechten Oberschenkel liegenden Schwertscheide hat sich eine sehr gute Textilumhüllung eines feineren Leinens erhalten. Das in der Scheide steckende Schwert war zur Gänze mit einem Textil umwickelt (Abb. 6a). Vermutlich hat man den Stoff von oben über das Objekt gelegt und die Enden am Ortbandschlussstück zusammengefasst. So lassen sich die relativ glatten Strukturen im oberen Bereich der Schwertscheide erklären, welche unten in dicht beisammen liegende Falten übergehen. Ein interessantes Detail fand sich an dem Schwert noch auf der Rückseite in dem Bereich, wo es auf der Hand des Bestatteten auflag. Es handelt sich dabei um die Abdrücke der Haut des Toten. Nach dem Hautbild (Felderhaut mit Übergang zur streifigen Struktur der Papillarlinien an der Handinnenseite) ist es wahrscheinlich der Bereich des Daumenansatzes beim Handgelenk, der sich so abgedrückt hat (Abb. 7).

Zu Umhüllungen und Bedeckungen ist auch der Themenbereich „Leichentuch" zu nennen. Konkrete Fälle sind für die Eisenzeit in Österreich noch nicht klar nachgewiesen. Es sei jedoch wiederum das Fürstengrab von Eberdingen-Hochdorf zitiert, wo der Leichnam in verschiedene textile Schichten gehüllt wurde (Banck-Burgess 2014: Abb. 8.4). Ein interessanter Befund eines rechteckigen Leichentuches, das über den Bestatteten gebreitet wurde, bietet der Befund von Osteria dell'Osa, Grab 3 aus dem 9. Jh. v. Chr. Dieses ist rein durch die metallenen Randbesätze belegt, die durch ihre rechteckige Anordnung über dem Leichnam auf ein Leichentuch hindeuten (Gleba 2014: Abb. 7.1).

Im Ostalpen- und Zentralalpenraum kann bei Brandbestattung festgestellt werden, dass direkt bei den menschlichen Überresten in der Urne bzw. Steinkiste Textilreste gefunden werden (vgl. auch Fath 2012: 79; Grömer 2014: z. B. Kat. HaZ31–34 Bischofshofen-Pestfriedhof).

Theorien zu Umhüllungen in Gräbern

Margarita Gleba (2014) bietet eine Systematik zur Praxis der textilen Umwicklung an, wie sie in Gräbern letztendlich archäologisch fassbar sind:

a) Umhüllen bzw. Bedecken des Leichnams mit einem Leichentuch
b) Bei Brandbestattung Umhüllung des Knochenkleins in der Urne
c) Umhüllung der Urne mit den verbrannten Überresten des Toten
d) Umhüllung der verbrannten Reste in der Urne sowie Umhüllung der Urne selbst
e) Umwicklung spezieller Beigaben, z. B. Messer, Schwerter oder Spiegel
f) Systematische Umhüllung aller Objekte im Grab

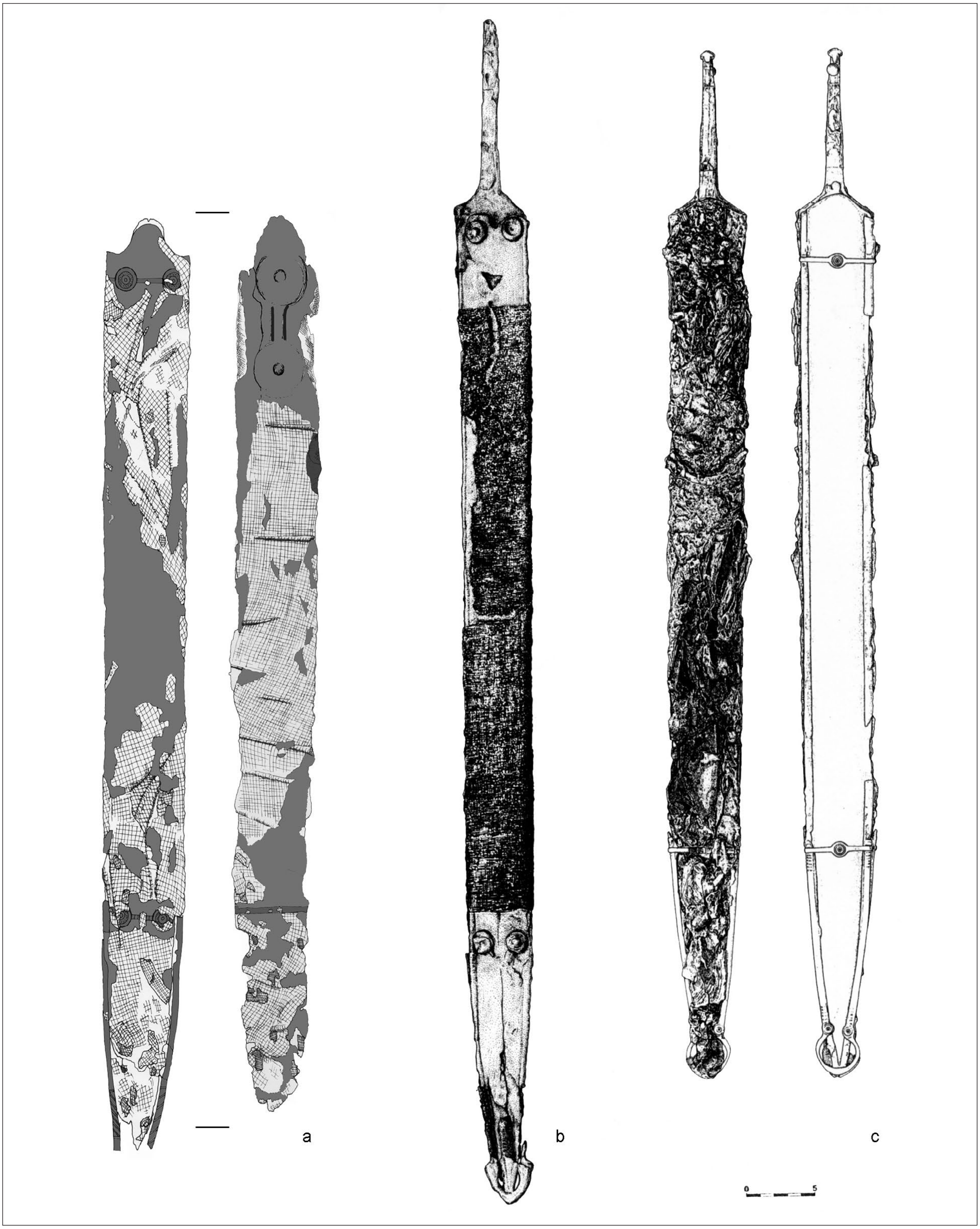

Abb. 6: Frühlatènezeitliche Schwertscheiden, in Tücher eingeschlagen: a Gemeinlebarn „Kriegergrab", b Franzhausen Grab 295, c Franzhausen Grab 768 (a Grafik K. Grömer, b und c nach Neugebauer 1996).

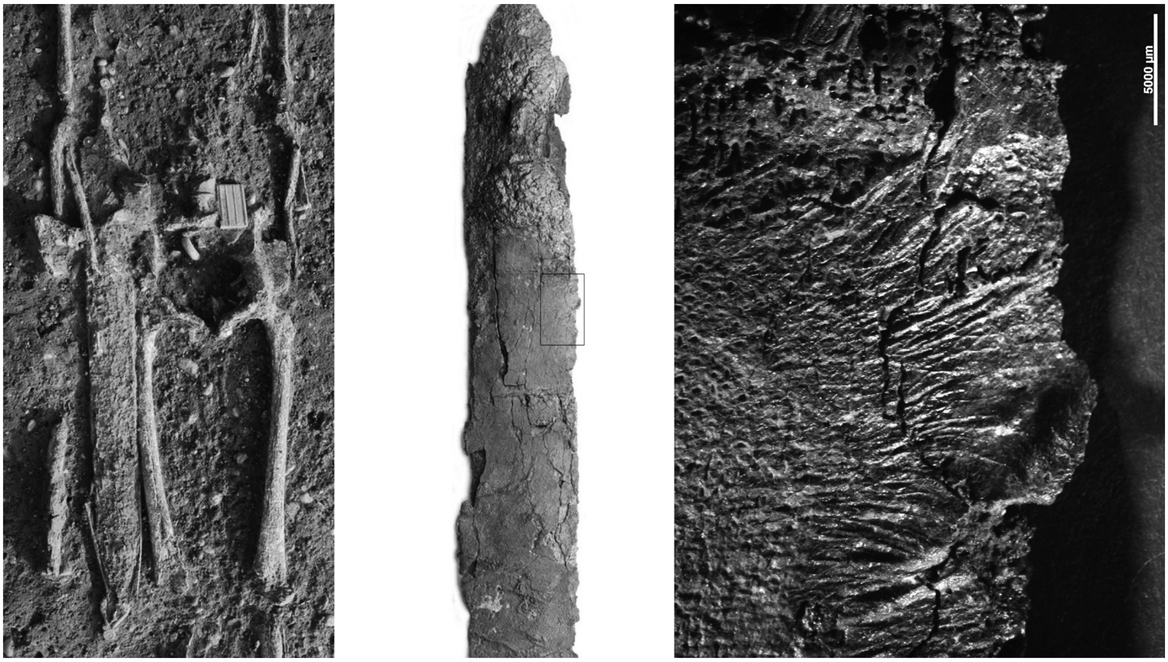

Abb. 7: Gemeinlebarn „Kriegergrab“: Befund mit Schwert in Schwertscheide, sowie Detail der Korrosion mit Hautabdruck (Fotos: F. Preinfalk, S. Heimel und A. Kroh).

Für die verschiedenen Arten der Umhüllung finden sich die unterschiedlichsten Deutungsansätze, die hier grob in eine funktional-praktische sowie in eine metaphysische Intention unterteilt werden.

Umhüllung als funktionales und repräsentatives Element

Umhüllungen können zunächst auf der funktional-praktischen Ebene gedeutet werden. Die textile Hülle des Knochenkleins bei Brandbestattung kann m. E. zunächst einmal simpel als Behältnis gedeutet werden, wie es auch die Urne ist. Der textile Behälter dient vordringlich dem Zweck, dass von den menschlichen Überresten nichts verloren geht. Dass derartige Umhüllungen der Brandreste auch aus wertvollen Materialien gestaltet sein können, wird etwa bei Homer beschrieben (Ilias 34.796 und 23.254): Hectors Gebeine werden etwa in reiche purpurne Stoffe gehüllt und dann in eine goldene Aschenkiste (*larnax*) gelegt, bevor sie in einem Tumulus bestattet werden. Einer der spektakulärsten derartigen Funde wurde im sogenannten Tumulus des Philipp II. in Vergina, Griechenland, aus der zweiten Hälfte des 4. Jh. v. Chr. entdeckt. In einer Vorkammer von Grab 2 des großen Tumulus wurde die Brandbestattung einer Frau entdeckt, eingeschlagen in ein golden und purpurfarben gemustertes Gewebe und niedergelegt in einer goldenen *larnax* (Andronikos 1984).

Weiters gibt etwa Margarita Gleba (2014: 142) zu bedenken, dass Umhüllungen eventuell auch als Schutz von wertvollen Beigaben gemeint sein können. Selbiges vertritt auch Anton Kern (2005: 8), der in den Wollbandagen der ältereisenzeitlichen Schwertklingen aus dem Gräberfeld von Hallstatt einen Schutz vor Verrosten sehen möchte – vor allem wenn diese mit Öl oder Fett getränkt wären.

Für Barbara Fath (2012) ist wesentlich, dass Stoffe neben schützender und schmückender Funktion auch eine repräsentative Wirkung im Grabkult haben – als Statusanzeiger neben Schmuck und Bronzeobjekten. Sie stellte in einer Studie früheisenzeitliche Brandgräber in Oberitalien und dem Ostalpenraum zusammen und beobachtete die Inszenierung von Geweben, Werkzeugen zur Textilherstellung und bildlichen Darstellungen von Spinn- und Webszenen.

Metaphysische Bedeutung von Umhüllungen

Textile Umhüllungen in Gräbern sind durch ihren Kontext auch auf metaphysischer Ebene zu deuten, da sie eine wichtige Funktion bei den Bestattungsriten haben. Sie dienen nach dem Tod einer Person für die *rites de passage*. Es ist eine psychologische, symbolische und physische Transformation des umhüllten Leichnams und von Objekten, die für den Übergang in das Jenseits dient. Eine derartige Transformation kann man auch etwa im Verbiegen, dem absichtlichen Zerstören von Schwertern erkennen (z. B. Pottenbrunn, Gr. 854, 855, 975 und 1005: Ramsl 2002: Taf. 72/4, 73/5, 76/11, 80/7). Eine derartige rituelle „Zerstörung" bzw. „Unbrauchbarmachung" von Objekten, die im Grab platziert werden, wird auch im etruskischen Brauch gesehen, Spiegel mit Textilien zu umhüllen (Gleba 2014: 142).

Johanna Banck-Burgess (2014: 153–154) stellt die wichtige Frage, zu welchem Zeitpunkt die Verhüllung der verschiedenen, den Status des Verstorbenen anzeigenden Gegenstände vorgenommen wurde; bereits bei den verschiedenen Riten der Totenaufbahrung und Trauer oder erst knapp bevor die Grabkammer verschlossen wurde? Zudem vertritt sie das Konzept, dass der Akt des Umhüllens eine Unsichtbarmachung von Gegenständen ist. Diese soll eine Grenze zwischen den Toten und den Lebenden aufbauen. Was dem Toten gehört hat, muss verborgen werden, auch zum Schutz der Lebenden vor dem Einfluss des Verstorbenen. Sie sieht im Verhüllen aber auch eine Art der Kommunikation zwischen Lebenden und Toten.

Margarita Gleba (2014: 140–141) differenziert weiter, indem sie ausführt, dass zu unterscheiden ist, ob Gegenstände durch Umhüllung „unsichtbar" gemacht werden, oder ob sie im Gegenteil durch Gewebe an Sichtbarkeit gewinnen. Sie führt an, dass Urnen teils durch „Bekleidung" mit Textilien und Schmücken mit Bändern wieder anthropomorphisiert werden. Derartige Riten sind vor allem in Ober- und Mittelitalien zu beobachten.

Weitere Textilien in Gräbern

Im Fokus textilarchäologischer Überlegungen stehen meist Gewebefragmente, die sich als Überreste von Kleidung oder als Umhüllung/Bedeckung identifizieren lassen. Manche Textilfunde aus Gräbern lassen sich jedoch diesen Kategorien nicht zuweisen.

Textile Beigaben

Ein Bereich, der nur schwierig wahrzunehmen ist, ist jener der textilen Beigabe. Wie wir von zeitgleichen antiken Kulturen wissen, sind Textilien als wertvolle Gaben, Repräsentativgeschenke und selbst als Weihegaben an Götter schriftlich belegt (Wagner-Hasel 2000) – gleichrangig neben Bronzeobjekten und Schmuck. Viele der kostbaren Tücher aus dem Fürstengrab von Eberdingen-Hochdorf können *per se* durchaus als repräsentative Grabbeigabe angesehen werden, so etwa die über den großen Bronzekessel drapierten Stoffe, die teils gefärbt und gemustert, sowie mit breiten, kostbaren Brettchenwebborten geschmückt waren (Banck-Burgess 1999: 72–76, Taf. 24–29). Stoffreste, die bei den großen Bronzespiralen im Brandgrab von Berg/Attergau niedergelegt wurden (Grömer in Trebsche et al. 2007), stellen eventuell auch ein Gewand oder sonstiges Stoffstück dar, das mit den Trachtbestandteilen im Grab als Beigabe niedergelegt wurde. Eventuelle Textilbeigaben, die nicht bei Bronzeobjekten abgelegt wurden, sind jedoch in den Gräbern in Mitteleuropa nicht zu fassen.

Textile Grabausstattung

Wiederum das Fürstengrab von Hochdorf zeigt ein sehr eindrucksvolles Beispiel dafür, dass die Ausstattung des Grabes selbst, der Aufbau, mit Stoffen prunkvoll inszeniert wurde. Dafür sprechen der Bodenbelag oder die Wandbehänge, die teils aus gemusterten Stoffen bestehen und auch mit Brettchenwebborten dekoriert sind (Banck-Burgess 1999: 75, 194). Diese Gewebe dienten nicht *per se* als Beigabe, oder sollten bestimmten Gegenstände verhüllen, sondern fanden in der repräsentativen Gestaltung der Grabkammer Anwendung. Sie sind also visuelle Träger der Repräsentationsidee, die hinter der Gesamtinszenierung dieses Grabes steht.

Um Textilfragmente auf derart weitreichende Weise interpretieren zu können, müssen ausgezeichnete Bergungsbedingungen vorliegen. Besonders Blockbergungen kompletter eisenzeitlicher Gräber, die vor allem in den letzten Jahren in Süddeutschland vorgenommen wurden, lassen auf weitere interessante Detailbeobachtungen hoffen.

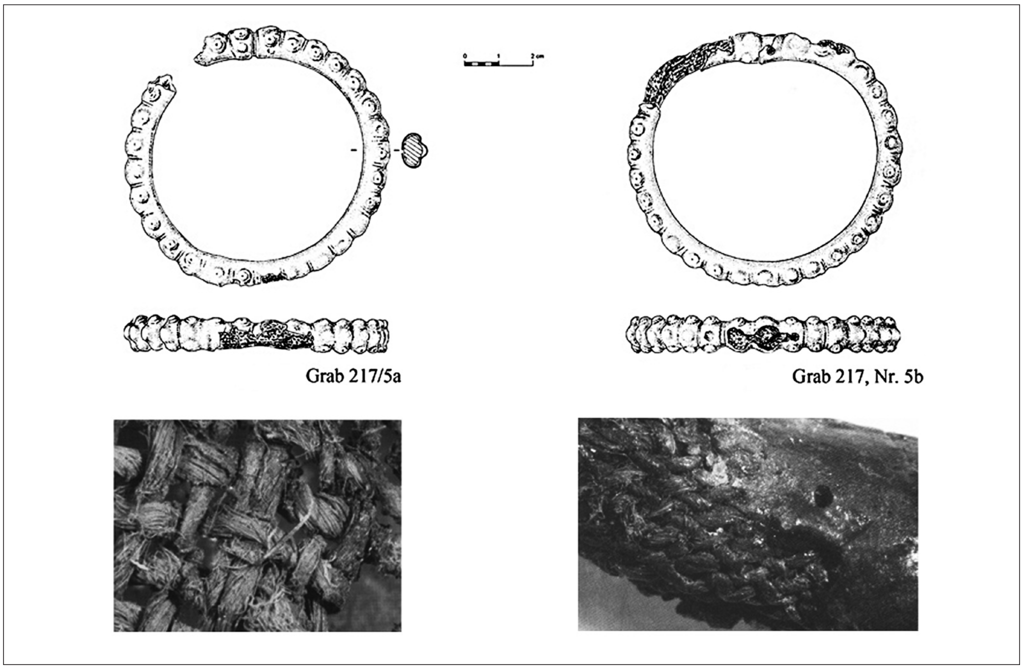

Abb. 8: Reife mit Innenfütterung aus Mannersdorf (nach Müllauer, Ramsl 2007).

Textilien integriert in andere Artefakte

Textilien können aber auch zum funktionalen Aufbau eines Objektes gehören, sie wurden dann nicht bewusst als Kleidung, Umhüllung oder Beigabe in einem Grab platziert.

Es kann hier etwa der als Beispiel für Mikrostratigrafie genannte Gürtelblechfund von Berg/Attergau in Oberösterreich mit seinem textilen Innenfutter angeführt werden. Auch die immer wieder vorkommenden organischen Lagen in Schwertscheiden sind in diesem Kontext zu nennen, die sich unter anderem auch als textile Innenfutter zeigen. Ein besonders eindrucksvoller Befund dieser Art stellt die latènezeitliche Schwertscheide aus Horath in Deutschland (Haffner 1976: 230, Abb. 62) dar.

Für die Latènezeit kommen in Österreich (Müllauer, Ramsl 2007), wie auch in der benachbarten Slowakei (Belanová 2005) regelhaft meist am Fußgelenk getragene Hohlreife vor, die mit einem teils organischen Innenleben ausgestattet sind. Füllungen aus Textil in verschiedenen Kombinationen mit Holz und Lehm sind vor allem bei den aufwändigen Reifen mit Raupenzier nachgewiesen. Diese hatten einen technischen Nutzen bei der Herstellung der Reife und dienten auch zur Stabilisierung, da die Reife aus nur sehr dünnem Bronzeblech bestehen. Die Fußreife aus Mannersdorf in Niederösterreich (Abb. 8) sind mit Textilien aus mittelfeinem Leinen gefüllt.

Conclusio

Dieser kurze Impulsbeitrag, dessen Fokus auf Österreich und dessen Nachbarländern liegt, hat versucht, Analyse- und Kontextualisierungsmethoden von Grabtextilien vorzustellen. Der fragmentarische Zustand, in dem die Textilien in Gräbern meist vorliegen, macht es unmöglich, jedes einzelne Fragment einer bestimmten Funktion zuzuweisen. Diese Auflistung soll jedoch die Bandbreite dessen zeigen, was an Interpretation möglich ist. Es soll hier zur Diskussion zu den Möglichkeiten und Grenzen der Interpretation der Textilfunde in Gräbern beigetragen werden.

Textilien konnten mit verschiedenen Intentionen in ein Grab gelangen (Abb. 9). Es sei bei der funktionalen Ebene darauf verwiesen, dass es Textilreste aus Gräbern gibt, die nicht bewusst im Grab deponiert wurden. Sie gelangten als „technisches Textil", also als funktionaler Bestandteil

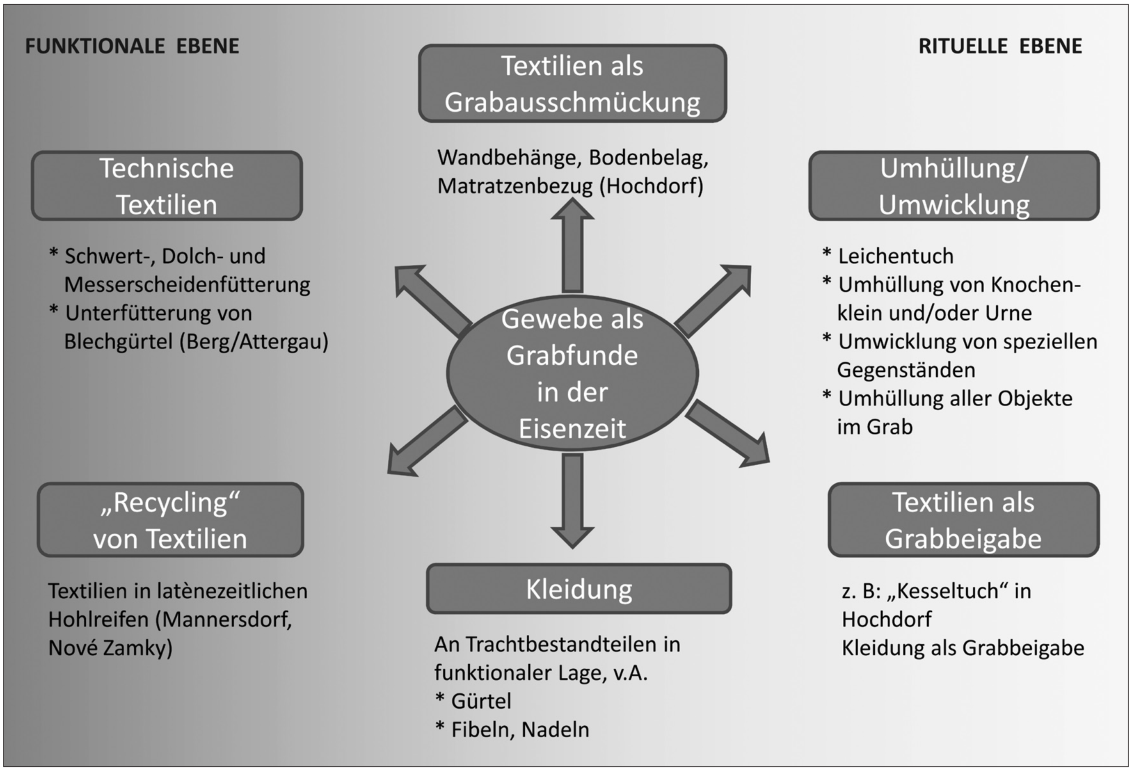

Abb. 9: Textilien in eisenzeitlichen Gräbern (Grafik: K. Grömer).

eines anderen Objektes ins Grab, etwa als Innenfutter einer Schwert-, Dolch- oder Messerscheide; nachgewiesen wurde auch eine Unterfütterung eines Blechgürtels. Auch Textilien, die eigentlich als „Recycling“-Produkte anzusehen sind, also solche, die in latènezeitliche Hohlblechreife gestopft wurden, gelangten mit diesen in die Gräber.

Zur bewussten Anbringung von Textilien in Gräbern zählt jede Art der textilen Grabausstattung, wie etwa Wandbehänge oder Bodenbeläge. Derartige Verwendung von Textilien, wie auch Kleidung, wird auch im Kontext der Lebenden praktiziert. Der Themenbereich der Kleidung, der in der archäologischen Diskussion eine wichtige Rolle spielt, ist für den Grabritus wichtig, dient aber auch stark zur Darstellung der Identität des Toten. In diesem Beitrag werden auch Parameter diskutiert zur Abgrenzung, ob es sich bei den Gewändern der Verstorbenen um eine auch zu Lebzeiten getragene Alltagskleidung oder eine reine Totentracht handelt.

Die rituelle Ebene umfasst vor allem jene Textilien, die eine spezifische Bedeutung für die Praktiken im Grabritus haben. Für den Kontext eines Grabes hat im Sinne der *rites de passages* die sakrale, rituelle Ebene eine wesentliche Bedeutung. So sind viele der Textilien in Gräbern auch in diesem Sinne zu deuten. Einige Gewebefunde sind auch als direkte textile Grabbeigabe anzusprechen, wohl in ihrer Wertigkeit gleichberechtigt neben anderen Grabbeigaben wie Bronzegefäßen o.Ä. Der Ritus der Verhüllung bzw. Umwicklung des Leichnams, des Leichenbrandes und von Gegenständen ist für die Eisenzeit in Österreich und Mitteleuropa häufig belegt. Gerade in den letzten Jahren wurden viele Theorien zum Bedeutungsinhalt dieser Praktiken publiziert.

Wenn hier versucht wurde, die verschiedenen Funktionen von Textilien in Gräbern etwas zu systematisieren, so darf nicht außer Acht gelassen werden, dass es in den Bedeutungsebenen einzelner Objekte durchaus Überschneidungen geben kann. So sind Textilien, die als Beigabe niedergelegt wurden und solche, die der Ausschmückung des Grabes dienten, wie auch die Umhüllungen, sicher in einem rituellen Gesamtzusammenhang zu sehen.

Nicht im Detail diskutiert wurden hierbei die spezifischen Unterschiede zwischen Brand- und Körperbestattungen, bis auf die Tatsache, dass die am Leichnam aufgefundene Kleidung nur bei letzterer vorkommen kann. Welche sakralen und rituellen Überlegungen zu den in der Eisenzeit fassbaren Grabinhalten führen, kann mangels schriftlicher Überlieferung nur schwer nachvollzogen werden.

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6.2. Funktionstechnische Analyse von neuzeitlichen Kleidungsstücken aus der Michaelergruft, Wien 1

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Funktionstechnische Analyse von neuzeitlichen Kleidungsstücken aus der Michaelergruft, Wien 1

Karina GRÖMER und Michael ULLERMANN, Wien

Schlagworte: Gruft, Kleidung, Totentracht, Funktionsanalyse, Neuzeit

Zusammenfassung
Kleidungsteile aus neuzeitlichen Grüften werden meist nach restauratorisch-konservatorischen und kostümhistorischen Aspekten sowie auch nach textilanalytischen und modernen analytischen Methoden untersucht. Oft ergibt sich in der Diskussion des Bestandes die Frage, ob es sich bei den in den Grüften vorgefundenen Kleidungsstücken um normale, tragbare Kleidung oder eine spezielle Totentracht handelt. Im folgenden Beitrag wird nun vor allem versucht, Unterscheidungskriterien zu definieren, anhand derer Funktionale Tracht, Adaptierte Lebendtracht und Totentracht voneinander abgegrenzt werden können. Als Fallbeispiel dienen ausgewählte Bestattungen des 18. Jahrhunderts aus der Michaelergruft in Wien, Österreich.

Functional analysis of garments in modern era burials from Michaelergruft in Vienna

Keywords: crypt, clothing, funeral garments, functional analysis, 18th century AD

Garments found in crypts usually are analyzed due to costume history, aspects of conservation and preparation. Also textile analysis and modern analytical methods are applied to the material. In discussing those garments, questions about the interpretation of the clothing arises such as if they are "normal" daily life (or festivity) garments or specific funeral costumes. In the following paper criteria are discussed which enable to distinguish between "functional garments" worn also in daily life, "adapted garments" (daily life clothing that has been re-sewn, cut or altered to be used as garment for the dead), and "funeral costumes" that have been deliberately made. Selected burials from the Michaelergruft in Vienna (St. Michael's crypt), Austria, serve as case studies.

1. Einleitung

Bei der Kleidung der Toten handelt es sich um ein als Bedeutungsträger inszeniertes Gewand – je nach den Normen der Sozietät und auch nach den individuellen (finanziellen) Möglichkeiten. Als Totenkleidung kann eine zu Lebzeiten getragene Kleidung verwendet werden~~,~~ oder auch speziell angefertigte Totenkleidung (Totenhemden), die im täglichen Leben keine Anwendung finden würde.

Hier wird der Forschungsfrage nachgegangen, wie zu Lebzeiten tragbare (getragene) Kleidung von reiner Totentracht analytisch unterschieden werden kann. Durch die auch aus anderen Grüften in Europa bekannten Erhaltungsbedingungen in der Michaelergruft in Wien 1, die dazu führten, dass in etlichen Särgen komplette Gewänder bis heute überdauert haben, wurden aus dieser Begräbnisstätte vier Frauenbestattungen und zwei Männerbestattungen ausgewählt, um obige Forschungsfrage zu bearbeiten.

2. Kontext – Die Michaelergruft in Wien 1

Die Errichtung der Michaelerkirche ist in den 20er Jahren des 13. Jahrhunderts anzusiedeln.[1] In dieser Zeit ist auch der älteste Teil der Gruftanlage (Abb. 1), die sog. Priestergruft, im Fünfachtelschluss des Chores entstanden. Bereits 1310 ist ein Friedhof an der Kirche erwähnt, der 1508 durch Kaiser Maximilian I. gesperrt wurde. Ab 1560, mit Wilhelm Freiherr zu Herberstein, ist die Errichtung von Adelsgrüften belegt.

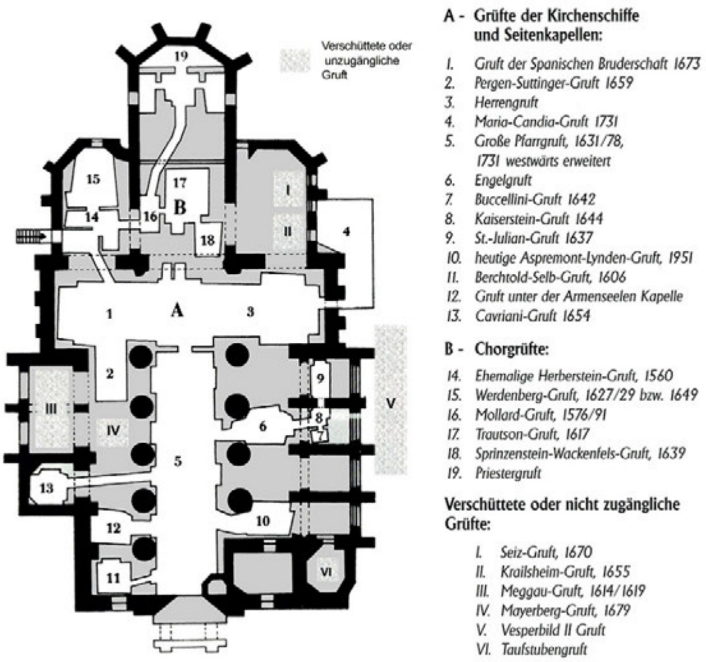

Abb. 1 Wien, Michaelergruft. Grundriss.

Im Zuge der Gegenreformation wurde durch Kaiser Ferdinand II. 1626 der Orden der Barnabiten aus Mailand nach Wien an die Michaelerkirche berufen. Sie haben das heutige Erscheinungsbild der Kirchenanlage maßgeblich geprägt und die Gruftanlage in St. Michael ausgebaut. Ab der Mitte des 17. Jahrhunderts wird der zu St. Michael gehörige Friedhof in Maria Hilf erwähnt und kurz darauf, 1668 bis 1673, werden die großen Räume der Michaelergruft in den Totenprotokollen erstmalig namentlich erwähnt: Herren-, Engels-, Pfarr-, Vesperbild-, Taufstuben- und Spanische Gruft. Sie befinden sich hauptsächlich unter dem Querhaus und Mittelschiff der Kirche. Die Entstehung der Grüfte kann aber schon früher angenommen werden, da ja bereits durch die Schließung des Friedhofes die Notwendigkeit von

[1] Kat. Ausst. St. Michael 1988, 75; Rainer 2005.

Bestattungsmöglichkeiten gegeben war. Einzig die Maria Candia Gruft, in welcher sich die meisten Mumien und Textilien erhalten haben, wird erst ab 1731 in den Totenprotokollen erwähnt. Während sich in den großen Grufträumen nur Holzsärge befinden, findet man in den Adelsgrüften ausnahmslos Metallsärge. Als *terminus ante quem* ist die Bestattungsverordnung Josefs II. von 1783 zu nennen, die ab 1784 umgesetzt wurde und womit Bestattungen in der Innenstadt von Wien generell verboten waren. Gleichzeitig wurden auch sämtliche Bruderschaften aufgelöst, von denen sechs in St. Michael ansässig waren, die bedeutendste darunter die Corporis Christi Bruderschaft. Diese waren eng mit dem Bestattungswesen verknüpft.
1829–1831 wurde die gesamte Gruftanlage saniert, Zugänge zu den Adelsgrüften geschaffen, die heutige Zugangstreppe gebaut und Trennwände der Grufträume entfernt.
1923 wurde die Pfarre an den Orden der Salvatorianer übergeben, der bis heute die Pfarre führt. 1926 wurde die Gruft ein letztes Mal von zwei Salvatorianerfratres geräumt, so dass nur die Metallsärge (33 Stück) und die am besten erhaltenen Holzsärge (221 Stück) erhalten blieben.
In den Totenprotokollen[2] sind die Namen und Sterbedaten aller Bestatteten vermerkt, leider können diese nur in wenigen Fällen den Bestattungen zugeordnet werden. Die Kosten der Bestattungsplätze waren sehr unterschiedlich, so kostete der Liegeplatz in der für die vorliegende Untersuchung relevanten Maria Candia Gruft 40 Gulden, im Friedhof in Maria Hilf dagegen nur 15 Kreuzer.

2.1. Konservatorische Maßnahmen in der Michaelergruft

Aufgrund eines Rüsselkäferbefalles (*Penthartrum huttonii*) durch drastischen Klimawandel in der Michaelergruft, der 2004 erkannt wurde, hat man nach einer Planungsphase mit Proberestaurierungen, Voruntersuchungen sowie ergriffenen Notmaßnahmen ab 2009 50 Särge restauriert.[3] Dies geschah in enger Zusammenarbeit mit Pfarre, Erzdiözese, Bundesdenkmalamt und Stadt Wien. Die Methode der Konservierung wurde vom Bundesdenkmalamt Wien entwickelt.
Nach provisorischer Umbettung der Sarginhalte durch die Bestattung Wien – gefährdete Objekte wurden dazu temporär entnommen – wurden die Särge grob gereinigt und über drei Wochen auf Werkstattklima konditioniert. In der Folge wurden nach Bedarf mittels Cyclohexan Wachsflecken entfernt, pudernde Malschichten mit Klucel 3% in Ethanol gefestigt, anschließend die Schmutzauflagen mit Aceton und Ethanol abgenommen. Ebenso wurde zerstörte Holzsubstanz mit Paraloid 72 10% gefestigt und die Verbindungen der Sargteile wiederhergestellt, um ihre Funktionalität zu erhalten. Ergänzungen wurden nur in Ausnahmefällen vorgenommen. In der Folge wurden die Bestattungen in ihre originalen, konservierten Särge zurückgebettet. Die Maßnahmen wurden von 2009 bis 2014 in sieben Etappen durchgeführt.

[2] MiKA (Michaeler-Kirchen-Archiv), Totenprotokolle.
[3] Fankl 2010–2014.

Es wurde versucht, das Raumklima in den Grüften durch den Einbau einer Klimaanlage zu stabilisieren. Ebenso wurden die Luftschächte, die ursprünglich zur natürlichen Mumifizierung vieler Toter geführt hatten und im letzten Jahrhundert vermauert worden waren, wieder geöffnet. Im Zuge der Konservierung konnten die Textilien aus 50 Särgen eingehend dokumentiert werden. Die Erhaltung der Fasern ist ungewöhnlich, da Seide sehr gut, Leinen und Baumwolle mäßig und Wolle überhaupt nicht erhalten ist. Das hat zur Folge, dass Damenkleider aus Seide teilweise sehr gut, Justaucorps[4] und Hosen aus Wolle meist nicht erhalten sind. Da in vielen Fällen das Seidenfutter der Justaucorps erhalten ist, lässt sich die ursprüngliche Form der Männerkleidung sehr gut rekonstruieren. Aufwändigere Stoffe, wie gemusterte Seidensamte, finden sich nur in den versiegelten Metallsärgen der Adelsgrüfte und sind daher kaum zugänglich. Die vorhandenen Kleidungsteile[5] entsprechen in ihrer Erscheinung im Wesentlichen der Mode der Mitte bzw. zweiten Hälfte des 18. Jahrhunderts (vor 1784).
Neben Bestattungskleidung wurden auch zahlreiche Grabbeigaben gefunden,[6] wobei in jedem Sarg Rosenkranz und Handkreuz vorhanden waren. Diese konnten sowohl ephemeren Charakter haben und aus billigem Material speziell für die Bestattung (Handkreuze aus Wachsschnüren)~~,~~ als auch aus edlen Materialien gefertigt sein, wie aufwändige Handkreuze aus Holz mit Perlmutteinlagen oder Rosenkränze aus Jet und Halbedelsteinen. Zudem fanden sich Wallfahrtsplaketten vor allem an Rosenkränzen, Drucke von Gnadenbildern und Objekte, die auf die Zugehörigkeit zu Bruderschaften hinwiesen, wie Skapuliere oder Bruderschaftsgürtel. Schließlich seien noch medizinisch intendierte Objekte in den Särgen erwähnt, wie aufgelegte Bleiplaketten und Fontanellenbleche.[7]
In vielen Bereichen des Bestattungswesens in St. Michael ist der direkte Einfluss des Wiener Hofes zu erkennen, was durch die räumliche Nähe und personelle Überlappung begünstigt war. Dies schlägt sich insbesondere in den Ausprägungen der verwendeten Totentracht nieder.

3. Zu Lebzeiten tragbare Kleidung versus Totentracht – Methodik zur Bestimmung

Forschungen an Textilien und Gewändern aus neuzeitlichen Grüften in Europa allgemein umfassen meist deren konservatorische Begutachtung, Restaurierung und/oder auch kunsthistorische Einordnung,[8] wobei teilweise – je nach Möglichkeit – die neuesten analytischen Methoden, wie CT Analysen, 3D-Rekonstruktion oder Faser- und Farbstoffanalytik, zur Anwendung kommen.[9] Teilweise werden spezifische Totengewandungen diskutiert;[10] auch im Hinblick auf ihre symbolische und dynastische Bedeutung wird getragene Kleidung als

[4] Herrenoberbekleidung des späten 17./frühen 18. Jahrhunderts in Form einer knielangen, mit Knöpfen besetzten Jacke; Vorform des Frackes (Vgl. auch Bönsch 2001, 159, 190-194).
[5] Ullermann 2005, 69-73; vgl. Bönsch 2001.
[6] Mais 1954.
[7] Häck und Nehrlich 2016.
[8] Bravermanová 2010; Giuliani u. a. 2013; Hofmann 2010; Petrascheck-Heim 1978; Ströbl 2013.
[9] Z. B. Cybulska u.a. 2013; Lipkin u.a. 2015.
[10] Z. B. Vedeler 2010, 255.

Totengewand und dezidierte Totenkleidung voneinander differenziert,[11] aber nicht in ihren Unterscheidungskriterien in Abgrenzung zu alltäglich tragbarer Kleidung definiert.
Eine der grundlegenden Forschungsfragen bezüglich der Bestatteten aus der Michaelergruft ist nun jene, ob es sich bei den Gewändern um zu Lebzeiten getragene Kleidung oder um reine Totenkleidung handelt.
Es wurden repräsentative Bestattungen aus verschiedenen Grüften (Pergen-Suttinger Gruft, Herrengruft, Cavriani-Gruft) ausgewählt, anhand derer die Fragestellungen überprüft werden sollen, vier Frauensärge und zwei Männersärge. Aus Platzgründen werden drei davon hier detailliert in Katalogform dargestellt. Für die funktionale Analyse der Kleidungsstücke wurde zunächst jede Bestattung dahingehend untersucht, ob alle Kleidungsstücke bzw. Lagen an Kleidungsstücken, die üblicherweise gemeinsam getragen wurden (diverse Über- und Unterkleider, z. B. Unterröcke, Hemd etc.), an dem Leichnam vorhanden sind. Daraufhin wurden die einzelnen Kleidungsstücke auf Merkmale untersucht, welche auf eine Funktionalität als ein zu Lebzeiten getragenes Kleidungsstück hinweisen würden. Die dahin gehende, im Jahr 2018 durchgeführte Analyse beschränkte sich auf makroskopische Betrachtungen vor Ort und Fotodokumentation. Dies liegt darin begründet, dass zu diesem Zeitpunkt die Körper bzw. Bekleidungen nicht aus den Särgen entfernt werden durften. Als Hilfsmittel zum Anheben von Kleidungsteilen, um bestimmte darunterliegende Schichten beurteilen zu können, dienten Holzstäbe und Pinzetten.

3.1. Analysepunkte: Funktionalität als ein zu Lebzeiten getragenes Kleidungsstück

* Sind beispielsweise Knöpfe und Knopfleisten an Gewändern wie Justeaucorps, Westen oder vorne schließbaren Damengewändern etc. funktionstauglich oder sind die Gewänder etwa zugenäht und Knöpfe und Knopfleisten nur rein als Dekor zu verstehen?
* Wie ist die Ausführung der Gewänder, gibt es die für Alltags- oder Festkleidung in Kostümsammlungen charakteristischen Fütterungen, Verblendungen etc.?
* Sind bei Damengewändern funktionale Elemente (die nötig sind, um ein Gewand anzulegen), wie Häkchen, Ösen und dergleichen, vorhanden?

3.2. Analysepunkte: Hinweise auf eine „Adaptierte Lebendtracht"

* Zuarbeitungselemente als Hinweise auf „Adaptierte Lebendtracht": Wurde tragbare Alltagskleidung „reduziert", umgearbeitet oder angepasst, um als Kleidung für eine tote Person zu dienen, wird dies hier als „Adaptierte Lebendtracht" bezeichnet.
* Veränderung der Kleidungsform durch Abtrennen sperriger Elemente (vor allem bei Damenkleidung, z. B. Reduktion von Stofffülle im Rockbereich). Wurden etwa bei Kleidungsstücken mit seitlich stark abstehenden Rockteilen die unteren Kleidungsschichten weggelassen, dann ergab sich eine zu große seitliche Saumlänge des Gewandes. Es wurde auch

[11] Richter 2010.

beobachtet, dass diese gekürzt wurde, was an den überschnittenen Saumverstärkungen erkennbar sein kann.

* Aufschneiden des Kleidungsstückes im Rückenbereich, Öffnen von Nähten u.Ä.
* Es ist zu diskutieren, ob auch die Weglassung etwa von zugehöriger Unterkleidung, wie Reifröcken oder Korsetten, bereits als „Reduzierung“ und somit ein derartiges Ensemble als „Adaptierte Lebendtracht“ zu werten ist.
* Es können auch „Halbfabrikate“ einer Lebendtracht adaptiert worden sein, um als Totenkleidung zu dienen – solche, die durch Anbringen von Verschlüssen bzw. Auftrennen zugenähter Teile sogar im Alltag tragbar wären. Dies wäre eine Hybridform zwischen „Adaptierte Lebendtracht“ und „Totentracht“.

3.3. Analysepunkte: Hinweise auf die Funktionalität als Totentracht

* Eindeutige Hinweise auf eine spezielle Totentracht (Funeraltracht) liegen dann vor, wenn ein Kleidungsstück definitiv als nicht funktional tragbares Objekt angefertigt wurde. Diese „Kleidungen“ ergeben zwar optisch ein richtiges Bild einer zeittypischen Kleidung,[12] sie weisen die korrekten Elemente im Design auf, könnten aber nicht angezogen werden[13].
* Es ist zu analysieren, ob etwa Kleidungsteile, die bei zu Lebzeiten getragener Kleidung als Verschluss dienen würden, zusammengenäht sind bzw. als „Fake“ vorliegen (z. B. als Fake genähte Knopfleiste).
* Wurde ein „Kleidungsstück“ als auflegbares, kleidförmiges Textilobjekt gefertigt, das gar nicht dreidimensional um den Körper schließen würde? Es handelt sich dann um eine speziell genähte und drapierte Totentracht.
* Wichtig zu beachten ist auch, dass es in verschiedenen Zeitperioden auch immer wieder spezielle Totenhemden gibt, die zwar als getragene Kleidung funktionieren würden, die jedoch – wie auch in Bild- und Schriftquellen ersichtlich – nur für Funeralzwecke verwendet wurden.

3.4. Weitere Kriterien

* Schuhe: sind sie getragen worden oder nicht? Dies ist an den Sohlen erkennbar.
* Schleifen und Bänder: wurden für die Ausschmückung von Schuhen, Kleidung, Hauben etc. gleiche Schleifen und Bänder verwendet, ist dies zumindest ein Hinweis darauf, dass hier ein zusammenpassendes Ensemble gefertigt wurde. Gibt es auch weitere Hinweise, die eine Abweichung von zu Lebzeiten getragener Kleidung zeigen (z. B. aufgeschnittene Kleidung), dann erhärten sich die Hinweise auf Funeraltracht oder zumindest auf Adaptierte Lebendtracht.

[12] Vgl. etwa BÖNSCH 2001, 190-207.
[13] Vgl. dazu auch HOFMANN 2010, 33-34.

Abb. 2 Zusammenfassung der Kriterien für Funktionale Tracht, Adaptierte Lebendtracht und Totentracht.

4. Gliederung des Materials – Katalog der Beispiele

Nach den oben besprochenen Kriterien wurden nun drei verschiedene Kleidungstypen herausgestellt, die in der Michaelergruft für die Totenkleidung zur Anwendung kamen (Abb. 2): Die Funktionale Tracht, die Adaptierte Lebendtracht und die reine Totentracht. Im Folgenden werden drei charakteristische Beispiele vorgestellt, anhand derer die Bestimmungskriterien noch verdeutlicht werden.

4.1. Beispiel Funktionale (Alltags-)Tracht: Sarg-Nr. 88

Standort: Pergen-Suttinger Gruft, ehemals Herrengruft, ursprünglich wahrscheinlich Maria Candida Gruft
Datierung: bestattet 1769[14]
Kurze Befundbeschreibung: Auf Hobelspänen liegende Männerbestattung mit Armen über dem Bauch verschränkt, sehr gut erhalten und mumifiziert, Haare fehlen. Gut erhalten und sichtbar ist die Perücke, die der Mann trug, deren funktionaler Unterbau aus Filetnetz, Randverstärkungen und aufgenähten Tressen aufgrund der nicht erhaltenen Haare gut zu erkennen ist. Erhalten ist auch der feine Stoff des Übertans, der während der Aufbahrung über den offenen Sarg gebreitet wurde und beim Schließen des Deckels im Sarg verblieb. Der Tote ist bekleidet mit Schal/Tuch um den Hals, Justeaucorps, Hemd, Kniebundhosen, Strümpfen und Schuhen (Abb. 3).
Konservatorische Anmerkungen: Gewand 2018 gereinigt.[15]

[14] MAIS 1954, 258.
[15] Restaurierung durch Carine GENGLER (vgl. GENGLER 2018).

Erkennbare Kleidungsstücke: Das helle Tuch bzw. der Schal um den Hals ist schlecht erhalten und besteht aus sehr feinem Stoff. Vom Justeaucorps ist der Futterstoff (Seide, Köper 2/2 1/1 S-Grat) erhalten, das wahrscheinlich wollene Obermaterial ist vergangen. Dies ist daran erkennbar, dass die Nahtzugabe zur Oberseite hin umgeschlagen ist und Nähte teils frei liegen. Von den Kleidungsverschlüssen sind die hölzernen Kerne der Knöpfe erhalten, welche wahrscheinlich von ebenfalls nicht mehr erhaltenem Wollgewebe überzogen waren. Sie bilden eine gerade Reihe vom Halsbereich bis zur Mitte der Oberschenkel. Unter dem Justeaucorps ist noch das helle seidene Hemd identifizierbar. Ebenso unter dem Justeaucorps sind die Kniebundhosen und die seidenen Strümpfe sehr gut erhalten, von denen aufgrund des flächig erhaltenen Justeaucorps nur der Bereich von knapp oberhalb des Knies abwärts sichtbar ist. Die Kniebundhosen aus Seidensamt haben ein Bündchen, seitliche Knöpfe konnten aufgrund der Lage nicht festgestellt werden. Die Schuhe haben Schnallen, die Sohlen sind nicht beschädigt oder verschmutzt, also in neuwertigem Zustand.
Funktionalität: Alle Kleidungsteile scheinen für eine zu Lebzeiten getragene Tracht voll funktionsfähig zu sein.
Interpretation: Der Mann ist voll bekleidet mit der zeittypischen Tracht, er hat alle relevanten Teile an, Justeaucorps, Hemd, Halstuch, Kniebundhose, Strümpfe und Schuhe, inkl. Perücke. Lediglich ein Gilet (Weste) konnte nicht festgestellt werden. Für diese Bestattung wurde keine eigens gefertigte oder zugerichtete Funeralkleidung verwendet.



Abb. 3 (links) Wien, Michaelergruft. Überblick zu Sarg 88 mit Funktionaler Tracht.
Abb. 4 (Mitte) Wien, Michaelergruft. Überblick zu Sarg 83 mit Adaptierter Lebendtracht.
Abb. 5 (rechts) Wien, Michaelergruft. Detailaufnahme zum Hüftbereich mit Poschen in Sarg 83.

4.2. Beispiel Adaptierte Lebendtracht: Sarg-Nr. 83

Standort: Herrengruft
Datierung: um 1755
Kurze Befundbeschreibung: Frauenbestattung auf einer Bettung aus Hobelspänen, im Kopfbereich sieht man, dass dort ein Polster lag bzw. eine textile Zwischenschicht aufgelegt war. Die Frau ist mumifiziert, die Haare fehlen. Sie liegt gestreckt, mit den Händen im Brustbereich überkreuzt, diese halten ein Kreuz. Die Kleidung ist sehr gut erhalten, es handelt sich um ein Kleid mit Unterkleid, Handschuhen, Häubchen, Stöckelschuhen aus fünfbindigem Seidendamast und hellen, partiell erhaltenen Seidenstrümpfen (Abb. 4).
Konservatorische Anmerkungen: Sarg restauriert und gefestigt;[16] Kleid gereinigt.[17]
Erkennbare Kleidungsstücke: Die Frau trägt ein Häubchen mit Rüschen um den Kopf, es wurde korrekt angelegt. Um den ganzen Körper findet sich ein schwarzes Überkleid mit zwei Rüschenbahnen vorne von den Schultern bis zum Saum, das Oberteil ist hoch geschlossen und im Brustbereich gefältelt. Die Ärmel weisen helle, angenähte Rüschenbahnen auf. Seitlich an der Hüfte finden sich charakteristische Falten eines Kleides (Abb. 5), unter dem ein Panier querovaler Form oder Poschen getragen werden[18]. Das Überkleid ist hinten offen und im Rockteil über den Leichnam gelegt, die Arme sind in die Ärmel eingefädelt.
Die weißen Lederhandschuhe reichen bis über den Ellenbogen und sind eng anliegend – an keiner Stelle ist erkennbar, dass sie irgendwo zum Anlegen aufgeschlitzt wurden. Die Lederhandschuhe sind im Fingerbereich zurückgeklappt, so dass die Finger frei liegen. Das helle Unterkleid (Chemise) aus Leinen ist im Rockbereich durch eine aufgegangene Naht am Überkleid sichtbar, es reicht vom Halsbereich (festgestellt durch Anheben des Halssaumes des Oberkleides) bis knapp über die Knöchel. Die Schuhe scheinen nie getragen worden zu sein; die Nähte sind gesprungen, aber es sind alle Teile vorhanden, Ledersohle, Holzabsatz und Obermaterial aus Seidendamast.
Funktionalität: Das Kleid scheint von der Machart (Ausführung des Oberteils, Falten am Rockansatz, die darunter Platz für ein querovales Panier oder Poschen bieten) funktional für ein auch zu Lebzeiten tragbares Kleid zu sein. Dies wird auch unterstrichen durch das funktional wirkende Unterkleid, das Häubchen, die Lederhandschuhe und die Schuhe. Allerdings ist das Oberkleid hinten aufgeschnitten und aufgelegt und Kleidungsteile wie Poschen/Panier und Unterröcke fehlen.
Interpretation: Es handelt es sich bei diesem Ensemble um Teile einer auch zu Lebzeiten funktional getragenen Tracht, die jedoch modifiziert wurde, um als Funeralkleidung zu dienen. Dazu wurden stoffreiche bzw. ausladende Teile weggelassen und das Kleid hinten aufgeschnitten, um es dem Leichnam anziehen zu können.

[16] Fankl 2012; siehe auch Kapitel 2.1. Konservatorische Maßnahmen in der Michaelergruft.
[17] Reinigung des Gewandes durch Carine Gengler (vgl. Gengler 2018).
[18] Unter Röcken wurden – auch um bestimmte Rockformen zu unterstützen – in der Neuzeit verschiedene Formen von Reifröcken getragen. Paniere sind kuppelförmige und extrem ausladende Reifröcke; ab 1750 verwendete man Poschen, zwei voneinander getrennte Teile, die an der Hüfte saßen und mit einem Taillenband getragen wurden (siehe auch Loschek 1999, Stichwort „Reifrock“, 391-393.

4.3. Beispiel Funeraltracht: Sarg-Nr. 147

Standort: Cavriani-Gruft
Datierung: um 1760
Kurze Befundbeschreibung: Die Frauenbestattung ist skelettiert mit wenigen Hautresten, gebettet auf Hobelspänen, ca. 40–50 Jahre alt. Sie trägt ein helles Seidenkleid aus Seidentaft mit Rüschenbänderung, weiters eine Haube mit Seidenband, die Brustpartie (Stecker) ist schlecht erhalten, aber Reste von Kupfernadeln zur Fixierung der Gewandteile sind am Brustausschnitt zu finden. Schuhe aus Seidendamast, Strümpfe sind nicht erkennbar (Abb. 6).
Konservatorische Anmerkungen: 2006–2008 wurde an diesem Sarg eine Proberestaurierung von Ingvar Magnussen durchgeführt, wobei zerstörte Holzpartien auf Plexiglas montiert wurden. Das Gewand wurde bei diesen Maßnahmen nicht angetastet.
Erkennbare Kleidungsstücke: Die Frau trägt ein helles Seidenkleid mit Rüschen, bei diesen handelt es sich um Bänder mit gestanztem Randabschluss. Die Rüschen sind am Kleid in einem von der Schulter bis zur Taille reichenden Wellenmuster angeordnet, ab der Taille finden sich ausladende gegenläufige Wellen. Das Kleid entspricht als einteiliges Kleid mit bis zur Taille spitz ausgeschnittenem Dekolleté in der Form stilistisch einer Adrienne.[19] Es sind bei dieser Frauenbestattung keine weiteren darunter getragenen Kleidungsstücke erkennbar. Unterkleidung, wie Chemise und Unterröcke, fehlen, im Oberkörperbereich ist wahrscheinlich auch kein Korsett/Schnürleib etc. vorhanden. Dies kann jedoch wegen mangelnder Zugänglichkeit nicht endgültig verifiziert werden. Die Schuhe haben ausschließlich einen dünnen Seidenstoff als Obermaterial. Sie bestehen nicht wie üblich aus mit Seide bezogenem Leder, bieten daher kaum den nötigen Halt beim Gehen und haben damit ephemeren Charakter. Sie müssen wie alle anderen Seidenschuhe gleicher Machart in der Michaelergruft als Funeralschuhe verstanden werden; insbesondere da das Muster mit dem Gewandstoff nicht korreliert. Eine helle Haube mit umlaufenden Rüschen aus Gazé und einem Band aus schwarzem Seidentaft mit Schleife ist mit Nadeln fixiert. Schleifen aus Seidentaft finden sich auch an den Manschetten in Höhe der Ellenbogen und an den Schuhen.

Abb. 6 Wien, Michaelergruft. Überblick zu Sarg 147 mit Totentracht.

[19] Eine Adrienne (auch Andrienne) ist auch eine der im 18. Jahrhundert typischen Kleidformen mit den charakteristischen, von den Schultern herabfallenden breiten Falten (LOSCHEK 1999, 101); zu Frauenkleidung im 18. Jh. siehe BÖNSCH 2001, 198-205.

Funktionalität: Das Kleid ist im Rockbereich hinten aufgeschnitten und auf den Körper aufgelegt. Im Oberkörperbereich wird der Zwickeleinsatz bzw. Vorstecker des Mieders nicht durch Hefteln verschlossen und an seinem Platz gehalten, sondern ist mittels Kupfernadeln zusammengesteckt (Abb. 7). In den Randbereichen des Zwickeleinsatzes am Mieder sind keinerlei Hefteln, Ösen oder dergleichen feststellbar, die üblicherweise in diesem Bereich das Gewand verschließen.
Interpretation: Es handelt sich bei diesem Ensemble um Funeraltracht und wahrscheinlich keine umgeformte Alltags- oder Festtracht, sondern um ein extra angefertigtes Kleidungsstück, das optisch den Anschein eines zeittypischen Gewandes ergibt.

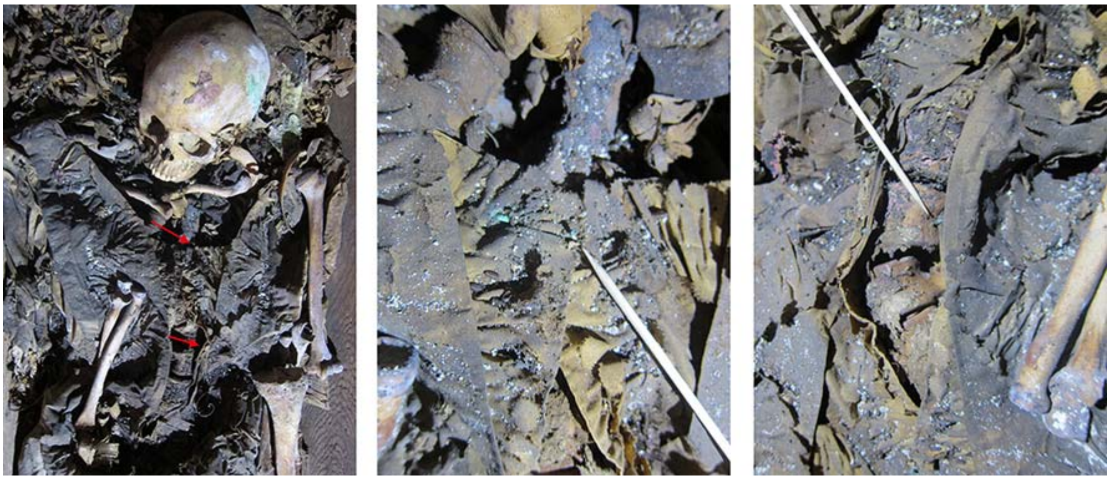

Abb. 7 Wien, Michaelergruft. Detailaufnahmen zu Sarg 147.

5. Diskussion und Ausblick

Bei der – wie auch immer gearteten – Kleidung, in der Menschen bestattet werden, handelt es sich als menschliche Universalie bei den meisten Gesellschaften – unabhängig von Region und Zeitabschnitt – nicht um das profane, beim Sterben getragene Kleidungsstück.[20] Es ist vielmehr mit vielen Bedeutungen aufgeladen, die im Rahmen der gesamten Gesellschaft, der religiösen Ausrichtung, der sozialen Stellung und den individuellen (finanziellen) Möglichkeiten zu lesen sind. Auch im christlichen Kontext, vor allem auch der frühen Neuzeit, sogar noch weit in die Zeit der Aufklärung hinein, wurde durch die bewusste Auswahl des Gewandes eine Aussage über die bestattete Person, aber auch über die bestattende Gemeinschaft getroffen. In den Vordergrund rückte die Inszenierung, in der der aufgebahrte und zu begrabende Leichnam ein letztes Mal in der Öffentlichkeit und vor Gott erschien.
Bei den vorgestellten Analysen geht es auch um die Überlegung, ob die tote Person in einer Kleidung bestattet wurde, die auch – ob nun als Alltags- oder wahrscheinlich Festkleidung – zu Lebzeiten getragen worden ist, oder ob es sich um eine speziell angefertigte Totentracht handelt. Dazu wurden mehrere Kriterien zur Beschreibung und funktionalen Einordnung des Bestandes

[20] Vgl. Überlegungen bei Grömer 2014, 117–120.

vorgestellt[21] und anhand von Fallbeispielen diskutiert. Diese sehr detaillierten Kriterien für einen standardisierten Beschreibungskatalog sollen nun Textilkonservatoren und Textilforschern, die sich mit Kleidungsstücken aus Grüften beschäftigen, zur Diskussion und Weiterentwicklung gestellt sein.

Im Falle der aus der Michaelergruft beschriebenen Kleidungsensembles und Beobachtungen an vielen anderen Särgen aus dieser Gruft kann vorerst festgehalten werden, dass Männer oft mit einer funktionalen Tracht bestattet sind (jedoch in neuen Schuhen), während Frauen in einer Adaptierten Lebendtracht oder reinen Totentracht zur letzten Ruhe gebettet wurden. Dies mag auch daran liegen, dass vor allem repräsentative Damengewänder der Oberschicht des 18. Jahrhunderts, mit denen wir es bei den bearbeiteten Särgen in der Michaelergruft zu tun haben, durch ihre Untergewänder sehr raumgreifend sind und rein physisch in ihrer Gesamtheit in einem Sarg kaum Platz finden würden.

Bei zukünftigen Forschungen ist es auch wünschenswert, in Bezug auf die Verwendung der Begriffe „funktionale~~r~~ Tracht“, „Adaptierte Lebendtracht“ und „Totenkleidung“~~,~~ chronologische und regionale Tendenzen sowie spezifische Unterschiede etwa zwischen Gewändern aus katholischen und evangelischen Grüften herauszuarbeiten. Diese können neben dem hier untersuchten Hauptaugenmerk auf die Funktionalität der Kleidungsstücke zusätzlich auch etwa die Farbigkeit oder spezifische Kleidungsaccessoires betreffen. Weiters ist handelt es sich hier auch um einen wesentlichen Forschungsansatz für die Bearbeitung von Textilresten aus neuzeitlichen Friedhöfen mit Erdbestattung, da sich bei diesen organische Reste durch die Bodenlagerung nur kleinteilig erhalten. Die aus der Michaelergruft gewonnenen Erkenntnisse bezüglich der Verwendung von funktionaler Tracht, Adaptierter Lebendtracht und Funeraltracht dienen auch als wichtige Stütze bei der textilarchäologischen Beurteilung von Kleidungsresten etwa von Bestattungsplätzen in Österreich wie z. B. St. Pölten Domplatz[22] oder dem Friedhof St. Stephan in Wien 1[23]. Hier ist auch zu untersuchen, wie sich die Unterschiede in den verschiedenen sozialen Kontexten gestalten. So unterscheiden sich Bestattungen einer ländlichen Bevölkerung, wie beispielsweise in Zwettl[24] deutlich von den Grablegen adeliger/reicher Personen, wie dies in der Michaelergruft mit ihrer Nähe zum habsburgischen Kaiserhaus sicher auch der Fall war. Die spezifischen Unterschiede zwischen solchen Bestattungen müssen durch weitere Forschungen an Trachtbestandteilen mit Textilresten aus Erdgräbern wie auch durch spezifische Analysen an Gruftbestattungen erbracht werden. Als eines der ersten Ergebnisse in dieser Hinsicht kann folgendes festgestellt werden: In der Michaelergruft finden sich bisher eher

[21] Ein sehr ähnliches Schema der Kategorisierung zwischen "drapiert und angesteckt, umgearbeitet und tragbar" wurde bei derselben Tagung "Leben mit dem Tod. Der Umgang mit Sterblichkeit in Mittelalter und Neuzeit" auch im Beitrag "Gruftbestattungen in der Klosterkirche von Riesa (Sachsen)" von Amelie ALTERAUGE und Cornelia HOFMANN aufgezeigt, jedoch wurden die konkreten spezifischen Untersuchungsmerkmale nicht so dezidiert herausgestellt.

[22] https://www.nhm-wien.ac.at/forschung/praehistorie/forschungen/textilforschung/domplatz [Zugriff: 27.2.2019] und Facebook: Stadtarchäologie St. Pölten.

[23] KLAMMER, KÜHTREIBER und MITCHELL 2018.

[24] KÜHTREIBER, FETTINGER und HEISS 2015.

nur Holzknöpfe, während es in den Friedhöfen am Propsteifriedhof in Zwettl[25] und am Domplatz von St. Pölten viele Knöpfe aus anderem Material sowie Ösen, Schnallen, Nieten usw. gibt. Diese können dann gemeinsam mit eventuell existierenden Verzierungselementen aus Metall, wie Rosetten, Zierknöpfen, Zierblechen usw., durch ihre Lage an den Skeletten[26] bei der Rekonstruktion der Textil- und Lederobjekte behilflich sein, gemeinsam mit eventuell anhaftenden Organikresten[27]. Für die Beurteilung dieser rekonstruierten Gewänder aus den Erdgräbern muss dies schließlich mit den Erkenntnissen aus den Grüften zum Thema Funktionale Tracht – Adaptierte Lebendtracht – Totentracht diskutiert werden, wozu die hier angeführte Studie aus der Michaelergruft ebenfalls Anstoß geben soll.

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[25] GRÖMER, RUDELICS und TOPA 2015

[26] Z. B. St. Pölten: https://www.nhm-wien.ac.at/forschung/praehistorie/forschungen/textilforschung/domplatz [Zugriff: 30.10.2018].

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6.3. Recycling of Textiles in Historic Contexts in Europe. Case Studies from 1500 BC till 1500 AD

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Recycling of Textiles in Historic Contexts in Europe
Case Studies from 1500 BC till 1500 AD

Karina Grömer

Introduction: What is textile recycling?

Recycling is a term, nowadays used for various actions, usually meant as a key component of modern waste reduction. There are some more meanings of the term recycling, as demonstrated by the official definitions of recycling after Dictionary.com (http://www.dictionary.com/browse/recycle, accessed: March 31, 2017):

a) to treat or process (used or waste materials) so as to make suitable for reuse

b) to alter or adapt for new use without changing the essential form or nature of

c) to use again in the original form or with minimal alteration

d) to pass through a cycle again; repeat a process from the beginning

To explain that with modern examples (see e.g. https://en.wikipedia.org/wiki/Textile_recycling, accessed: March 31, 2017): For modern consumers the most common way of recycling textiles is reuse through reselling or donating to charity, e.g. to Salvation Army (https://en.wikipedia.org/wiki/The_Salvation_Army, accessed: March 31, 2017) or Caritas (https://en.wikipedia.org/wiki/Caritas_Internationalis, accessed: March 31, 2017). In such ways donated textiles are treated in various different ways. One the one hand, they can be resold; therefore they are sorted by color, size and quality, then packed, baled and sold as good reusable clothing.

Some textiles can be re-made into other pieces of clothing. Interesting examples of that kind of textile recycling are among the Do-it-Yourself (DIY) movement – people, who are building, repairing and modifying things without the direct aid of experts or professionals. A new platform for DIY is the world wide web. Thus, via internet creative designs are spread, such as to refashion old blue jeans into skirts or bags (e.g. https://de.pinterest.com/pin/764486105465629026/ or http://wonderfuldiy.com/wonderful-diy-10-ways-for-transformation-of-the-old-jeans/, accessed: April 28, 2017). Those ideas are posted e.g. on Pinterest or on websites and blogs, inspiring millions of people worldwide. (Fig. 1).

In modern textile recycling companies, damaged textiles are sorted out and converted into rags to make industrial wiping cloths and other items. Textile fibers can also be processed: Fiber reclamation mills grade incoming material into type and color. The textiles are shredded into “shoddy” fibers and blended with other selected fibers, depending on the intended end use of the recycled yarn.

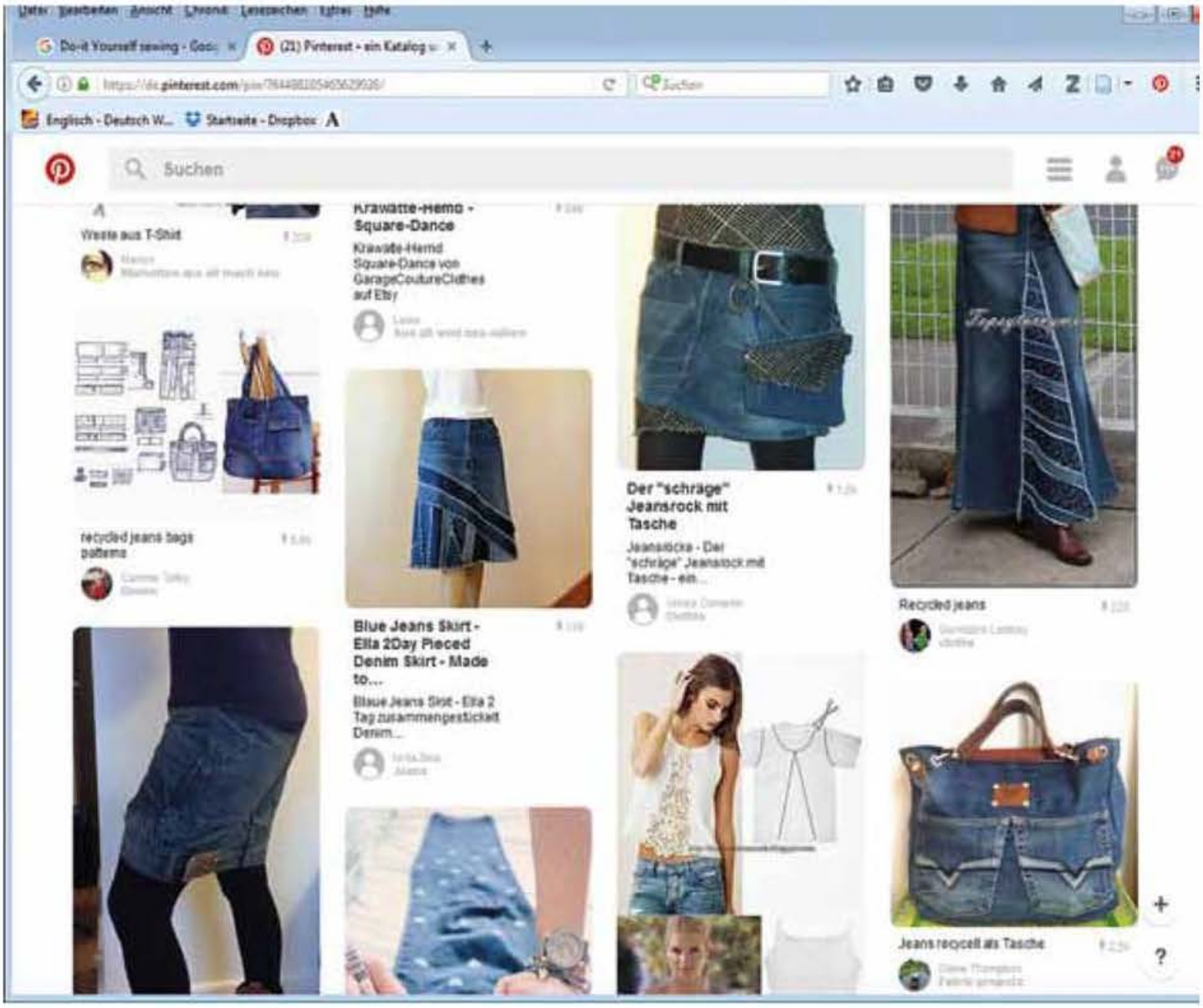


Fig. 1: Pinterest posts dealing with refashioning old jeans (screenshot: https://de.pinterest.com/pin/764486105465629026/).

In prehistoric and historic times (this study covers roughly the period between 1500 BC and 1500 AD) textiles have been produced for various purposes, one important among that is clothing, worn in daily life or for specific occasions. Textiles also have been used for funeral practices or as soft furnishings such as wall hangings, cushions or pillows (Grömer 2016: 291–318). There are also various possibilities, how textiles have been recycled and re-used within that time-span. Among them, some case studies are presented.

Re-use and recycling of garments

As evidenced by prehistoric and historic finds, garments have been treated in various ways: re-used in a different context, re-worked and still be used as clothing; garments have also been totally made of recycled material; also worn-out garments have been re-worked to serve for other purposes. Usually it is not easy to prove that on archaeological material due to the fragmentary state of most archaeological finds. In rare cases, also complete garments survived and those are valid for our further examples.

Re-working of garments in prehistory

Spectacular and well known finds of complete garments are known from Bronze Age Denmark, in particular from the peninsular Jutland, 14th to 12th centuries BC (Broholm & Hald 1935; Hald 1980; Bergerbrant 2007; Mannering *et al.* 2012). In Oak coffin graves complete outfits of women have been preserved, comprising blouses, skirts, belts, large wrap-around garments (blankets) and hairnets. In men's graves cloaks, smaller and irregular shaped wrap-around-garments, leather and textile belts have been found.

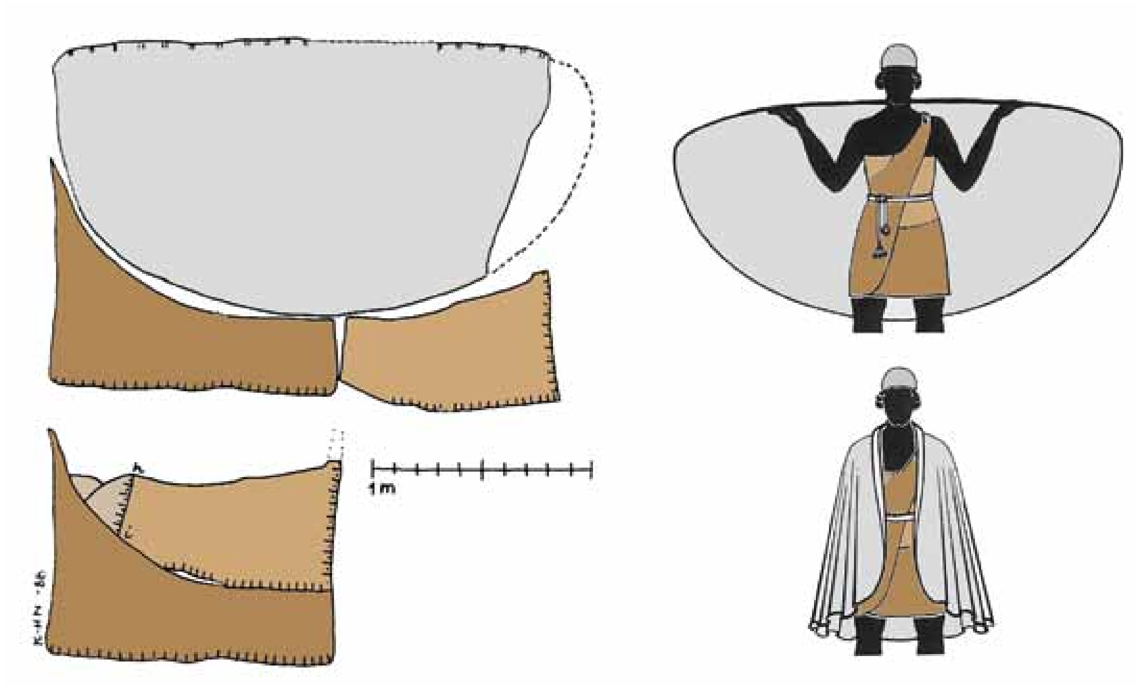
The specific shape of men`s wrap-around garments and kidney-shaped cloak especially caught the attention of some researchers. The cut pattern (Fig. 2) – how to tailor those two garments is striking: Firstly, the kidney-shaped cloak is cut out from a larger piece of cloth. The remaining part is of an irregular stripy shape with prolonged ends. That piece is cut into larger and smaller pieces and then put together again to form the more or less rectangular men's wrap around garment. It is an interesting fact, that the total amount of cloth needed for that cut pattern has the same size as the larger wraps ("blankets") found in graves of women. Thus, it was thought, that maybe men's garments might have been made out of garments that formerly have been worn by women (Eskildsen & Lomborg 1977; see also cut pattern in Munksgaard 1974; Randsborg 2011: 64).

Special case: re-use of high quality garments for liturgical vestments

From Medieval and Early Modern Europe a specific re-use of textiles is known, comprising a high-ranked context. It was common among the European elites to donate valuable textiles such as wedding garments or other precious cloth to the Catholic Church (Stolleis 2001: 15; Clegg Hyer 2012). They have then been made into ecclestical garments such as chasubles, stoles, copes or maniples. Such liturgical vestments are still kept in many European churches and monasteries, but also in costume collections. In some cases, still the donating persons as well as the former use of those textiles are known.

For example, in AD 934 the Anglo-Saxon king Athelstan donated some textiles to the shrine of St. Cuthbert near Durham in Great Britain. Among the precious gifts was also a gold-embroidered band that later was cut, sewn together and re-worked into a maniple. The former use of that band has been as clothing tie from a cloak or headdress of a piece of royal secular dress (Clegg Hyer 2012: 50–51 and fig. 3.1).

Fig. 2: Cut pattern of Bronze Age male garments from oak coffin burials in Denmark (drawn by: K. Grömer, based on: Munksgaard 1974 & Schlabow 1937).



A striking example of re-use of donated textiles is a vestment kept at the Schnütgen museum in Cologne, Germany (Sporbeck 2001: 109–111). It is a chasuble made of a precious cloth, a red velvet with gold brocade in large floral pattern. Count Gumprecht II von Neuenahr is named as donator, after the death of his wife in AD 1459, he gave the textiles to the church. It can be clearly seen that the red velvet was former used as another type of secular garment, because the large piece that was needed for the chasuble was set together from various pieces of the same cloth, causing some cuts that disturb the large floral pattern.

Even the donation of a coronation-gown is documented from the St. Stephen`s cathedral in Vienna, Austria, given by members of the Habsburg family. Empress Karolina Augusta, the 4th wife of Franz I. from Austria donated her coronation-gown on 17th January 1859 (Donin 1873: 515). The precious silk damask fabric of the gown is embroidered with silver threads. It has been re-made into a chasuble (Fig. 3), 4 dalmatics and a cope: the so-called Maiornat (Inventory St. Stephan 2003: Inventar-Ordner 48, No. 9001/2182). The fabric was used for decorative parts of the ecclestical garments.

Such a 'reuse' of valuable textiles, which were given to the church, is a well-known phenomenon. Particularly female members of royal families and the elite donated precious textiles to be made into liturgical vestments. Some chasubles are stored in St. Stephan's which were made from the wedding gowns of diferent members of the Habsburg family (e.g. Eleonorenkasel) (Catalogue St. Stephan 1997, 238 and 253). In 1647 new vestments were made, using these 'old' fabrics.

All kinds of cloth have been given to the church, there are also interesting cases that textiles and garments, brought from far away, have been re-used for ecclestical garments. From Braunschweig (Stolleis 2001: 17–18, fig. Kat.Nr. 5), a chasuble is known that has been made of a pre-

Fig. 3: Liturgical garments, so called "Maiornat", , decorative parts made of a coronation gown, donated to St. Stephan’s cathedral in Vienna by the Habsburg family: chasuble and detail of a cope (copyright: St. Stephan’s cathedral).

cious silk fabric with woven-in Arabic letters which praise Allah and the glory of a sultan. Definitely, the person who donated that fabric c. in AD 1430/1440 did not understand the letters. For him, it was just a precious fabric, worth to be re-worked as liturgical Christian garment. The silk cloth originated from the Near East and dates c. AD 1300.

Garments in graves

If we assume, that clothing is something to be worn in daily life, textiles used as shrouds or clothing in graves can be discussed as re-use. Usually we don`t know if the textiles we find there have been especially made for a grave purpose. Only in specific cases we know that textiles in a grave have been woven directly for that. The Iron Age tomb of Eberdingen-Hochdorf in Germany (Banck-Burgess 2012a, b) is such a case. In this grave, a c. 40-year-old male member of the Hallstatt elites had been buried together with precious grave goods. Among them are a gold-plated torc, amber jewelry, bronze dishes, drinking horns, a large cauldron with lions, a couch and a four-wheeled wagon. In the richly furnished burial chamber a number of precious textiles have been found, also the deceased was wrapped into several layers of cloth. Microscopic analysis of the textiles, such as fibre analysis brought to light, that the textiles might have been exclusively made for this tomb. A hint for this hypothesis is e.g. that fine badger fibres have been used to weave fine cloth such as tablet woven bands, while the coarse hair of badgers were found as stuffing of mattress and pillow (Banck-Burgess 2012a: 142–143). The coarse badger hair has been sorted out and separated from the fine under-coat of the badger before spinning and weaving fine cloth. As that kind of raw material is quite unusual, and artefacts deriving from different steps of processing the hair are found together in the grave, it has been interpreted to be made at the same time and for the same purpose, i.e. for the burial.

From archaeological finds, there are also hints that garments from daily life have been re-used for dressing the dead. Former use of a burial garment in daily life can be attested through tear and wear.

Among the afore-mentioned Bronze Age grave finds of complete garments in Denmark, some of them have mended parts, thus pointing to a longer use during life-time (Broholm & Hald 1935: fig. 56 and 68; Mannering *et al.* 2012: 101). One of such repaired examples comes from the female grave from Egtved. Also the blouse from Borum Eshøj displays some weak parts at the sleeves, deriving from heavy use.

From Iron Age, bog bodies have been found in Northern Europe, e.g. in Denmark and Schleswig-Holstein (Northern Germany). There has to be differentiated between people who have been buried in the bogs and persons who have been victims of accidents (Van der Sanden 1996, chapter 7). The latter ones of course wear their daily garments, whilst the garments of buried people have been selected for the funeral purpose. Some of the bog bodies deriving from a burial wear garments that have been repaired. A good example is the find discovered in 1949 at Hunteburg in Northern Germany (Möller-Wiering 2012: 161). The calibrated 14C dates vary between 245 and 415 AD. The bodies of two men lying side by side have been wrapped into large cloaks with marks of repair (Schlabow 1976: 51–53 and fig. 74). Cloak A of Hunteburg displays a damaged tablet woven border which had been torn and then fixed with secondary stitches to make it wearable again. Another type of use-wear was identified with the cloak B of Hunteburg. In the centre of the garment, layers of mending-stitches are visible, covering a huge area (Fig. 4). When worn, that part of the cloak is laid on the shoulder, precisely, there it was fixed with a fibula. Thus, the penetration with the fibula, done daily when taken on, caused massive damage and weakening of the cloth. That has been met with mending the damaged area several times. Such, we can assume that this cloak has been worn long time during life-time, before it ended up to cover the dead body. Another example of the use of a heavily worn costume as grave garment for a dead person can be named from Dätgen in Germany. The clothes of the Dätgen body (Schlabow 1976: 55–57, fig. 83; Möller-Wiering & Subbert 2012: 161), which date to cal AD 345-535, consist of trousers and a worn-out cloak. The cloak has been mended and patched also due to the use-wear, it has been cut off and thus the original size of the cloak was reduced.

Interesting hints for the re-use of a garment worn during life-time in a grave can even begained from entomological analysis. Thus, a textile found on a bracelet of a Roman Period child's burial in Furth/Göttweig in Austria (Grömer 2014: 232 and Taf. 20), dated to the 4th century AD, displays an interesting evidence for our question: When microscopic analysis of the textile was carried out, also a human body louse (*Pediculus humanis corporis*) have been found (Fig. 5). The textile fragment was attached on the inner side of the bracelet and thus indicates that it formerly belonged to a sleeve of a tunic. Roman terms for garments are well known – a long-

Fig. 4: The cloak of Hunteburg bog body B with marks of repair on the shoulder (after: Schlabow 1976: fig. 74).

Fig. 5: Textile from a roman childs burial from Göttweig, Austria, with human body lice (after: Grömer 2014).

sleeved tunic is a *tunica manicata*. As body lice depend on living human beings to survive, we know that this specific *tunica manicata* also was worn during lifetime – whether by that person buried with it or another one can not be proved.

In the cases of graves garments which can be proved that those have been made for to be worn during life-time, we can state a re-use: Although it is still used as a garment, the function of the textile is not the same – the context is different. It is not any more worn, taken on and off by a living person, but buried with the deceased.

Re-use of rags for garments

Throughout history, rags have also been used for creating garments – that usually is a sign of low economic background and poverty. To point again to a more modern example – the *boro*-textiles in Japan (Koide & Tsuzuki 2008): It is a term, deriving from Japanese *boroboro* (something tattered or repaired) and meaning a heavily mended garment patched with recycling material or a garment one made out of scraps or recycled rags. In the Edo-Period (roughly 17th till 19th centuries AD) the economic background of the low social classes has been quite poor. Thus, peasant farming classes made their garments with spare fabric scraps out of economic necessity. In many cases, the usage of such a *boro* garment would be handed down over generations, eventually resembling a patchwork after decades of mending.

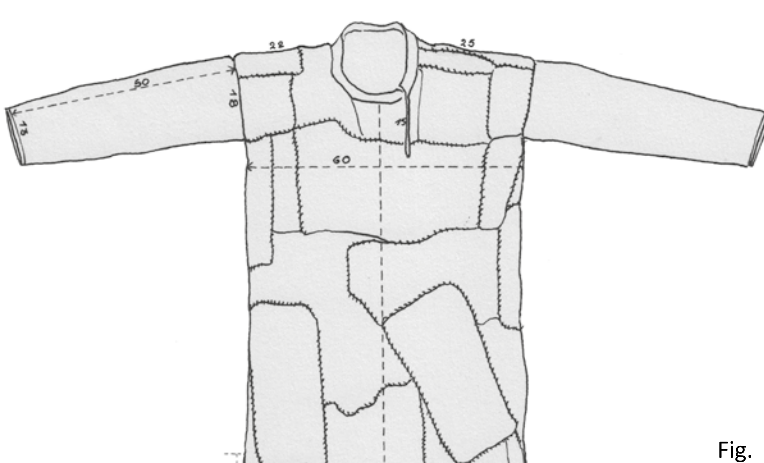
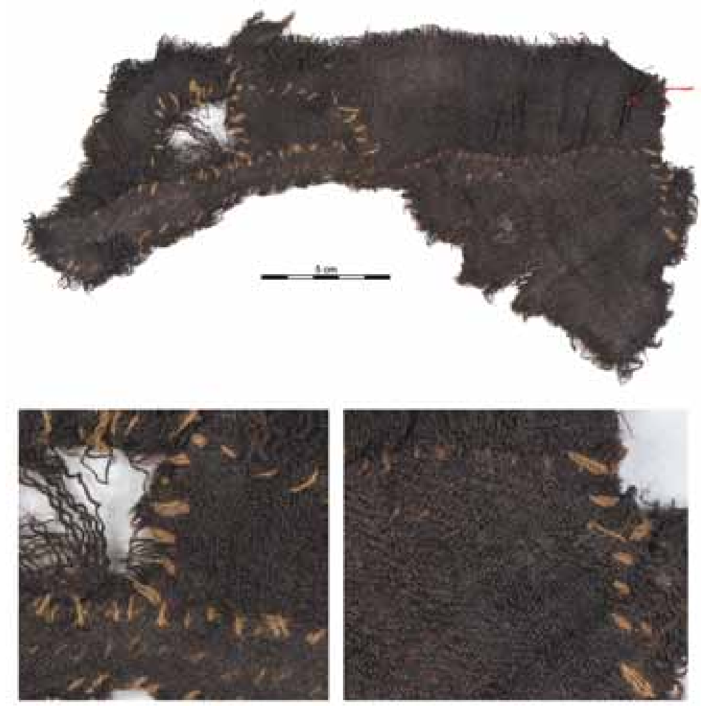


Fig. 6: The patched garment from Bernuthsfeld, Germany
(after: Schlabow 1976, fig. 149).

Fig. 7: Recycled textile in Hallstatt, Austria (HallTex 97) (© Natural History Museum Vienna; photo: A. Rausch).



For prehistory and early medieval Europe, complete textiles are rare: There is only one garment that can be proved totally to be made of rags; the tunic of Bernuthsfeld in Germany (Fig. 6) (Schlabow 1976: 72–73, Fig. 149; Farke 2001). It was found in a bog on a man`s body, who also wore a fringed cloak, a pair of puttee-like leg-bindings and a plaid. Recent C14 dating (1290+-45 BP, ca. AD 660) has shown that it is not an Iron Age bog body as it has been published before, but comes from the Early Medieval period. All parts of the men`s costume show clear signs of wear and damage. As they are patched and mended, they presumably have been used for a long time. Of specific interest here is the tunic (Fig. 6) consisting of a patchwork of different weaves and weave qualities, among those are coarse to fine tabbies as well as twills of different qualities and types (simple twills as well as zig-zag or lozenge twill). A total number of 45 separate patches have been sewn together, which makes it seem as if the majority of the patches were the starting material of the garment. So recycled material – rags – are the foundation of the garment.

Massive patching can also be seen on the cloak of the Damendorf Man (Schlabow 1976: 54–55, fig. 76; Möller-Wiering & Subbert 2012: 161) (Germany), dated to cal. AD 135-335. The garment was mainly made of diamond twill. Totally, there are 11 patches in various sizes attached, the smallest measuring 2x2 cm, the largest 11x25 cm.

Re-use of garments for other purposes

It is tricky to prove from an archaeological context that textiles, which formerly have been used as garments, have been converted into another artefact to be used for a completely different purpose. From the salt-mine Hallstatt in Austria some Iron Age textiles (c. 800-400 BC) have been found that clearly were used as garments, before they were re-worked and then ended up in the mine. A specific item is HallTex 97 (Grömer *et al.* 2013: catalogue, p. 423-425), a brownish twill fabric with several different stitches (Fig. 7). The analysis of the stitches clearly demonstrates different "hands" who made them. Firstly, there is a flat fell seam, carefully done with a thread that matches the main web in terms of colour and yarn diameter. The stitches of the seam are made very regularly. That seam might be the remnant of a garment. Also the overall appearance of the item places it among cloth to be used for garments: it is a patterned (spin pattern) twill fabric of fine quality, made of regular spun threads. After wear and tear it has been re-worked, it was torn, folded and roughly stitched together with up to three layers. The secondary seams and stitches have been carried out with other type of thread, a thicker yellowish one. The stitching is done irregularly, not with the same care that can be seen at the primary seam. Also the stitches with yellow thread superimpose sometimes the other ones (Rösel-Mautendorfer 2011: 73).

Nevertheless, even if the item looks quite chaotic, it is likely that an object for a specific purpose was produced. The stitches create a strong, multilayered flap in dimensions that fit very well into a human hand, also the hole, surrounded by stitches seems to be intentionally. The precise function of the object is difficult to determine due to the lack of comparable objects, but with that specific shape and the sewn hole it acts like a so-called *Handleder*. That is an item known from Hallstatt, usually round to rectangular in shape with a hole and made of leather. A *Handleder* is used to protect the palm when handling tools or ropes (Reschreiter & Kowarik 2009: 57)

Textile rags for production of items

Rags of textiles have also been used as makeshift tools for various production processes. There is archaeological evidence for textiles used by potters, bronze-smiths and even for salt processing.

Textile rags for pottery

From different periods we have evidence that rags have been used for handling ceramic products during the making. Indicators are textile imprints on pottery. They must have originated during the work of the potter. Only if the fabrics were pressed into the not yet hardened clay (shortly after the shaping of the vessel) and the vessel afterwards has been fired, the textile imprints could remain until today. Whether specific fabrics were used for this purpose, or whether simply worn-out rags were used, can not be ascertained, but it is likely.

An imprint of a textile was found on the handle of a 2nd–3rd century AD vessel (Fig. 8) from the Roman settlement in Vienna, Austria (Grömer 2014: catalogue Rö-184 and plate 45). The textile impressed was a slightly rep-like tabby fabric of medium quality. Next to the textile imprints also the fingerprints of the potter can be documented. That evidence strengthens the interpretation that the textile probably has been a working tool of the potter. After the vessel was formed (but still in the damp state) obviously it was handled and touched using a cloth.

Sometimes also impressions of textiles or mats can be identified on the bottom of vessels. In that cases, the potter used the cloth as clean pad or support to keep the ready-formed vessels until they have been dry enough to fire them. One impressive example comes from Bilce Złote in nowadays Ukraine (Bender Jørgensen 1992: 84, fig. 110) and belongs to the neolithic Kultura trypolska, which roughly dates between 4200-2750 BC.

From the Early Middle Ages there are also finds for the use of textile rags in combination with a potter`s wheel. Certain imprints on the bottom of pots in Mikulčice and Olomouc in Czech Republic from the 9$^{th}$ and 10$^{th}$ century AD (Kostelniková 1972: Taf. I und II) can be interpreted such. It is likely that they functioned as a caulking of the axis of a potter`s wheel, because they are pressed into the centre of the bottom piece in a special way.

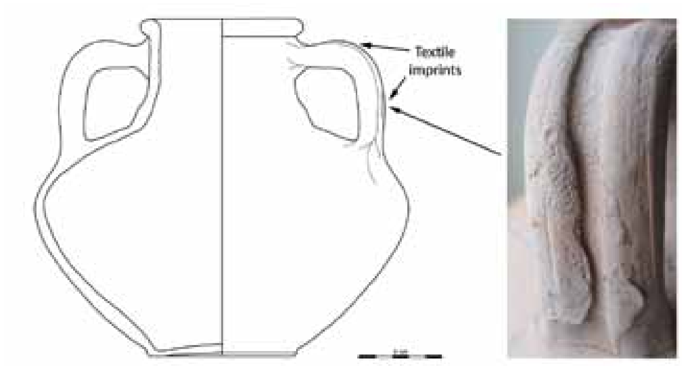


Fig. 8: Roman vessel from Vienna, Austria, with textile imprints caused by the potter (after Grömer 2014, © Wiener Stadtarchäologie).

Textile rags not only comprised handling during the manufacture of ceramic vessels, but also for other products of clay such as bricks. On Roman bricks (Wild 1970: Tab. A/30, 33, Tab. B/74) sometimes impressions of fingerprints as well as of textiles are found, the latter can be interpreted as a mark of production-technological handling.

Production of clay figurines

Next to the use of textile scraps as make-shift materials for handling, fabrics also have been employed as material for stabilization.

That could be documented e.g. by scientific analysis of pipe-clay figures by craftsmen in the 15th century in the Rhine area (Kaszab-Olschewski 2015). Many pipe-clay objects display textile structures which are preserved in the clay.; e.g. a St. Catharine-figure from ´s-Hertogenbosch in the Netherlands.

The craftsmen in the Late Middle Ages used textiles to assist in the manufacture of their products. They worked on a high artistic level and persisted successfully in the 15th century in competing with other arts and crafts producers (graphic artists, woodcarvers, etc.). They manufactured various ceramic objects such as larger figurines, reliefs and small statuettes which have been manufactured in series by applying negative or hollow forms (moulds). The statuettes were mostly produced by using separate moulds for the front and back sides by means of a two-part mould (like antique terracotta figures or today's Easter Bunny chocolate figures). The afore-mentioned textile traces are either concealed inside the objects or more or less clearly visible on the front- and backsides.

The textile inside helps to cake the individual layers of clay during the firing phase. The layers of clay sometimes differ in respect of consistency and material structure. The different clay-pastes with textile inserts allowed a sharper impression and prevented air bubbles in the product. The lattice structure of the fabric also had a stabilizing effect on the product.

Production of jewellery and dress accessories

Another type of use of recycled textiles for production processes can be observed from Iron Age and Early Medieval bronze-smiths.

Textile rags, together with other organic material were employed in the production of late Iron Age hollow rings. The hollow anklets and bracelets were made of very thin bronze sheets and decorated. They have been filled with clay, sand, wood or textile to stabilize the shape. This was an absolute necessity during the manufacturing, because the filling should protect the hollow body from buckling. After finishing the objects, the filling was not removed, because its shape-protective properties also were utilized even during wearing. The textiles found in the hollow

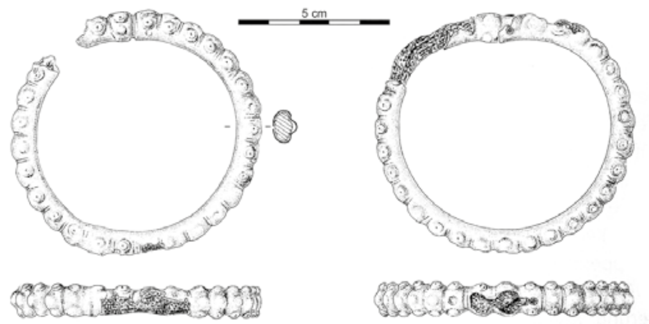


Fig. 9: Hollow rings filled with textile rags from Mannersdorf am Leithagebirge, Austria (after: Müllauer & Ramsl 2007).

rings are always fragments of flax tabbies. Such objects have been excavated in the women's tombs of the Early and Middle Latène period, especially in Moravia and Slovakia (Belanová 2005; Belanová-Štolcová 2012: fig. 15.11-15.12), as well as in Lower Austria, for example in Mannersdorf am Leithagebirge (Fig. 9) (Müllauer & Ramsl 2007).

As a special example, Grave 9 at Nové Zámky in Slovakia (Pieta 1992) is to be emphasized. In the two anklets of the women's burial, several fragments of a linen-woven fabric were discovered, which were decorated with red woolen embroidery. That piece of cloth definitely was primary made to be worn as a garment. Thus, it is obvious that we see here the "recycling" of old textiles. Additionally, it is also discussed in Slovakian research whether the textiles worn in a hollow body on the body could also have been textiles of a specific origin with a symbolic connotation or magical-ritual function.

A different use for recycled textiles was carried out for the production of Avar strap-ends in the Early Medieval. Strap-ends are an important part of a specific type of belts used by male members of the Avar Empire to represent wealth and social status. The strap-ends are highly decorated and in the 8th century AD they have been made in the technique of bronze-cast. At the Avar cemetery Leobersdorf, Austria (Hundt 1987: fig. 1-2) strap-ends could be analysed that had impressions of a textile at the inner side of the object. What makes the textile structures outstanding, is that they have been casted in. Different theories arose, how a textile structure can appear from the bronze casting process and how this was done technically. Hans-Jürgen Hundt (1987: 10–17) used the method of experimental archaeology to reconstruct the production process. It was already known that the basis of casting those strap-ends have been wax models which were formed in clay or wooden models before. The wax models then have been coated in clay and fired, the wax melts, leaving a mold into which molten metal can be poured (lost-wax method). Additionally Hundt found out that a textile scrap (soaked with wax) has been attached to the back of the strap-end wax model, because the object is quite thin (to save later on casting bronze material) and thus it tends to break or to bend out of shape. The textile served to stabilize the wax model and as a distance-holder. When the casting was done, the textile structure was visible on the back of the strap end. Similar techniques for stabilizing thin wax models for bronze cast also has been identified among Scythian and Viking finds.

Textiles used for briquetage

At Erdeborn, Saxony-Anhalt in Germany, excavations brought to light an Early Iron Age site (Ipach 2015). The archaeological evidence and artefacts indicate, that on this site salt was produced from brine, using the briquetage-technique. Thus, densely packed ceramic vessels filled with brine are heated in kilns. As soon as the liquid vaporized, the salt crystals could be harvested and taken out of the vessels, which remain in thousand fragments on the site. During scientific investigation in some cases textile imprints could be found inside the vessel (Ipach *et al.* 2014). The textile traces are of different kinds – coarse tabbies, a twill cloth and a coarse veil-like fabric. They do not represent standardised fabric types as the vessel types are. Therefore it seems feasible that different kinds of rags that have been easily available have been used, and not textiles specifically made for that purpose.

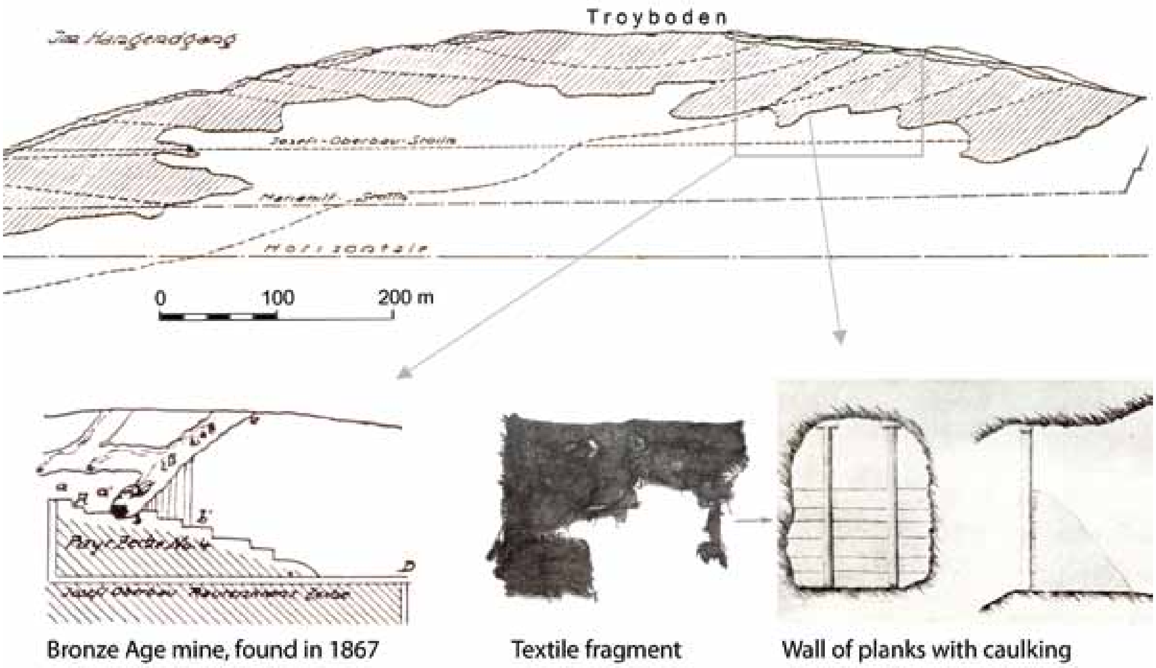
Here also, experimental archaeology (Fig. 10) was applied to understand the function of the textiles. It was assumed that the textile rags could have been used in the production of the salt. They might have been inserted to serve as a layer between the briquetage-vessel and the salt clump which is gained after firing. This theory was proved by an experiment. If the brine is heated in a vessel layered with cloth, the salt crystallizes along the textile structure and such a clean salt piece can be removed from the vessel easily.

Textiles as caulking material

Caulking (e.g. https://en.wikipedia.org/wiki/Caulking, accessed: April 28, 2017) in a historic meaning is usually understood as to fill or close a seam, joint, etc., as in a boat. Thus, it is made watertight by filling the seams between the planks with oakum (hemp fibre soaked in pine tar) or other material driven snug. More general, the term caulking also means to seal joints or seams in various other structures and some types of piping. The same term also refers to fill or close seams or crevices e.g. of a tank, window, etc. in order to make watertight, airtight, etc. In a modern sense, caulking also means driving the edges of plating together to prevent leakage. Silicone or polysulfide caulking came up in the 20th century, but even until recent days caulking has been done with textiles or half-finished products like bundles of roughly prepared flax or hemp fibres. The idea, to use properties of textile materials like flexibility and elasticity for making something wind- or waterproof can be traced back quite far in history.

Fig. 10: Erdeborn, Germany: 1 Textile imprint on a briquetage-fragment, 2-4 Experiments. 2 cross-section of a vessel with textile and crystallized salt, 3 reconstruction of the briquetage-furnace, 4 crystallized salt from the heating process (after: Ipach *et. al.* 2014).

Fig. 11: Mitterberg copper mine, Austria: wall of planks found in the 19th century with textile caulking (after: Klose 1916 and Zschocke & Preuschen 1932).



Sealing for water-management in a copper mine

At Mitterberg-Hochkönig in the Austrian Alps (Stöllner *et al.* 2009), a Bronze Age copper mine was found which was an important producer for raw copper especially in the second half of the 2nd millennium BC. Different mining relics above and below ground have been explored such as the copper extractions in the mine and wet processing sites and smelting.

In the mine a wooden construction was found – a wall of planks had been erected up to half the height of the tunnes, supported by a stone sand deposit. As in other mines, at Mitterberg the miners had problems to manage unwanted water in the adits and tunnels. This protective device in the Bronze Age copper mine served as insulation against water, it should keep the invading day water from the part of the pit in which the miners were working. To even better serve that purpose, organic material was stuffed between the planks (Fig. 11). Among the caulking material also a textile (Klose 1916: 35, Abb. 45–46) was found, used as a sealing material. Textiles, especially items made of wool are very suitable for that purpose, because wool can absorb a lot of water and thus holding dry.

Caulking wooden ships

In historic times, ships were built with planks that are laid butting up against one another (carvel construction) or with planks laid slightly overlapping (clinker construction). The wood to wood joint of the carvel construction is narrow but cannot be clinched together, so that, those ships mainly rely on caulking the joints to make them water-tight.

When in the 19th century in Nydam (Möller-Wiering 2011) in southern Jutland, Denmark, boats were found in a bog, the preservation conditions have been excellent. The excavator Conrad Engelhard had the possibility not only to observe different technical details of how the ships were built, but he also detected woven caulking material from two ships: the oak ship (Nydam boat B) and the pine vessel (Nydam boat C), which unfortunately was destroyed shortly after the excavation. From his report (Engelhardt 1865: 7 and 12, translation in Möller-Wiering 2011: 93) we learn about the oak ship: "*Between the planks where they cover each other, [the boat] is sealed with woollen cloth and a pitch-like and sticky matter*." And concerning the pine vessel: "*Underneath, there are patches of a sealing substance of woollen, woven cloth and a stichy, pitch-like matter which appears similar to that used for winding around arrow shafts*." Nydam boat B was dated to AD 310-320. Recent analyses (Möller-Wiering 2011: 85–87) indicate the caulking textiles to be protected by some water-repellent matter. A variety of different fabrics have been used for caulking, such as tabbies or twills made of wool and plant material, also more elaborate textiles like diamond twill were used. All of them display different qualities, ranging from coarse fabrics to very fine ones. The textiles didn`t belong to a specific type that might have been produced for that purpose. So, we can deduce that only recycled material – textile rags – ended up as sealing material. The textiles have been heavily pressed between the wooden planks, that and the repellent kept the boat water-tight.

Textiles for insulation of medieval castles

In the course of modern renovation works in medieval castles, sometimes textiles, shoes and other rubbish were found below floorboards, in filled vaults and all kinds of holes in the stone walls (e.g. Nutz 2015).

One of the most impressive finds discovered in the last years, come from Lengberg castle in Tyrol, Austria (Nutz 2015). There, a vault filled with dry materials deposited in different layers was uncovered in the castle between the 1st and 2nd floor – an architectural feature dating to the 15th century AD. The fill consisted of dry material in different layers, among them organic material such as twigs and straw, but also worked wood, leather (mainly shoes) and more than 2700 textile fragments. Among them are torn garments, also fragments of silks and a lot of colourful fabrics. Several fragments provide evidence for a secondary use. They were torn into strips and used as binding material, as some pieces with knots suggest.

The textiles have been disposed in such a way not only to get rid of rubbish. Textiles stuffed in walls and under floors also have a practical function in thermal insulation of the building.

Textile recycling for salt mining

In the 1st millennium BC, Hallstatt and Dürrnberg-Hallein in the Austrian Alps were important salt mines to provide the region with that vital commodity. Both of the mines offer the same product, but they have different working traditions. At Hallstatt (Kern *et al.* 2009), mining for salt is proved since Bronze Age (c. 15th century BC), whilst the Dürrnberg (Stöllner 2002; 2005) salt deposit was used from the 6th century BC onwards. Both salt mines offer excellent conditions for the preservation of organic material due to the high degree of salt penetration. Such the amount of leather, textile, wooden items is exceptional. Most fabrics are discovered in the so called "Heidengebirge", secondary rock-salt debris compressed together with waste of the salt production process. The layers completely fill up the old galleries. From Hallstatt, we know as well Bronze Age textiles from between 1500-1200 BC as well as a huge corps of Early Iron Age textiles from roughly between 900 and 400 BC, whilst the textile fragments discovered at Dürrnberg are slightly younger, most of them dating to the 5th and 4th century BC (general timespan 6th-1st century BC).

Textiles in the salt mines are usually found as smaller torn fragments. So far, no complete garment could be found. The fragmentary state of the textiles often can be explained such as they already have been brought into the mine as rags (Stöllner 2005: 171; Reschreiter *et al.* 2009; Grömer *et al.* 2013, chapter 5). In the mines, they have then been used for different purposes, which are discussed in this chapter.

Makeshift binding material

Both from the Iron Age parts of the Hallstatt and Dürrnberg mines, textile scraps are known that have been intentionally torn into strips. Some of those pieces of fabric have knots, some of them are tied together. We also find conjunctions with bast material (Fig. 12) (Stöllner 2002: fig. 12, Taf. 4/1375, 5/1674; Reschreiter *et al.* 2009: fig. 6).

These fabrics were apparently used as a makeshift binding material. A particularly impressive example has been found from the Dürrnberg/Hinterseng site (Fig. 13) (Kyrle 1918: fig. 60). As early as the middle of the 19th century, an elaborately coloured patterned fabric was discovered there, knotted around a broken tool handle. The primary purpose of this beautifully designed piece was likely as clothing; it was finally recycled and used for repair work. This find is lost since World War II, but from the recent excavations, many repaired tool handles have been found, usually with leather bands (Stöllner 2002, Taf. 109, 111 or 140).

In the salt mines Hallstatt and Dürrnberg, strings and ropes made of various tree basts and grasses were used primarily as binding materials. If these were not at hand, fabric strips, leather strips or even young elastic twigs were used (Stöllner 2002: Taf. 9–10; Kern *et al.* 2009: 64–65).

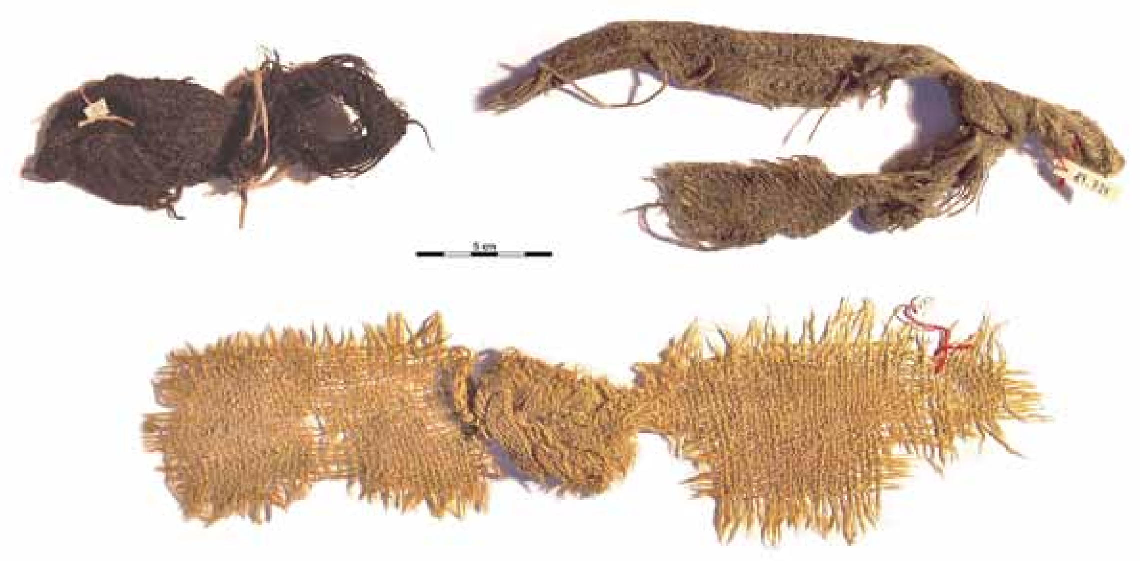


Fig. 12: Hallstatt salt mine, Austria: Iron Age textiles with knots (© Natural History Museum Vienna; photo: A. Rausch).

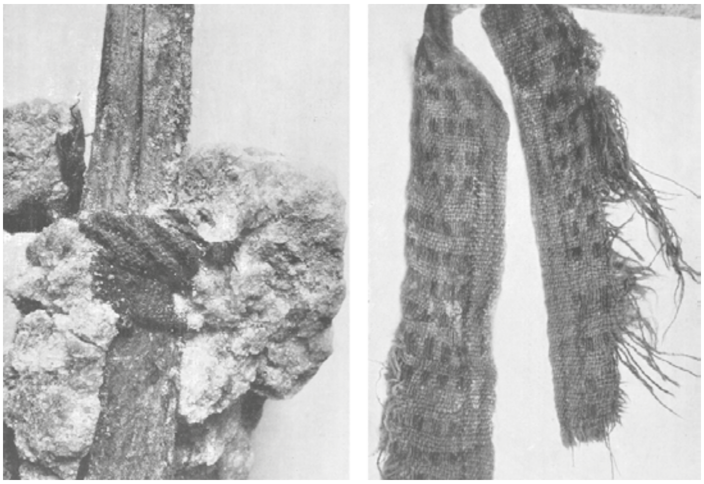


Fig. 13: Dürrnberg salt mine, Austria: patterned textile as makeshift binding material for a broken tool handle (after: Kyrle 1918).

Fixage for tools (Dürrnberg)

Beside improvised binding material, also direct use in combination with tools can be identified. For salt mining, bronze picks have been employed with wooden handles. To ensure the hold of the bronze pick in the mounting, sometimes a thin layer of a flexible material was inserted between wood and bronze: sheets of leather (e.g. Stöllner 2002: Taf. 190). Those sheets have a characteristic rectangular form, usually measuring 12x4 cm. Maybe some of the textile rags found in the salt mines that are torn (or cut) into a rectangle, also served as fixing for a tool handle (e.g. Stöllner 2002, Taf. 120).

Such form of technical secondary use can also be postulated from a Late Bronze Age hoard in Sublaines, France. In the shaft of a bronze axe a piece of textile could be found. Hans-Jürgen Hundt (1988: 261) assumed that the fabric had the function of wedging the wooden handle in the spout of the axe.

In both cases, the textile can be interpreted as secure fixage of the tool.

Wrapping, covering and hygienic properties

At least, more evidence for textile recycling is subsumed under wrapping, covering and hygienic properties, for presenting some examples for further uses for textile scraps and rags.

Wrapped objects in graves

For Iron Age contexts a specific rite could be identified (see e.g. Banck-Burgess 1999; Rast-Eicher 2008: 178–180), especially the wrapping of grave goods. Margarita Gleba (2014) recently set together more examples for the practice of textile wrapping, as they are documented especially in Italian graves:

* Wrapping or covering of the body with a funeral shroud
* Wrapping of the cremated remains placed in the urn
* Wrapping the urn containing cremated remains
* Wrapping of specific burial goods
* Wrapping of all objects in the burial.

Fig. 14: Hallstatt cemetery, Austria: textile wrapped around a sword, Early Iron Age (© Natural History Museum Vienna; photo: A. Rausch).

To give some examples from Central Europe: Specifically, knives, swords and other weapons were often heavily wrapped in the late Hallstatt and early La Tène periods (Rast-Eicher 2008: 178–180; Grömer 2014: 192–220). In the cemetery at Hallstatt (Fig. 14), it was documented that for some swords the iron blade was directly wrapped in textile bands (Kern 2005: fig. 10).

Various theories were discussed to explain this kind of archaeological evidence. The interpretative approaches are roughly divided into a functional-practical as well as a metaphysical intention. There may have been a taboo forbidding putting bare metal in the grave. Also some magical beliefs could be important such as to render the burial gifts invisible at the entrance to the otherworld (Banck-Burgess 2012b: 141–146). Among the practical reasons it was considered that envelopes may also be meant to protect valuable ingredients (Gleba 2014: 142). On the other hand, wrapping iron objects with textiles saturated with grease and oil might have served as protection against corrosion (e.g. Kern 2005: 8).

Unfortunately, we usually do not know whether the packaging material, the pieces of cloth, was made specifically for this purpose (primary use) or whether they were old, recycled textiles (secondary use).

Sanitary properties and wound dressing

Just in rare cases, there is some direct evidence that textile rags have been used for sanitary properties. One of them can be presented from the salt mine Dürrnberg (Stöllner 2005: fig. 12/nr.2817), dating to the middle of the 1st millennium BC. At the site Dürrnberg/Ferro-Schachtricht, 11 cm long bundle of a soft textile was excavated (Fig. 15). On closer examination, it was found that this soft, bright linen fabric was rolled up in the form of a finger and fixed in this form with a bast strip. It also contained a flat piece of wood. Obviously, the item served as finger bandage, a wound dressing for a finger. In the bundle also still unspecified plant remnants could be detected, which possibly served as blood stilling or support for wound healing.

Textile rags as "toilet paper"

Even more hygienic uses have been discussed concerning textiles from the salt mine Dürrnberg. Probably, the material remains in the mountain were also used for various hygienic purposes, for example as cleaning rags or for cleaning hands and face, and possibly as a kind of "toilet paper" (Stöllner 2005: 162–164, fig. 3-4). Still, there is no conclusive evidence for the latter, even though human excrements have also been found in the salt mines.

More direct evidence is known from medieval and early modern latrine in cities and monasteries. For example, in a latrine of Stallburg, which is part of the imperial palace in Vienna, Austria, among other rubbish also some textiles have been excavated. They derive from various filling layers of the latrine, dating from the middle of the 16th century AD. The preservation of the textiles is due to the rather acid environment in the latrine. The textiles are very fragmented and small, they have been made of woollen cloth in different qualities, coarse and fine ones. The context of a latrine is helpful for the interpretation of the textile remnants. Additionally, there are also clear indications for their intended use, because on some textiles, still brownish faecal remains (excrements) were attached (Fig. 16). Accordingly, the textile scraps were used as "toilet paper" in the latrine after their primary use.

This practice is by no means uncommon. As we learn from other textile finds from medieval and modern latrine, textile rags and scraps were often used for body hygiene. Examples can be named from the Augustinian monastery in Friborg im Breisgau, Germany (Banck 1992: 169–171), or from the early modern latrine in Schatz-Haus Salzburg in Austria (Müllauer 2008: 207–210). From the Stallburg latrine only simple tabby fabrics were found, in contrast to this, in other cloacs, even more magnificent fabrics have been excavated. From cities like Lüneburg or Einbeck in Northern Germany (Tidow 2005) we have proof for precious textiles such as Atlas bindings, tapestry fragments, and silk ribbons, deriving from torn garments. Even those found their final use in a toilet.

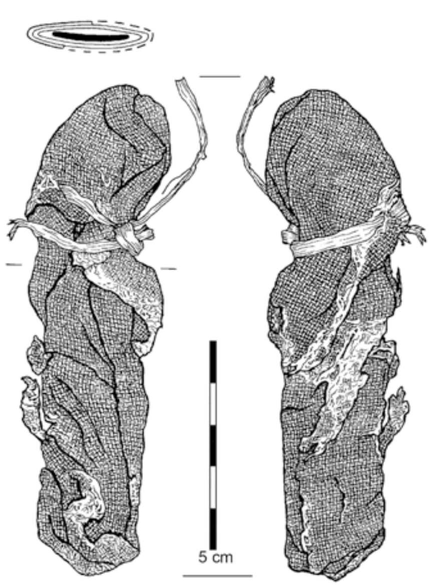
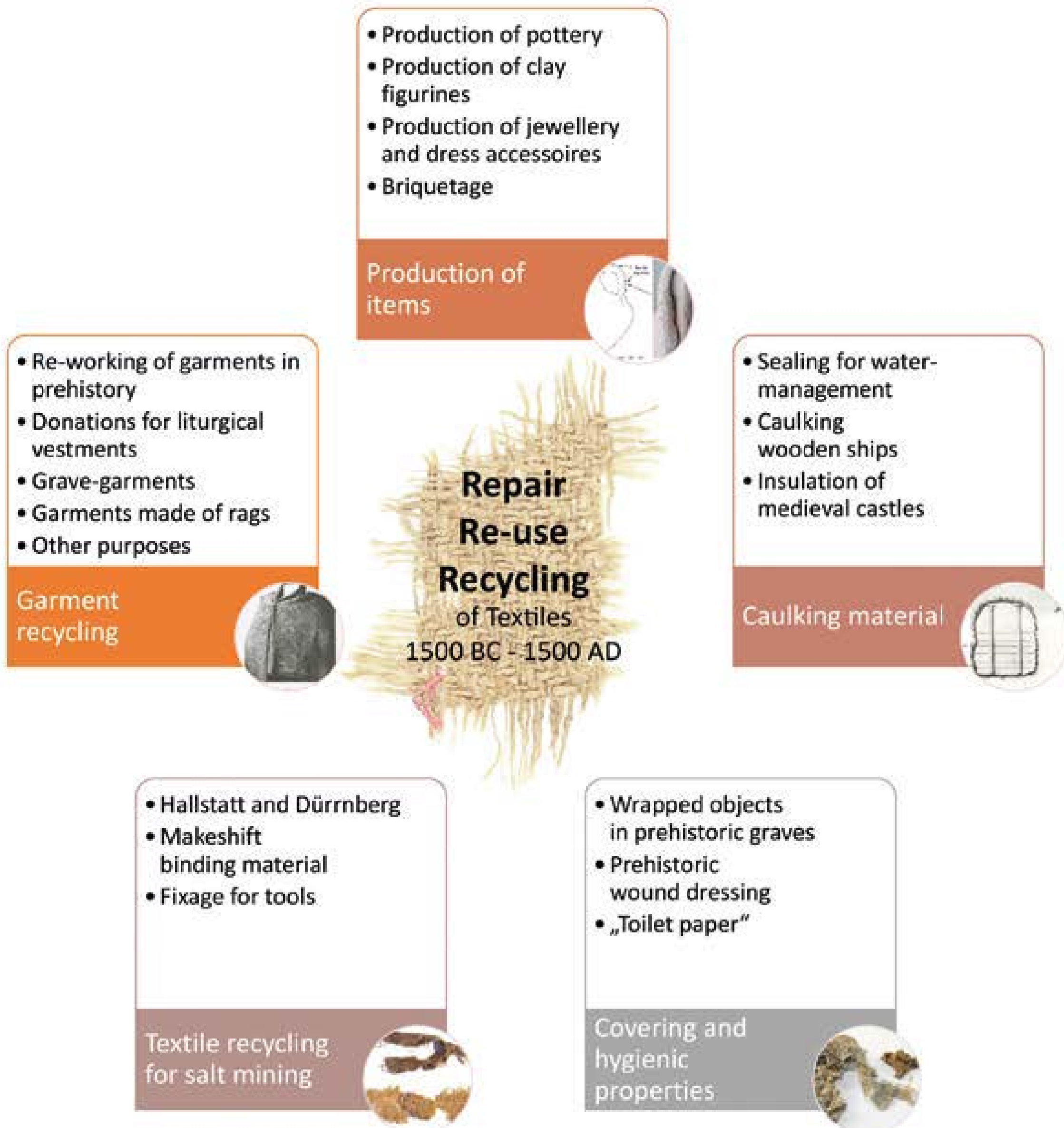


Fig. 15: Dürrnberg salt mine, Austria: Textile rag used as finger bandage (after: Ställner 2005).

Fig. 16: Vienna-Stallburg, Austria: Textile scrap found in a latrina with excrements still attached, 16th century AD (photo: K. Grömer, Natural History Museum Vienna).

Fig. 17: Different kind of re-use and recycling of textiles between 1500 BC and 1500 AD (image: K. Grömer, Natural History Museum Vienna).



Conclusions and further perspectives

Textile recycling today is seen as a method of reusing or reprocessing used clothing, fibrous material and clothing scraps from the manufacturing process. Prehistoric and historic examples presented are a small glimpse into repair, re-use and recycling of textiles in the past (Fig. 17). As exemplified, at least from Bronze Age on, we are able to trace back such behaviour. Recycling seems to be a common practice for most of human history (see also Rast-Eicher 2011), especially during periods when resources were scarce and hard to come by.

To apply modern systematics of textile recycling, as presented in the introduction, we can identify following cases in our historic study: "c) to use again in the original form or with minimal alteration" can only be proved with garments, e.g. when the function (dressing) is the same, but the context changed (daily life versus funeral use). "b) to alter or adapt for new use without changing the essential form or nature of" can be seen in cases, when e.g. garments have been repaired or patched.

Most textile fragments we discussed belong to the group "a) to treat or process (used or waste materials) so as to make suitable for reuse". As far as we can identify, worn out garments and other textiles have been torn or cut into desired shapes, sometimes stitched together and then used for different purposes. Those comprise all aspects of daily life – producing other items like pottery or bronze objects; for caulking; as makeshift binding material; for sanitary and hygienic purposes and many more.

An important task in modern textile recycling is "d) to pass through a cycle again; repeat a process from the beginning". That could not be identified among our historic material. This kind of uses of worn-out textiles would be e.g. for paper production (see e.g. Burns 1996; Rast-Eicher 2011: 22), what hasn`t been included into this study.

Today, in the Western World, the act of textile recycling often is motivated by a certain awareness of responsible use of natural resources, waste reduction as well as donating. Also, some economic factors can be named to re-use textiles (Joung & Park-Poaps 2013).

Back in time, economic factors as well as optimizing natural resources might have been the main motivation for textile recycling. Even in prehistoric times we can assume a sense for careful resource-management, as in an impressive way given by examples from the saltmines Hallstatt and Dürrnberg. Not only with the textiles, but also with other material groups some sort of re-use can be stated. This is especially explored for Hallstatt, where also wooden tool handles and wooden vessels have been re-used (Reschreiter *et al.* 2009).

Here it is important to be aware that in pre-industrial times the production of textiles is quite time-consuming. To prepare the raw material, spin and weave a cloth of a certain size can last months (Andersson-Strand 2010). Therefore textiles are to be used as long and carefully as possible. Not only the time inherent in the production of textiles might have been a motivator to apply secondary uses, but also the material value of certain raw materials. Especially in Medieval and Early Modern, due to the expensive raw-materials used such as silk and gold, textiles also have been re-used in a high-ranked context and not only as rags and scraps. Interesting historic examples for such elite contexts are the donations of textiles to the church. Their reuse as ecclestical garments also demonstrates, that those textiles were not seen as used rags, but as a precious source.

Waste-reduction, as it is very important motivation for textile repair, re-use and recycling in the 21st century, might not have been a primary motivation for people in the past. The awareness for ecologic problems is a more recent phenomenon.

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7. SOCIAL ASPECTS OF TEXTILES: STATUS/PRESTIGE AND REPRESENTATION

7.1. Textiles as Early Iron Age prestige goods – a discussion of visual qualities

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Textiles as Early Iron Age prestige goods – a discussion of visual qualities

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Abstract

In archaeological research, the topic 'prestige and representation' usually is discussed by means of bronze objects in graves, but textiles also fit in this topic. Similar to the famous textiles from the princely burial of Hochdorf, recently analyzed textile finds from the graves from Oss-Vorstengraf and Uden-Slabroek in the Netherlands demonstrate that textiles themselves can serve as prestige grave goods. In this paper some theories about visual qualities with regard to textile finds are also discussed. It is asked whether we can identify a visual code for representative expression of elite identities via textiles. The Hallstatt period fabrics are of high quality, and very decoratively designed with weave structures, colors, patterns and elaborately made borders. Within the Early Iron Age, the interplay between textiles and metal objects displayed on them reached a very high standard – expressing wealth and beauty. The visual complexity of textile objects, with their bright colors and interesting patterns, can be demonstrated, at least by original textile finds from the salt mine of Hallstatt. This development was perhaps fostered by the emergence of differentiated social structures at the beginning of the Iron Age.

Zusammenfassung

In der archäologischen Forschung werden Themen wie Prestige und Repräsentation meist anhand von Bronzeobjekten in Gräbern diskutiert – hier soll gezeigt werden, dass ebenso Textilfunde dazu herangezogen werden können. Ähnlich wie beim berühmte Fürstengrab von Hochdorf zeigen auch die erst kürzlich untersuchten Textilreste von den Gräbern Oss-Vorstengraf und Uden-Slabroek in den Niederlanden, dass Gewebe durchaus als repräsentative Grabbeigaben dienen konnten. Im folgenden Beitrag werden nun einige Theorien bezüglich der visuellen Erscheinungsbilder und Qualitäten von Textilien diskutiert, vor allem, ob eventuell bestimmte visuelle Codes zur Repräsentation von Eliten durch Textilien festgemacht werden können. Hallstattzeitliche Gewebe haben eine hohe Qualität, sie zeigen komplexe Muster mit Webstrukturen, Färbungen und kunstvoll gefertigten Webkanten. Vor allem das Zusammenspiel zwischen Textilien und damit verwendeten Metallobjekten (vor allem Schmuck, Trachtbestandteile) wurde in der Älteren Eisenzeit gezielt eingesetzt, um Reichtum und Schönheit zu zeigen. Die visuelle Komplexität der Textilien mit ihren intensiven Farben und Mustern kann hierbei am besten durch die Funde aus dem Salzbergwerk Hallstatt aufgezeigt werden, da die Gewebe dort noch organisch erhalten sind. Generell kann diese Entwicklung zu sehr prachtvollen Textilien auch im Rahmen der sozialen Struktur in der Eisenzeit gesehen werden, die offenbar eine derartige Repräsentationskultur begünstigte bzw. erforderte.

Introduction: textiles and contexts in the first half of the 1st millennium BC

Textiles survived under and are present in various conditions in the archaeological record of the first half of the 1st millennium BC in temperate Europe. They are found attached to metal grave goods in both cremation and inhumation burials. Similar to graves, the metal items in hoards can provide hints for textiles. It is together with those metal objects that organic finds can survive. Textiles themselves are rarely preserved in settlements, but sometimes imprints of fabrics on potsherds survive. Nevertheless, the tools found in settlements give a good chance to study the production of woven fabrics. For Central Europe, salt mines are also of importance for the study of textiles and other organic finds.

Grave finds

Intensive research of the last decades demonstrated that textiles are relatively common finds in Early Iron Age graves in Central Europe (Banck-Burgess 1999, 196-223; Belanová-Štolcová 2012; Gleba 2008, 45-63; Grömer 2014, 45-46; 192-206; Rast-Eicher 2008), depending of the abundance of metal elements in them. Textiles were used to wrap grave goods, as shrouds, and even as decoration of the grave chamber during burial rites (Gleba 2014). The latter has been impressively demonstrated by J. Banck-Burgess (2012, 44-45) with the analysis of the elite burial from Eberdingen-Hochdorf. A high quality diamond twill textile, folded several times and placed together with other grave gifts in a situla is known from Oss (Bender Jørgensen 1992, 218; also see the unpublished report: Grömer/van der Vaart-Verschoof 2015; Grömer in Van der Vaart-Verschoof forthcoming). The wrapping of objects seems to be an integral part of burial rites in the Early Iron Age (Gleba 2014). As can be seen for example in the cemetery of Uttendorf im Pinzgau, where knives and other grave goods were found wrapped in woven bands (Grömer 2014, 44 fig. 24).

Fig. 1. Textile and clothing related objects, Iron Age: jewelry and textile tools (spindle whorl and spools) from Bad Fischau, shoe-fibula from Leopoldau, textiles from Hallstatt, figurine with short tunic from Idria pri Bači (photo A. Schumacher, © NHM Vienna).

Inhumation graves, which become common from Ha C and Ha D onwards, provide even more information: if fibulae or metal belts are placed correctly on the body and textiles are attached on them – they might be the remains of the garment worn by the deceased (see Grömer 2016, 324-329). A patterned twill textile, for example, was found on the inner side of the bracelets on both arms of the burial of Slabroek in the Netherlands. The patterned textiles were probably part of a long-sleeved garment and the bracelets were worn over it (Grömer in Van der Vaart-Verschoof forthcoming).

Textiles usually survive in graves due to mineralization processes, attached on metal items (see Chen *et al.* 1998). We can clearly see a difference between rich burials and poorer graves, because in 'poor' graves with few or no metal in it, textiles hardly survive. We are therefore better informed about textiles of rich burials.

Settlements

Direct records of woven fabrics are scarce from Iron Age settlements. The organic textiles that were in use within the settlement usually do not survive, but sometimes we find imprints of textiles on clay objects (e.g. Grömer 2014, 46; 193). The latter finds can tell something about the production process of the clay objects. There are, however, indirect hints for textiles that might have been used in settlements as well. Some wall hangings, floor coverings, pillows and mattresses from the princely burial Hochdorf, (Banck-Burgess 2012, 44-45), for example may also have been used by the living persons to make their houses more comfortable. These kinds of soft furnishing are also depicted on works of situla art, which was a way of self-representation by wealthy strata of society in the southern and eastern Alpine region between the 6th and 4th century BC, *e.g.* on the mirror of Modena-Castelvetro (Lucke/Frey 1962, pl. 21).

Early Iron Age settlements are multifaceted – we know of large hilltop settlements, sometimes fortified, which served as central places for the elites (e.g. Heuneburg: Fernández-Götz 2015). There are also smaller lowland villages and single farmsteads. With regard to the topic of 'prestige goods' it would be very interesting to compare the kinds of textiles used in fortified hillforts and smaller villages. This could only be done through textiles found in burials associated with the specific settlement types. It is hoped that such extensive studies will be possible in future.

There have been some efforts to understand what kinds of textiles were produced within the different types of settlements. Textile tools from hilltop settlements, especially in situ finds of loom weights, have been studied in comparison with lowland settlements. As we know now *e.g.* for the eastern Hallstatt area, spindle whorls of different shapes and sizes occur in all types of settlements.

Different sizes of looms were in use in the Early Iron Age (Belanová-Štolcová/Grömer 2010, 17), and one could think that the use of extra-wide looms (3-4 m wide fabrics have been made on one loom) exceeds domestic requirements and hint towards specialized, representative or even ritually motivated production. The first example of such a very wide loom was found on the fortified hilltop settlement Kleinklein in Austria (Dobiat 1990), which is the central place for the Sulmtal necropolis. This evidence seemed to prove the exclusive and representative use of big looms in an elite context. Within the last decades, however, more finds of such big looms occurred, but also in lowland settlements such as Freundorf and Hafnerbach in Austria (Belanová-Štolcová/Grömer 2010, 17). So, the art of representative weaving of large size cloth is not restricted to hilltop settlements. Nevertheless, there must have been some production centers where high quality textiles were made, such as Smolenice-Molpír or Nové Košariská in modern Slovakia (Belanová-Štolcová 2012, 312-314).

Salt mines

For material culture studies of textiles, one at first glance unusual find context has to be considered: salt mines. The salty environment combined with constant climate and humidity prevents the decay of organic materials. As a result countless wooden artifacts are known from the salt mines Hallstatt (Kern *et al.* 2009) and Dürrnberg in the Austrian Alps (Stöllner 2005), as well as leather items, fur and textiles. Both salt mines were economic centers and the local inhabitants who lived and worked there (and left the textiles back in the mine) were among the wealthy communities of their time. This can be proved by studying the grave goods as well.

The Early Iron Age mining at Hallstatt dates between the 9th and 4th century BC, the salt mining activities at Dürrnberg begin in the 6th century, but mainly can be dated in the Late Iron Age.

Both sites together have more than a thousand textiles which are still colorful and offer a good overview of the textile techniques in use, but also of colors, dyes and patterns (e.g. Grömer *et al.* 2013; Stöllner 2005). The textiles were used in the salt mines as working material, maybe miners' clothing and carrying bags. But there are also textiles that were not directly made to be used for salt mining, also rags were brought into the mine to serve different purposes such as makeshift binding material. Amongst the salt mine finds there are also high quality products with complicated patterns. They might have been representative textiles in their primary use, but they ended up in the salt mine after wear and tear and recycling. Both at Hallstatt and Dürrnberg we are not restricted to organic textile finds from the salt mines, there are also some textiles in the graves. So we are able to compare the 'textile culture' used by the living with those used for burial rites. As far as we know now, they are similar in weave-type and quality (seen in thread count and yarn diameter), although the textiles in the graves do not offer colour information.

Visual qualities of objects – Theoretical background

To understand the visual qualities of objects, firstly we to have mention the recent studies by P. Wells (2008; 2012). He tries to understand the visual basis of communication in the Iron Age with the help of recent research in cognitive neuroscience and cognitive psychology. His main approach is that people in prehistoric Europe did see, experience and perceive things in a different way than we do today. With this, he responds to the concepts of the "cognitive map" and the "visual world" after J. Gibson (1950; see also Wells 2008, 32). The cognitive map is the essential model of the world that we have in our brains and to which we compare everything we see. In seeing things, interpreting what we see, and responding to our interpretations, our expectations play a vital role. The visual system and the cognitive map depend to a great extent on the early childhood experiences with vision and touch. Every individual´s cognitive map is unique, but the more similar the environments in which a group of individuals are raised, the more similar their cognitive maps and their visual experience will be. That means that for a person living in the 8th century BC the visual experience of a person located in Central Europe will differ completely from, for example, someone in contemporary Egypt, where monumental stone buildings and temples covered with hieroglyphs and other very complex visual impressions. In both contexts the person has to 'learn' what to see and how to interpret the incoming information – what the visual codes are for a high ranked person, for a person with a specific function within society (e.g. an Egyptian priest). This means that the cognitive map prehistoric people had and their former visual experience were vital to identifying representative goods. To take it boldly: you have to know how a kermes dyed textile looks like and that kermes is a precious dyestuff coming from far away – only with that information you are able to identify a person wearing a kermes-red gown as high-ranked. The cognitive map is key for sorting out visual codes.

Visual codes (see Chandler 2002) are a subcategory of nonverbal communication. Primarily, a code is a visual, audio or technical element that an audience has learnt implies meaning. The process of encoding converts information from a source into symbols for communication or storage. Decoding is the reverse process, converting code symbols back into a form that the recipient understands. All codes have a denotation and a connotation. The denotation is the literal meaning of a code, the connotation is a symbolic meaning of a code. Visual codes like colors, physical appearance and clothing, but also body language are unconsciously read by audiences who then understand them and sort information out about what they see. There are also specialized connotational and ideological codes to reflect particular social, political, moral, and aesthetic values.

Visual qualities of textiles

What kinds of visual qualities were created in textile art in the first half of the 1st millennium BC? There are different kinds of structure, texture, borders and weave types (see *e.g.* Grömer 2016, 121 fig. 67; 128 fig. 72; 135 fig. 76; 177 fig. 99). Here we concentrate on the most important of them for our specific topic about prestige goods: colour, patterns and the use of gold and metal together with textiles.

We often tend to think of prehistoric times as drab, but there is accumulating evidence that Iron Age peoples used many bright colors, at least for elite members of societies. For the Early Iron Age in Central Europe, the textiles from the Hallstatt salt mines are the prime source of information about colour and dyes (see Hofmann-de Keijzer 2016). Due to the mineralization-process it is not easy to detect dyestuffs in textiles that survived in graves, but some recent attempts from Hochdorf are promising (see Walton Rogers 1999) or Verucchio (Stauffer 2002, 216-219). Interestingly, primarily blue and red colors could be analyzed from grave-contexts (Hofmann-de Keijzer 2016, 149 fig. 84), deriving from plant dyes like woad or madder. For precious red colour insect dyestuffs were also used such as Kermes or the Polish cochineal. This could be proven from textiles found in princely burials like Hochdorf, Hohmichele (Walton Rogers 1999, 244) and Glauberg (Balzer *et al.* 2014, 2-8).

Fig. 2. Blue dyed textile from the salt mine Hallstatt, with polychrome repp ribbon (HallTex 100). Detail of blue dyed fibers (photos A. Rausch and R. Hofmann-de Keijzer, © NHM Vienna).

Fig. 3. Situla from Kuffarn and chequered textiles from the salt mine Hallstatt (HallTex 74, 91, 181, 203) (photos A. Schumacher and A. Rausch, © NHM Vienna).

Dye analyses on textiles from Hallstatt (Fig. 2) as well as dyeing experiments have demonstrated that the entire colour palette from yellow, orange and red shades to green, blue and black was available to Early Iron Age people and revealed how they could have achieved them (Hofmann-de Keijzer 2016). Blue was dyed with woad by vat dyeing. Yellow dyes were obtained by a dye-bath from various plants like weld, saw-wort or scentless chamomile, and red dyes derived from madder or bedstraw. Mordants may have been used to fix the dyes. Also tannins in combination with iron were used to obtain black colors. Different dyeing techniques were applied to a single textile to obtain specific shades, *e.g.* dyeing first yellow and the over-dye with blue in vat-dyeing to get a green colour. In Early Iron Age, patterns and even the use of gold also played an important role. This is discussed in the following paragraph.

Visual codes in textiles

Without written sources it is difficult to decode how Iron Age people perceived their surroundings. For sure, colour, patterns and decorations are important carrier of visual codes. In pre-industrial societies, where things were made by hand, all decoration was chosen consciously. Decoration is intended to draw and hold the attention of our brain. It helps us to see and recognize familiar motifs and therefore "situates us in social space" (Brett 2005, 62). Decoration is part of what D. Brett calls "visual ideology", it provides a link between the producers and the technology of an object as well as the observers and the material world in which they live, move and interact. Decoration thus serves as a communication medium, and in the context of prehistoric art it also serves as communication medium about elites. Decorated textiles of high quality may be a medium to express social status.

What kinds of textile decoration are common in the first half of the 1st millennium BC? We know of specific design principles: on the one hand spin patterning (use of groups of s- and z-twisted yarn to create a tone-on-tone pattern) is very common, but also dyeing textiles and colour patterns. The latter are of interest here. Early Iron Age textiles tend to be decorated during the weaving process (Banck-Burgess 1999), *e.g.* in tablet weaving or by using groups of different twisted or coloured threads in warp and/or weft to create checks or stripes (see *e.g.* Hallstatt salt mine Grömer 2016, 177 fig. 99; Grömer *et al.* 2013). There are a few examples of colour patterns from graves between the 8th and 6th century BC, like Verucchio in Italy (Stauffer 2002; 2012) or Uden-Slabroek in the Netherlands (unpublished report Grömer/Van der Vaart-Verschoof 2015; Grömer in Van der Vaart-Verschoof forthcoming), where alternating small groups of red (?) and blue threads in both thread systems form a houndstooth pattern. Checkered cloth is also depicted on contemporary high-status bronze objects such as situlae (e.g. Kuffarn, Fig. 3; Lucke/Frey 1962).

Late Hallstatt period elite burials provide us with further kinds of visually striking patterns: floating threads applied during weaving in weft-wrap (soumak) techniques or embroidered after weaving offer the chance for a free design-process and therefore patterns. A recent find from Glauberg tumulus 1, grave 1 allowed the identification of an embroidered pattern with a plait-like structure (Balzer *et al.* 2014, 5 fig. 6). The Hohmichele textile (Fig. 4) from grave VI is a well-known example for the weft-wraps (Hundt 1962, Taf. 36-39). It shows on a repp ground weave doubled square with swastika motive, accompanied by triangles. All of that repeated to form a band of a pattern. Weft wrap technique was also employed for some textiles from Hochdorf (Banck-Burgess 2012, 35; 55; 57) to create diamonds with swastikas or an element in the form of the letter Z. The base weave for these textiles were twill and tablet weaving.

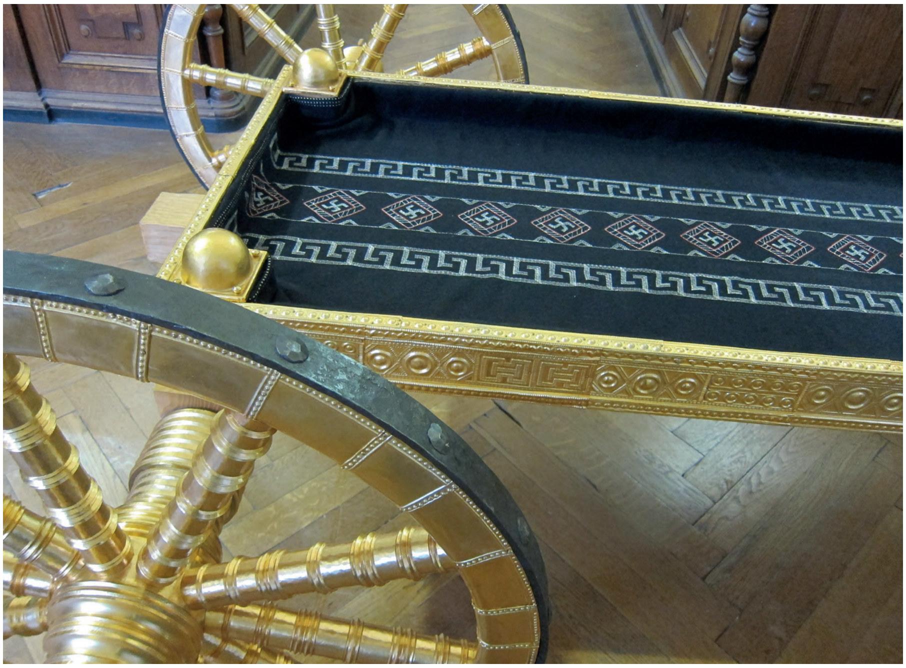

Fig. 4. Textile pattern from Hohmichele on a reconstruction of the chariot from Býčí skála cave, kept at the NHM Vienna (photo K. Grömer, © NHM Vienna).

Tablet weaving also was applied in the Hallstatt period to create amazing polychrome decorations. From the salt mine Hallstatt we know of bands decorated with meanders, filled lozenges and triangles (Grömer 2016, 181-184 fig. 102-104). Even tablet woven items from graves, rust-brown due to their mineralized state, demonstrate through their structure, that they formerly have been wonderful colour patterns (e.g. Apremont in France: Banck-Burgess 1999, 69 fig. 40-41). Even more complex are the tablet woven items from Hochdorf (Banck-Burgess 2012, 34-35; 52-53) with meander or checkerboard patterns with tiny lozenges, again swastikas form the main motif at Hochdorf.

A specific part of the visual code is the use of metal together with textiles. For Early Iron Age the most common case is that for example fibulae or metal belt elements were attached to garments made of woven cloth. Thus, the soft textile often formed a background, contrast and ideal surface for shiny metal objects (Gibson 1980, xii-xiii; Wells 2008, 68; 78). In the Iron Age, bright dyed colors like blue, yellow, bluish-black and red underline that concept.

The interplay between textiles and metal can also be gold threads woven in or buttons sewn on – forming very precious and high status textiles. Impressive examples of this were found in elite burials such as Hohmichele or Grafenbühel in Germany (Banck-Burgess 1999, 39 fig. 10). The Grafenbühel find consists of very fine gold strips only 0.2-0.3 mm wide. The sharp folds that can be seen on the strips indicate that they belonged to a tabby fabric where they were woven in. There are some bends which suggest that they were used to create a brocaded pattern where the strips float over several (2-4) warp threads to form a sophisticated pattern. An 11.5 cm wide sash with gold stripes woven in is mentioned in the early excavation reports of Hohmichele, grave 1 (Hundt 1962, 211 Taf. 1,4).

Textiles were also decorated with metal applications, a custom that we often find for the wealthy strata of societies in Early Iron Age. Famous examples come from Hallstatt, Stična and Mitterkirchen, all Ha C. In grave 360 from Hallstatt (Grömer 2016, 199 fig. 116) 3,000 small bronze buttons found on the upper body region

Fig. 5. Mitterkirchen grave X, burial chamber 2, woman with bronze buttons, archaeological evidence and replica (© Oberösterreichisches Landesmuseum).

Fig. 6. Spin patterned textile from the salt mine Hallstatt (HallTex 31). Visibility of a spin pattern according to vantage point and light angle (photos A. Rausch, © NHM Vienna).

of a woman may have belonged to a precious upper garment. At Mitterkirchen in grave X/2 (Pertlwieser 1987, 55-70) a woman was buried and thousands of bronze knobs were found on the upper body and leg region, additionally between the knees and toes they were lined with a double zigzag row of tiny bronze elements. Traces of leather and animal fibers suggest that the buttons were attached to a splendid leather/fur cloak (Fig. 5). At the burials in Stična however it was possible to identify patterns made with the bronze buttons, such as triangles, lozenges or flower-like arrangements (Hellmuth 2010, 63-68 fig. 2-5).

Visibility from different vantage points

What happens at different vantage points (Wells 2008, 60; 67) – if you look at a costume or a textile from far or near?

Interestingly, texture can look very different depending on the vantage point, as noted by P. Wells (2008, 44). For textiles this means that most of the textures like zigzag or diamond twill or repp done as monochrome cloth would look like a simple, plain surface from far away, while from close by the lines of the twill or the ribbed structure of the repp can be seen. The same holds true for textiles with spin-patterns and other subtle tonal patterns. Thus, the elements requiring the most skill can only be appreciated in close proximity to the object. The creative expertise of the maker is demonstrated at the intimate personal level, not at a distance.

Colour and patterns, as described before, can be seen clearly from a distance, but there are other techniques of patterning like spin pattern, which are only visible from nearby. A lot of thought and design work was spent on them, but the patterns are almost invisible. For a spin pattern (Fig. 6), the difference of spinning direction was exploited to provide decoration, for otherwise identical S- and Z-spun threads laid side by side will catch the light differently and give a subtle tonal pattern. This created a special visual effect: stripes or bands created by alternating groups of S- and Z-spun threads.

One of the earliest such pieces comes from the copper mine Mitterberg in Austria (transition Early/Middle Bronze Age, 1600 BC) (Grömer 2012, 31 fig. 1,2) and is a finely made woolen repp-band (warp-faced) made with plied yarn. The special effect of the band is caused by the irregular change of groups of S- and Z-twisted plied yarns for the warp. So this is a first hint of spin-patterning from 1600 BC. Spin pattern especially is a very common pattern type in Central European Hallstatt culture (Banck-Burgess 1999; Bender Jørgensen 2005), a hint to creative choices of pattern effects in Central European Region, but also in Iron Age Italy, as we know *e.g.* from the finds of Verucchio (Stauffer 2002; 2012).

So we have to think about who was allowed to come near enough to see complex twill types or spin patterns? The same also applies to other delicately worked objects such as fibulae. They can have surfaces textured by incised lines that are so fine that the unaided human eye can barely make them out. Are those again visual codes for 'insiders'? You have to know high quality items and be near to see them. P. Wells (2008, 60) calls that a 'visual privilege', whereby some members of the community were permitted to see something from a distance, whilst others were allowed to view objects up close to examine details.

Light

Light also plays a very important role in visual appearance and the perception (Wells 2012, 48-51), especially in the perception of prestige goods. Light changes affect how objects appear. This can be demonstrated very easily with for example the representative costume of an elite member (Fig. 7). A typical Early Iron Age high status woman's ensemble are two fibulae worn on the shoulders and a belt (see also Grömer 2016, 390-394), in the most luxurious case one of bronze sheet. A dress worn together with it might be for example blue, which is a perfect background for the shiny golden bronze dress attire. Also – as we know from the

Fig. 7. Reconstruction of dress accessories from the cemetery Hallstatt, grave 551, blue textile and patterned braid after finds from the salt mine Hallstatt. Model: Gloria Lekaj (photo A. Schumacher, © NHM Vienna).

situla art, some colorful patterned ribbons might be attached on the neckline, the sleeves and the lower hem (e.g. situla from Vače: Lucke/Frey 1962, table. 7).

During daylight, more so in direct sunlight, the viewer's attention recognizes the shiny metal objects, but also the blue colour and the patterned braid. This view changes completely in a dark environment that is only lit by fire. That means again that the perception of textiles, their colour and especially their pattern is not the same under different lightning conditions. This also applies to the textiles with woven-in gold threads or sewn-on metal buttons. If for example gold was worked into a bright blue dyed textile, under moderate lightning conditions both colors could be recognized. In direct sunlight the gold elements start to glitter on their nicely visible blue background, while in a dark surrounding only a fire, taper or torch light the metal objects while the textile remains a dark and dull mass.

So – when and where were what kinds of luxurious textiles and garments chosen for representation? This also refers to the light conditions that were presence in the residences of the elites.

Textiles – visual expression of elites

Conventional studies on prestige goods usually focus on metal objects. This is the same with the recent work by R. Schumann (2015, 23-24), who also discussed the definitions of status and prestige. Related to prestige goods is the question: what are elites? It is accepted that Iron Age society was hierarchical (Fernández-Götz 2015, 75-76). When P. Wells wrote his 2008 book "Image and Response in Early Europe", he focused on metal objects and mainly on elite contexts. By 'elites' he (Wells 2008, 11) refers to individuals and groups of people with greater authority, power and wealth than the majority of people, but he also mentions that there might be specific kinds of social and political systems. M. Fernández-Götz (2015, 75) writes "population growth and an increase in available arable land and other economic resources formed the real basis of the wealth of the social elite that is so impressively visible to us in the form of the so-called "princely graves" (*Fürstengräber*)". These, the top strata of society, are accompanied by other wealthy groups. We are not sure whether 'princely elite', a concept mainly used for the western Hallstatt area, can also be applied to persons buried at the Hallstatt cemetery (Kern *et al.* 2009), but there a wealthy population can definitely be identified who expressed their status and prestige via precious vessels, jewelry and – of course textiles.

As we have seen, textiles – although rare finds in comparison with other object groups like pottery, jewelry or weapons – have the potential to add to our knowledge about prestige goods. We know that in contemporary Greece pieces of cloth and garments formed an essential part of the dowry, served as representative goods for gift-exchange between elites and were high-ranked offerings to the gods (Wagner-Hasel 2000, 152-163; 2006, 257-269). Moreover, in Greek contexts status definition and the visualization of social status was achieved through textiles and clothing. The Greek epics attest that the visual potency of a person "*charis*" was also tied to their clothing.

For the Central European textile material which was presented here, we have to discuss: what are elite and luxurious items (see also Schumann 2015, 36-39 about the problems in identifying status and prestige objects)? For the present discussion, textiles with metal sewn-on or gold strips woven-in are seen as

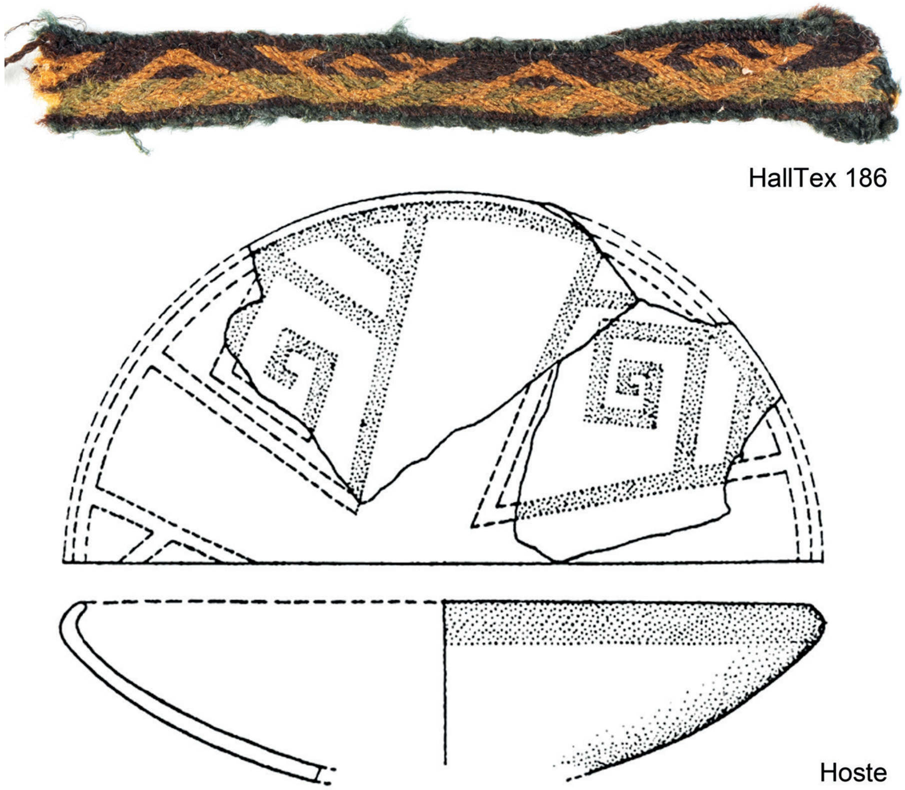

Fig. 8. Textile from the salt mine Hallstatt in comparison with a vessel from Hoste (© NHM Vienna).

luxurious objects. Insect dyes, which have to be imported from the south or east, are also precious. The exclusive materials in combination with craft skills indicate so in these cases. Are we also allowed to see luxurious goods – prestige goods – in objects with complex visuality, such as tablet woven bands or the textiles patterned with soumak techniques or embroidery? Such items have similar visual codes like high ranked pottery that can be found in graves as well and amongst hillfort settlements. The meander-motif, filled lozenges and triangles of the patterned tablet woven bands from Hallstatt are also known from Hallstatt period pottery *e.g.* from Hoste (Fig. 8) or Leobendorf (Griebl 1997, 96 fig. 33; Schappelwein 1999, 110; 214). This means that this kind of decoration was positioned in the cognitive map of the time and the specific meanings and even value was clearly understood. In the case of textiles it is a fact that highly complex items require specific skills, know-how and their production is usually time-consuming (see Grömer 2016, 184-185). For textile patterns we cannot know, which connotation (symbolic meaning of the visual code; Chandler 2002) was attached to specific kinds of colors or patterns. Which one was a 'sign' of a specific rank within the hierarchy? For the Roman period we know, for example, that the colour purple had a specific connotation, it functioned as visual code for the rank of a senator and later for the emperor.

Conclusion

Textiles can be found in various contexts in the European Early Iron Age, the most striking and numerous finds are known from the salt mine Hallstatt. But textiles also survive in graves, especially those with metal items – the most famous among these is the evidence from the princely grave of Hochdorf. Sophisticated excavation and analytical techniques employed during the last centuries allow us to gather more and more data. The material presented indicates that textiles and clothing played an important role in the Early Iron Age in temperate Europe for the expression of wealth, and as status symbols and prestige goods for the elites. The Hallstatt period textile culture is characterized by a lot of variations in weave types, patterns and textile qualities. Also, the textile patterns fit in the 'visual world' they belong to – carrying codes and information which should also be understood.

Handcraft skills in combination with precious raw materials create a powerful visual code that was worn on the body and thus carried around. Furthermore, textiles with colors, patterns and applied decoration represent the idea of creative work with textile material, according to the knowledge, the skill and rules of the society.

Specific colors and/or patterns were perhaps understood in the Iron Age as visual codes, to express the 'social space', group relationships – hierarchical, regional, or supra-regional. It is striking, that for the most complicated pattern techniques like soumak or tablet weaving in some cases specific patterns appear. For the elite burials related to the Heuneburg, *e.g.* Hohmichele and Hochdorf, it is the Swastika-motif. Maybe with this we can detect the visual code of the elite in the modern Baden-Württemberg area. In contrast – for the Eastern Hallstatt area (and 'border' line between East and West: Hallstatt and Mitterkirchen) we can see the use of applications to embellish textile surfaces, famous examples are the cloak with buttons from Mitterkirchen and the marvelous decorated garment from Stična. Especially the glittering bronze and sometime gold objects attached to (eventually dyed in bright, contrasting colors like deep red or blue) textiles allow a distinct visual appearance – even from far away. That visual code highlights rich women in that area.

For the visual appearance of textiles two further interesting matters are the vantage point and the light conditions. Did elites use special colors and/or colour patterns to mark their status and prestige to the masses of people looking at them from farer away? Who then was allowed to come near enough to see sophisticated details such as the spin patterns discussed?

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7.2. To pleat or not to pleat – an early history of creating three-dimensional linear textile structures

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To pleat or not to pleat – an early history of creating three-dimensional linear textile structures

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(with 18 figures)

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Abstract

In this study we present an early history of creating longitudinal three-dimensional textile structures, which might be produced by folding and pressing ready-woven cloth, but also by various spinning and weaving techniques such as spin patterning or barred damasks. They all have ONE thing in common: they result in the visual appearance of a pleated structure, a three-dimensional longitudinal pattern which produces a special effect. In this article we follow the history of pleated structures from 4000 BC to AD 1000. Archaeological textile finds from Central and Western Europe with some glimpse of Egypt are the basis of the different aspects of garments with pleats or a ribbed structure – including some thoughts on body language, visual effects and textile identity. We review well known finds and present new data.

Pleated textiles have been known for centuries, even millennia! Such attempts to produce three-dimensional structures started in prehistory, already during the late Neolithic Period. Linen textiles woven in tabby found in lake-dwellings and dated to the 4th millennium BC show horizontal lines woven in twill. These lines in another pattern than the main weave tend to be higher and three-dimensional. Later in Iron Age pleated garments have been created by experimenting with spin-patterning. Pleated garments are well visible on pictorial sources of that period. During the Early Medieval Period, pleated garments have been made technically in two ways, either by hand-pleating after weaving or creating the pleats in the weave (so-called "*Rippenköper*", a twill variant). It seems to have been a fashion worn by rich Germanic women (tunic) and men (mantle); the variant with woven pleats have been made only in Alemannic areas (South Germany/Bavaria and North-East Switzerland).

Keywords: Archaeological textiles, pleated structures, Central Europe, Stone Age, Iron Age, Early Medieval Period, fashion.

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Introduction

Textile research is an important task of the Department of Prehistory of the Natural History Museum Vienna. The department houses the collections of Bronze and Iron Age textiles from the salt mines Hallstatt (Grömer *et al.* 2013), but also various artefacts mainly from Iron Age and Early Medieval graves, where textiles survived in a mineralised state attached to metal objects (Bender Jørgensen 2005; Grömer & Sedlmayer 2012). Within the framework of international research projects such as CinBA – Creativity in Bronze Age (Bender Jørgensen *et al.* 2018), a re-assessment of textile finds from the Natural History Museum Vienna took place and new methods have been applied to the textile finds stored at the museum (Rast-Eicher 2013). During this effort, interesting details and features have been analysed and described the first time, such as folded and pleated structures. This was set into context with other finds of the same kind (mainly from Austria and Switzerland) that have been analysed by the authors. Here we try to trace back how three-dimensional linear textile structures evolved, also taking already published material and iconographic sources into account.

Woven textiles in general are inventions of early farmer societies; for example, they appear in Europe from the Neolithic Period onwards, 7000 years ago. Right from the beginning, the weavers put some effort in decorating these textiles. Surface and self-patterning structures were used before colour patterns (Grömer 2016: pp. 169–205). Linen was not easy to dye, and white or nearly white wool not available until the Bronze Age (Rast-Eicher 2018: pp.125–129.). Here we focus on longitudinal three-dimensional pleated structures – in textile history, they have been produced in many different ways.

Ribbed structures and pleats

Pleats have been used throughout human history to create special garments with highly visible, mostly vertical folds or a ribbed structure. In modern terms, the fullness of a textile is described by the depth of the pleats. “Zero fullness” would be a flat fabric, 100 % fullness *“is pleated so that it takes up exactly half as much width as it would if it were not pleated at all”*[3]. Prehistoric finds show different techniques to achieve three-dimensional structures (Fig. 1): plissé, *i.e.* folding and pressing already woven cloth, but also three-dimensional spin patterning as well as specific weave patterns like barred damasks can create pleat-like structures. In the Medieval Period as well as in (Early) Modern history, pleats have been sewn (*e.g.* early modern smock), or modern textiles were pleated by hand and were fixed by ironing (accordeon pleats) or with a pleating form (steam cupboard). Many materials have been and are used: silk, wool, linen, cotton (cotton drill), and artificial fibres (polyester). If wool is used, the textile should be a crêpe, a tabby woven with very hard spun yarns.

[3] WIKI “Pleats”: https://en.wikipedia.org/wiki/Pleat. Accessed 24th Nov. 2016

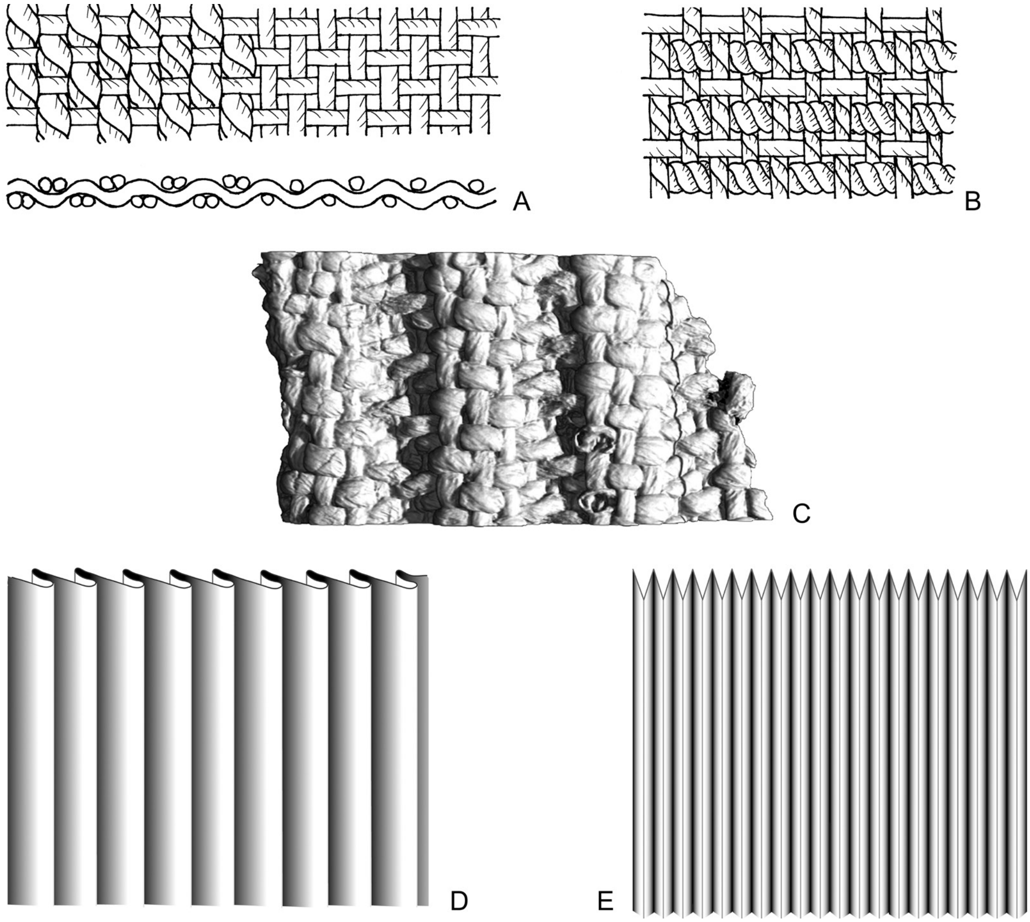

Fig. 1. Textiles with three-dimensional linear structures. A: three-dimensional spin pattern; B: ribbed structure; C: barred damask; D: round pleats; E: knife pleats (sources: K. GRÖMER, B. NOWAK, and B. NUTZ).

In folk costume, pleated textiles have been made all over the world. A technique used in Guizhou (China) still today might serve as an example: A long dark blue textile dyed with indigo and treated with rice paste is fixed with strings around a large wooden water container. Pleats are then made one by one by hand with a long pin. At the end, the pleated textile is coated with rice paste or *bletilla striata* to hold the pleats[4].

In this study about three-dimensional linear structures before the Middle Ages, we use the terms listed below which are defined as follows:

The term p l e a t s or p l e a t e d s t r u c t u r e / t y p e is used as the general term for all different three-dimensional linear structures.

[4] http://www.narrativemade.com/hand-pleating/3héo93cm0inqbs4lb8sjdxu79gc90fc

Plissé: Textile pleated after weaving with heat and/or pressure, linen or wool (here tabbies with hard spun yarns). The pleats can be sharp or round.

A barred damask is a 2/1–1/2 (sometimes 3/1–1/3) damask with change after three or five weft threads. This pattern automatically creates pleats. The pattern has been called *"Rippenköper"* – ribbed twill – by Hans Jürgen Hundt (1966: p. 100), an archaeologist, who discovered them among the Early Medieval graves in Southern Germany in the 1960's. In 2004 Martin Ciszuk introduced the term "barred damask", a term we will use here (2004: pp. 107–114).

A Three-dimensional spin pattern is created with the use of groups of single and plied yarn, usually of different twist direction. To create a three-dimensional effect, the plied yarn is thicker than the single yarn, also the single yarn is spun quite hard with a twist angle of about 50°. The weave type applied on those textiles is usually tabby.

Structure patterns are understood as types of decoration that are created as three-dimensional woven structures (*e.g.* barred damask – *Rippenköper* or Three-dimensional spin pattern), in contrast to other pattern types that are woven in a flat way (*e.g.* two-dimensional colour patterns).

Theoretical background: visual effects and textile identity

The types of cloth with pleated structure are not only an expression of creativity and randomly chosen, but also served as a social expression.

Thus, for our study, concepts of dress and identity from the perspective of psychology, sociology, and semiotics (Calefato 2004; Sommer 2012) are of interest, because throughout history, textiles and clothing were not only used for basic functions like keeping warm. From prehistory on, dress was used to decorate and to express status and it serves as an important non-verbal communication medium. For those who can read it, one can express identity, age, gender, ethnic and religious groups via specific garments, cloth types, colour, and – in combination with this – specific jewellery. All of that is subsumed in the term "visual codes" (Chandler 2002).

It also has to be asked, what do those fabrics with pleated structure "do" with the body of the person wearing it – how do they move and interact with the body or not, what are the effects on body movements. Thus, such garments do have specific significance for a certain body language (Pease & Pease 2006). Body language is a form of nonverbal communication related to the movement of the body or any part of it – which also comprises of facial expressions, eye movement, and – in relation to clothing – body posture, gestures and use of space.

Visual codes like colours, physical appearance, and also body language are unconsciously read by audiences who then understand them. There are also specialised connotational meanings and ideological codes to reflect particular social, political, moral, and aesthetic values (Sørensen 1997; Harris 2014: pp. 264–285).

Archaeological finds

Textiles belong to the most fragile finds in archaeology and are preserved in special conditions only: in humid layers, such as stone Age lake dwellings, in salt mines as the ones of Hallstatt (Austria) or thanks to oxidation of metal in graves. Dry conditions for the preservation of textiles are available in deserts. Research in archaeological textiles has become more and more important during recent years; international projects have shown the potential of this subject.

In the following paper, three-dimensional linear textile structures are studied focusing on the archaeological evidence in Central and Western Europe, from the Late Neolithic until the end of Early Medieval Period, that includes a time-span from *c.* 4000 BC to *c.* AD 1000. Within that time, different economic, social as well as technological circumstances formed the basis of daily life in Europe (KRISTIANSEN 2000). Those circumstances influenced the textile techniques available, their production, use, and impact on society. First farmers in Europe (second half of 6th millennium BC) brought flax – linen textiles were the first woven textiles documented in the Neolithic. The Late Neolithic is characterized by a rural way of life with domesticated animals and plants, but without big social differentiation; towards the Bronze Age (2200–850 BC) there are the first hints of a hierarchical society (KRISTIANSEN 1991), if we look at the different level of grave goods accompanying the deceased. From textile technology, Neolithic is the time when tabby weaving was the dominant type and textile technology is based on plant fibres. From the Bronze Age on and especially in the Iron Age wool was used, and twill and dyeing were employed. Especially in Iron Age Europe (*c.* 850–0 BC) we can trace an elite controlling a certain territory and living in central towns or settlements on hills (in Greece the *polis* is emerging), and extraordinarily rich chief's graves, showing their exchange with the Mediterranean (for an overview: CUNLIFFE 1998; KRISTIANSEN 2000). In such graves there are a lot of representative goods – jewellery and luxurious textiles, in many cases trade goods.

In the first half of the 1st millennium AD main parts of Europe were part of the Roman Empire and their advanced technology and trade systems also influenced life there. The areas north of the Roman Empire, north of the river Danube and east of the river Rhine, as well as the area of Scandinavia, were inhabited by Germanic tribes. In the middle of the first millennium AD widespread migrations within Europe started, which led to the fall of the Roman Empire. The Migration Period changed the map of Europe (FRIESINGER & VACHA 1987; HALSALL 2008), as a number of Germanic tribes such as the Alamans, Franks, and Lombards settled in various parts of what had been the Roman Empire; incursions by Asian tribes such as the Huns (5th century AD) and Avars (6th–7th AD century) also left marks. Within that time as well as in the Early Medieval Period, many economic achievements of the Romans were abandoned. The technology used during that time, especially for daily handcraft like building simple wooden houses, pottery, and smithery, often continues the standards of Pre-Roman times. Early Medieval society is based on kinship, and traded luxury goods were available for the higher strata of society.

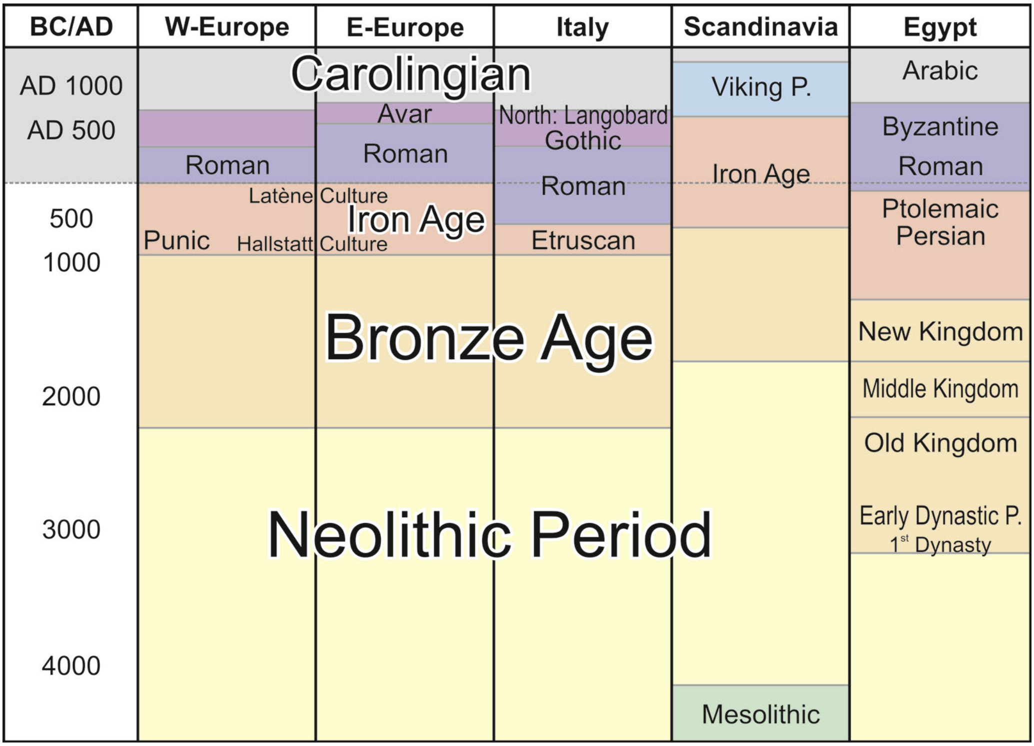

Fig. 2. Cultures and Time periods from 5000 BC till AD 1000 in Europe and Egypt (Drawing: A. RAST-EICHER).

The rich graves of the Merovingian kings family in the Basilica of Saint-Denis in Paris are the best examples for 6th and 7th century AD rich grave goods, including imported silks (FLEURY & FRANCE-LANORD 1998; DESROSIERS & RAST-EICHER 2013; a new publication of all finds is in preparation: PÉRIN, in press; RAST-EICHER, in prep.).

Early evidence of three-dimensional structures: ribbed fabrics, structural stripes, and pleats

The first evidence of woven textiles found in Neolithic Europe derive from the early farming cultures, dated to the first half of the 6th millennium BC: they are imprints on ceramics, like those from Szentes-Kiss Boliszár (Hungary; 1st half 6th mill.; RICHTER 2010) or Luleč in Czech Republic (mid 6th mill BC; GRÖMER 2016: p. 129). Organic preserved woven textiles from the lake dwellings have been found in layers dated to shortly after 4000 BC. Among the finds of the lakes of the canton of Zurich (Switzerland) 70 woven textiles dating to the 4th and 3rd millennium have been documented; they are made of linen with plied yarn and woven in tabby weave (RAST-EICHER & DIETRICH 2015). Few of these finds show a linear decoration – as linen is difficult to dye, it was probably the best way to create structure patterns. One of those patterns has been made with

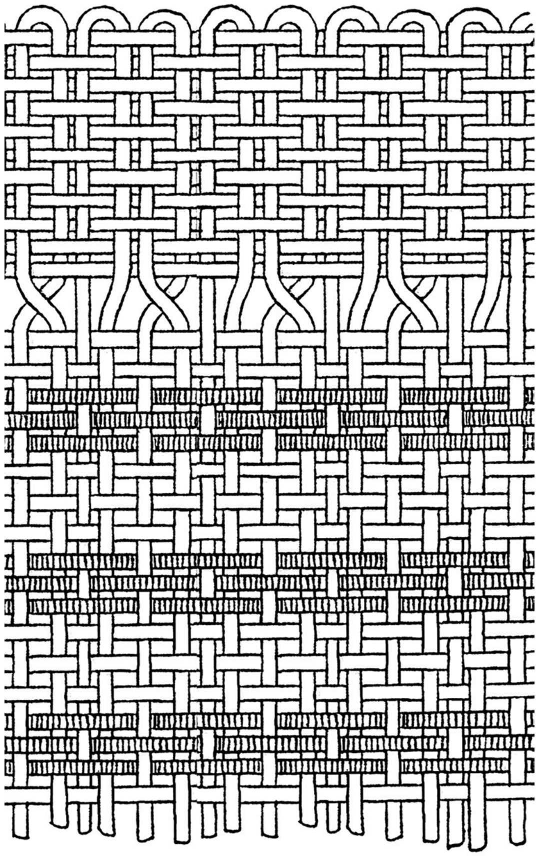

Fig. 3. Wetzikon-Robenhausen (CH): Linen textile with inserted pattern, *c.* 3800 BC (after VOGT 1937).

three weft threads in 3/1 twill-structure, which were probably introduced by picking up the correct threads for the pattern by hand (Fig. 3). These stripes are slightly three-dimensional, as the parts with twill tend to rise, if the weft threads are well beaten. Was this the beginning of the concept of pleats?

From the Bronze Age only a single textile with three-dimensional effect has been documented in Europe: in the settlement of Staré Město (Czech Republic) a small textile fragment from *c.* 1100 BC has been preserved showing a clear ribbed structure (HRUBÝ 1968/69: pp. 51–56). The structure was made by the change of single yarn and triple plied yarn in the weft (Fig. 1b). This type of structure is again found later in the Iron Age as well (see below).

It is important to mention Egypt in this survey of pleated textiles. A nearly complete linen garment with horizontal pleats found in Tarkhan (Egypt) has been preserved, another one from Deshasheh (old Kingdom; RIEFSTAHL & CHAPMAN 1970)[5]. Dated to the 1st dynasty (about 2800 BC), the Tarkhan textile is the oldest well preserved garment, which is nearly complete. It is woven in fine tabby with 22–23/13–14 threads/cm. In the upper part of the linen shirt, knife pleats (plissé) lie horizontally. They were made with 1 cm pleats in the damp textiles. The vertically pleated linen textile from Deshasheh (5th dynasty, 2470–2320 BC) has been pleated by weaving parts with loose warps, others with dense warps. The loose warps turn in the sense of the dense warps so that they create pleats (REIFARTH 2013). Another dress dated to the 11th dynasty (*c.* 2150 BC) is a tunic found in a tomb of Naga-ed-Der in Middle Egypt, now in the Museum of fine Arts in Boston (USA; RIEFSTAHL & CHAPMAN 1970). The sleeves are pleated vertically, the central body area horizontally. As we know from various examples from ancient Egyptian pictorial sources, very fine garments with pleats and draped narrowly around the

[5] http://www.ucl.ac.uk/museums/petrie/about/collections/objects/tarkhan-dress; http://www.ucl.ac.uk/museums-static/digitalegypt//deshasheh/uc31182.html

body seem to have been standard throughout the millennia of pharaonic Egypt (Landi & Hall 1979). Here it is also worth to mention that pleating plays an important role in textile production and dress in the Ancient Near East and Bronze Age Greece, as we know rich iconography depicting pleated fabrics and garments (*e.g.*, Strommenger 1971; Jones 2013, 2015; Peterson Murray 2016).

Iron Age: Early wool textiles with spin patterns and plissé

The European Iron Age knew a great variety of pattern types. Wool added important new venues to the decoration of textiles as it is much more elastic than plant fibres. To understand the impact of wool on the pattern types focused here in this study, we must address the fact that light (not fully white) wool became available in Europe during the Bronze Age. It must have been known for a longer period of time already in the Near or Middle East. White wool is necessary for dyeing; the first dyed wool textiles in Europe appear in the Bronze Age layers of the Hallstatt salt mine in Austria (Grömer *et al*. 2013: oldest blue dyed textile HallTex 211, catalogue pp. 269–270). Wool with crimp (known certainly in the Iron Age) is another important factor for the creation of plissé, as such wool is better suited for crêpe-like textiles. In the Central European Iron Age the option of colour had been developed into fancy patterns. This signifies a completely different concept of textile design.

Iron Age art provides us with different kinds of pictorial sources such as incisions or imprints on pottery, anthropomorphic fibulae, figurines, and stone stelae (Huth 2003). For our research question, the most important is the so called "situlae-art" (Lucke & Frey 1962; Turk 2005), as it preserved more or less naturalistic images of people and their garments. The situlae art is an artistic style in Late Hallstatt and Early Latène Period (between 700 and 400/300 BC), which is known mainly in alpine Austria, Slovenia, and Northern Italy. It belongs partly to the (South) Eastern Hallstatt Culture as well as to the Este Culture of the Veneti and the (Pre-?)Etruscan Villanova Culture around Bologna. The design is done mostly as a bas-relief with pins, small chisels, and punches. The scenes and figures are very detailed and even the garments of the depicted men and women are well developed. Compared with contemporary textiles, *e.g.* from the salt mine Hallstatt (Grömer 2016: fig. 99), we can see that the situla decorations reflect textile and pattern types like stripes and checks which were used in the Hallstatt Period.

One of the most famous items of situlae art is the situla of Vače, Nad Lazam in Slovenia, dated *c.* 500 BC. (Lucke & Frey 1962: pls 47–51; Turk 2005: cover, figs 2, 90, Kat. No. 48). Here a multi-pronged tool was used to work out the structure pattern of the fabrics. Can we deduce, that those veils and upper garments with the decoration in question had pleated structure? One detail might point to this fact: On the upper garment of the man sitting on a throne (Fig. 4) the pleated structure done with a punch with multiple teeth used in parallel rows follows the natural drape of the garment while sitting.

Contemporary Etruscan statuettes also depict garments with pleats, such as an ivory statuette (dated *c.* 575 BC), kept at the Staatliche Museen zu Berlin (Fig. 5; Bonfante 2003:

Fig. 4. Vače, SLO: Bronze situla, detail garment with pleated (?) structure, *c.* 500 BC (Scan: 7reasons; Situla housed at the National Museum of Slovenia, Ljubljana, Inv. No. P581).

pp. 176–177). It is a woman wearing a long dress with regular pleats running over the breasts and the lower body, thus enhancing the slim body silhouette.

Beside colour patterns, structure patterns have been used in European Iron Age. At the beginning of the Iron Age during the Punic Period in Spain (7th century BC), plissé garments seem to have been fashionable as demonstrated by a piece of woollen cloth with very fine pleats found in Carmona in southern Spain. The textile is a weft tabby with single threads (z, hard spun 35–60°, diameter 0.1–0.3 mm, 20–26/38–40 threads/cm; ALFARO GINER & TÉBAR MEGÍAS 2007: fig. 4). We do not know if the Spanish plissé had been influenced by Egyptian fashion. Culturally this could be possible, as many people migrated from the Phoenician towns in North Africa to colonies in Spain from about 1100 BC onwards, following the coasts to the West and crossing to Spain at Gibraltar. There were economic interests as gold, silver, copper, tin, and iron were found in Spain (BOTTO 2016). At the same time, textiles with pleats started to be found in other parts of Europe.

One of the first well-dated Early Iron Age wool textiles with plissé has been excavated in Verucchio (Italy; 725–650 BC; STAUFFER 2012: figs 10.10 and 10.11, pleated pattern). A ceremonial garment in the shape of a long sleeveless tunic with open sides and curved lower edges (Object A), made of balanced wool twill, possesses such a structure. On the surface of the garment, a regular system of folds in both directions could be detected under a strong lateral light by STAUFFER. The folds form small rectangles of about 4 by 3 cm and have been deliberately made. As the pleats run over the tablet-woven borders, it seems certain that the pleating was done after the garment had been finished. When pleated, the garment must have looked quite different than it did directly after weaving. Its shape was optically minimised and it would have looked more like a *chiton* than a wide fitting sleeveless tunic. *Chiton* is a generic term for a Greek tunic, more fitted to the body than the Roman *tunica* (CLELAND *et al.* 2007: pp. 32, 200–201).

In Central and Western Europe, the Hallstatt Period (*c.* 800–400 BC) is one of the first heydays of various pattern types: we find colour pattern such as stripes and checks, and complex designs made with tablet weaving such as meanders, lozenges, or swastikas (GRÖMER 2016: figs 99, 102–105, 107). Such patterns appear on textiles as well as on other types of objects (*e.g.* pottery, metals). The most famous structure pattern type is the spin pattern, which could be detected in more than 50 % of the textiles found in the salt-mine of Hallstatt. For a spin pattern, the difference of spinning direction was exploited to provide decoration, for otherwise identical S- and Z-spun threads laid side

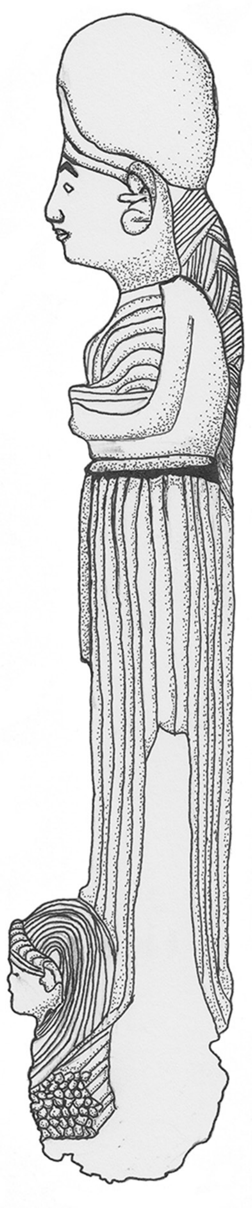

Fig. 5. Etruscan statuette with pleated dress, provenience unknown, *c.* 575 BC (Drawing: A. NARDINI and K. GRÖMER, after BONFANTE 2003: fig. 64).

by side will catch the light differently and give a subtle tonal pattern. Usually spin patterns were made using more or less regular groups of s- and z-twisted yarn in warp and/or weft; it creates a three-dimensional effect. As the textiles from the Hallstatt salt-mine, Austria, are preserved in their original organic composition and in very good condition the structural effects can still be seen very well. Recent microscopic and visual analysis of the spin patterned fabric with three-dimensional effect explained the phenomenon; the prehistoric weavers used groups of thicker plied and thinner single yarn of different twist direction to create a structure effect – thicker and thinner stripes in the fabric which look like pleating. This deliberately chosen effect is additionally highlighted when combined with hard or light spinning. The tightness of twist is defined by the angle of the fibres in the vertical axis of the yarn. *"A twist so tigh that the yarn is inclined to retwist on itself when not under tension generally referred to as a crepe twist since such yarns tends to produce a creped or crepe effect."* (EMERY 2009: pp. 11–12).

Textile HallTex 63 from the salt-mine Hallstatt is a large yellowish tabby, woven by alternating 8 S-plied yarns (0.4 mm thread diameter) and 8 z-single yarns (0.2 mm thread diameter; Fig. 6; GRÖMER *et al.* 2013: catalogue pp. 383–384).

Textiles from Iron Age graves did usually not survive in an organic state, but are mineralized and hardened; in the worst case, the former textile can be presevered only in form of mineralized remains attached to a metal artefact. Although colour information is usually lost, details of the thread and weave structures are commonly still visible and such single or plied yarn as well as the spin direction can be analysed on grave finds. Thus, the Hallstatt Period graves also offer some information about the pleated structure effects.

From Berg/Attergau in Austria, dated to *c.* 600 BC (GRÖMER 2014: catalogue p. 195 [No. HaZ-12]) we know of a woollen twill fabric with alternating groups of 5 Z-plied yarns (0.7 mm thread diameter) and z-single yarns (0.5 mm thread diameter). In this case, the fragment is too small to see the effect, but with the technical details, it is comparable to the three-dimensional spin pattern of HallTex 63 from Hallstatt (see Fig. 4).

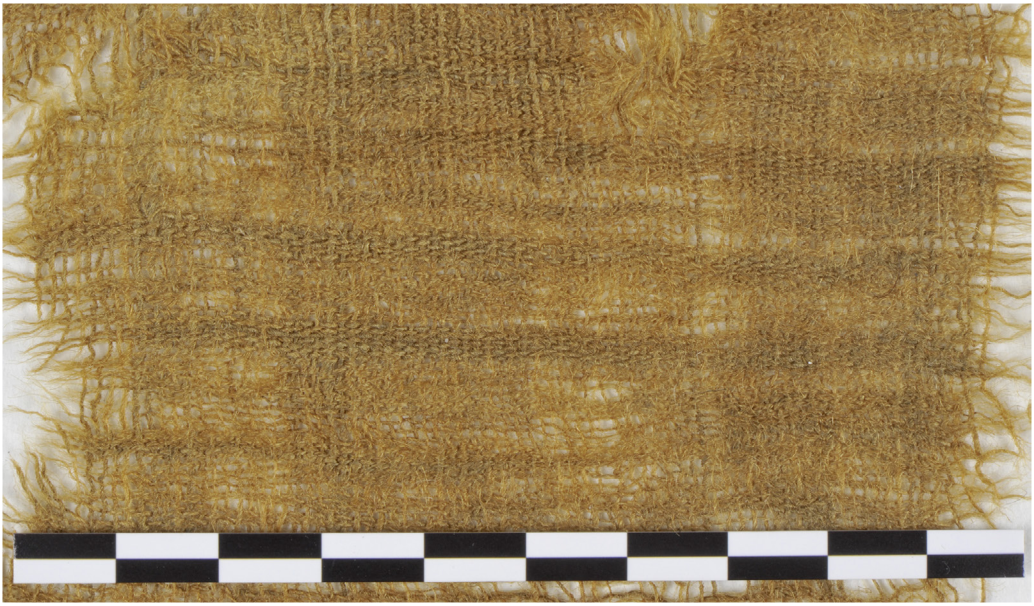

Fig. 6. Hallstatt (A): HallTex 63 with spin pattern in three-dimensional structure effect, 800–400 BC (© Natural History Museum Vienna, Photo: A. RAUSCH).

A pleated structure was also visible in fragments from the later Iron Age in Giubiasco, Southern Switzerland (canton Ticino), similar to the techniques found in Hallstatt: by combining a fine warp thread (hard spun) to a thick weft (soft spun) a ribbed structure was achieved (Fig. 7) on a 2/2 twill fabric (Tomba 10, reperto 2; RAST-EICHER 2016a).

Plissé is sometimes visible even in small fragments from graves. One example is a well-dated early Iron Age linen textile of

Fig 7. Giubiasco (CH): 2/2 twill mineralized on an iron fibula, late Iron Age, the finer warp is combined with a soft spun weft (Photo: A. RAST-EICHER).

Bulle-Teraillet (Canton of Fribourg; CH; Bulle-Teraillet 2015, Inv. 205; Hallstatt C, *c.* 750 BC) woven in tabby. The fragments show regular small folds which were made intentionally (Rast-Eicher 2016b).

Roman and Early Medieval Period: plissé and barred damask

Based on archaeological textile material, the evidence for pleated structures is scarce during the first half of the 1st millennium AD in Europe. In the North East European Wielbark Culture (Poland) dated to the AD 1st–5th century AD, no textiles with pleats have been found so far (Maik 2012).

In the areas of the Roman Empire during the 1st/2nd century AD cremation graves are dominant, during the Late Antique Period (3rd to 5th century AD) in the Central and Western European Provinces inhumation graves were preferred. In Scandinavia, cremation and inhumations were practiced, so that textiles of that period are more numerous. Among these graves one is especially interesting, because a single pleated textile has been found; dated to the 5th century AD, it is a 2/1 barred damask otherwise not found in this region (Hjemsted Grave 1409; Bender Jørgensen 1986: fig. 100c).

Textiles of the Roman Period graves (*e.g.* Germania, Danube provinces, Noricum/Pannonia) have been a research focus in the last years. Among the hundreds of textiles recorded, tabbies clearly dominate (Grömer 2014: fig. 17 and tab. 4); pleated textiles are rare and only plissé, no other textile type creating three-dimensional linear structures could be identified so far. Two of the rare examples of plissé textiles in Late Roman context have been found in the Late Antique cemetery of St. Maximin in Trier (D), graves 287 and 304 (Reifarth 2013: figs 287/7 and 304/3).

Roman Period textiles in Italy would be very important, but have not been documented in sufficient quantity to judge the question of patterns. This is why we have to look at material in Roman Egypt, where they also used a pattern variant creating a pleated structure; in the sites of Mons Claudianus and Krokodilô, sites dated to the 1st/2nd century AD (Cardon 1999; Ciszuk 2004: pp. 107–113), two types of barred damask types have been found – the barred damask 1/2–2/1 and 1/3–3/1. Another 2/1 barred damask has been discovered in the late Roman fort of 'Abu Sha'ar (1st half of 4th century AD) (Fig. 8). They are all made of wool. The first variant then became very important in the Early Medieval Period in Europe from the 6th century AD onwards, and was made of linen.

During the Early Medieval Period, in the second half of the 1st millenium AD, pleats seem to be common. Two types of pleated structures have been known: the first is a textile woven in tabby and pleated after weaving (plissé) and made of wool or linen, the second the barred damask (or *"Rippenköper"* by H. J. Hundt) and made of linen. In the Early Middle Age the plissé has been produced with round or sharp pleats of about 7 mm depth. The sharp pleats were probably made as knife pleats (see Fig. 12), as for

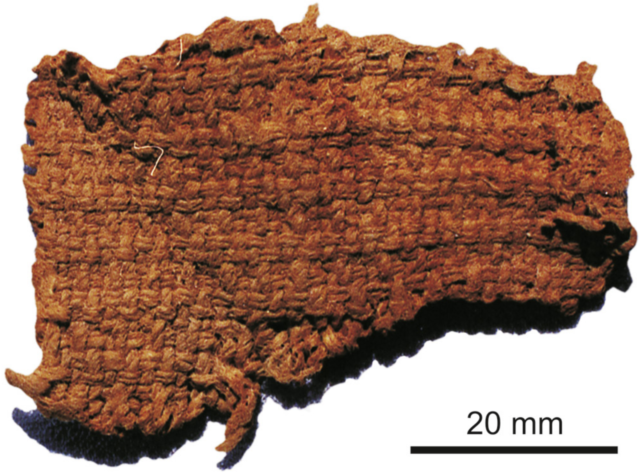

Fig. 8. 'Abu Sha'ar (Egypt): Barred damask (no. 309), 300–350 AD (Photo: L. BENDER JØRGENSEN).

the round ones Agnes GEIJER proposed warm iron sticks to form the pleats (GEIJER 1938: p. 17, pl. 1; HÄGG 1991: pp. 209–210). Technically, the plissé is made of a textile with hard spun threads, and spun in warp and weft in the same direction, in Europe mostly z/z. The hard spinning creates a crêpe-like surface which is ideal to make the later pleating hold (Fig. 9).

The second pleated structure type has been woven as 2/1–1/2 barred damask with changes after three or five weft threads. This pattern creates durable pleat-structures, even surviving washing.

In a few cases, barred damask 2/1–1/2 has been combined with a second pattern, a herringbone twill: four examples are known: from Niederstotzingen (D; HUNDT 1967), Elgg (Canton of Zürich, CH; WINDLER 1999), and Fehraltorf (Canton of Zürich, CH; RAST-EICHER, 2017), all of them dated to the 7th century AD (Fig. 10). Combinations of patterns have been known in the Iron Age already (RAST-EICHER & TIDOW 2002; GRÖMER *et al*. 2013: pp. 163–178;). The pattern with twill barred damask combined with herringbone twill seems to be an Alamannic speciality, as the few textiles known so far have all been found in Southern Germany and Eastern Switzerland, the probable geographical expansion of this Germanic tribe which was ruled by the Merovingian dynasty.

For the 6th and 7th century AD in Central and Western Europe all examples of the plissé of the 6th century AD are located in France, Germany, and Switzerland, with two exceptions, one in England and one in Italy, but both in Germanic context. The pleated textile found in the ship burial of Sutton Hoo (GB) was wound around a mailcoat (CROWFOOT 1983). The pleats visible on fig. 319 of Crowfoot's article are broken and look similar to the mineralized ones attached to a brooch from Flaach (Canton of Zürich, CH; Fig. 11; RAST-EICHER 2012) or from a Lombard grave of Maria Ponsee (A; Fig. 12). However, this type appears later in Scandinavia, for example in Birka in Sweden, and there the textiles were held by tortoise pins (GEIJER 1938).

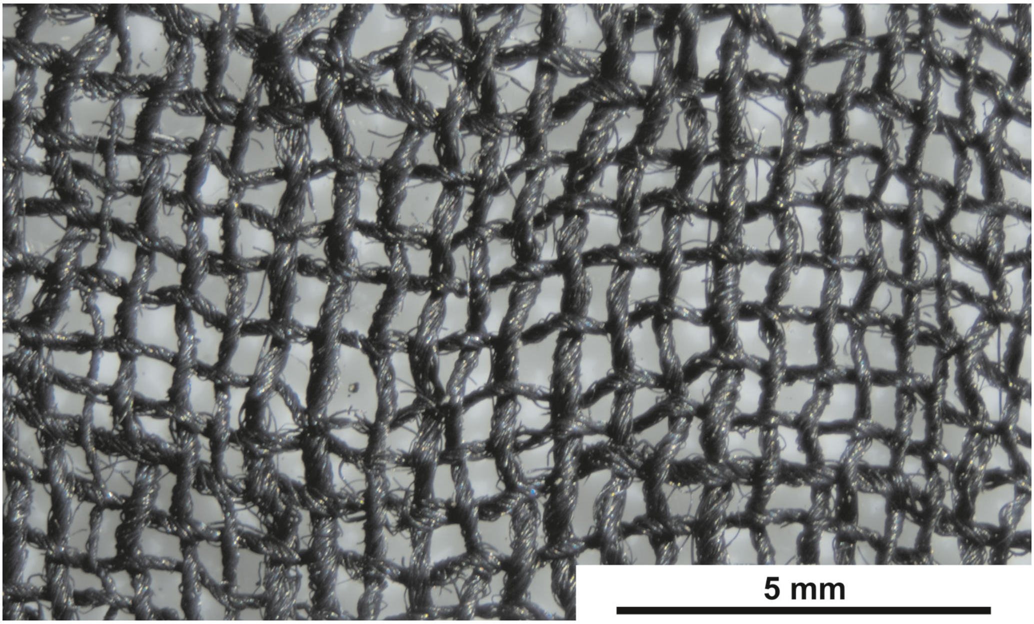

Fig. 9. Saint-Denis/Paris (F): Detail of pleated textile of grave 48, 6th century AD (Photo: A. Rast-Eicher).

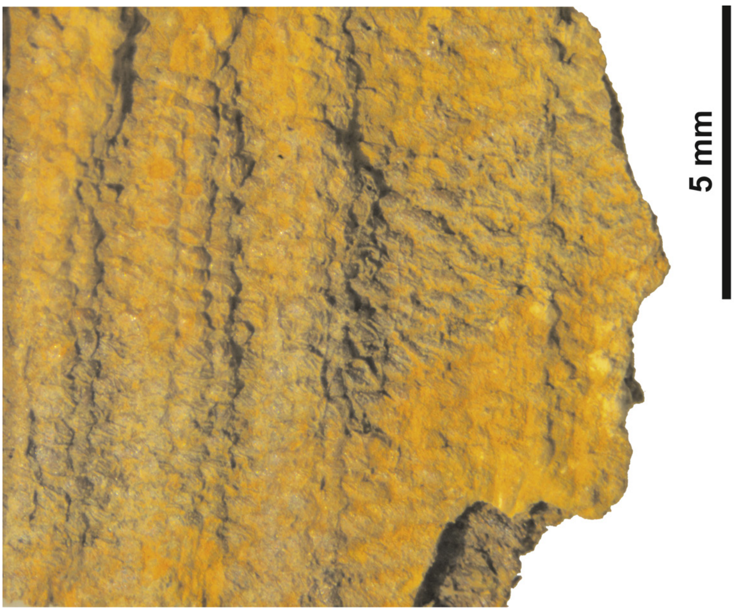

Fig. 10. Fehraltdorf (CH): Barred damask with herringbone twill, grave 53, 7th century AD (Photo: A. Rast-Eicher).

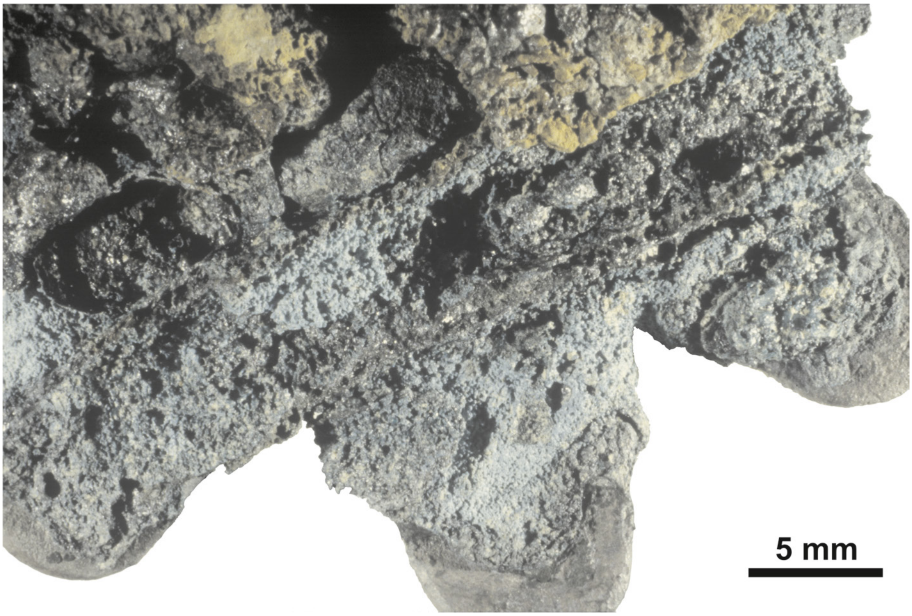

Fig. 11. Flaach (CH): Pleated textile mineralized on a girdle plate, beginning of the 6th century AD (Photo: A. Rast-Eicher).

Fig. 12. Maria Ponsee (A): Pleated textile on a knife, grave find, 6th century AD (Photo: A. Schumacher, NHMW).

The function of these textiles with pleated structure seems quite clear: in women's graves the pleated textiles have been found under the girdle or pinned with a brooch, in men's graves those textile types were identified over the girdles. We have interpreted the women's garment as a tunic or over-tunic with a front opening, the men's garment as a cloak. In several graves, the textile could be documented in connection with more than one object. In the 6th century AD graves pleated garments have been found attached on certain fibulae (bow brooches) or found on buckles, also in the graves of Flaach (canton of Zürich, CH) dated to the beginning of the 6th century AD. This cemetery is especially interesting, as it is the oldest Germanic graveyard south of the Rhine, documenting the expansion of Germanic tribes towards the South at that time (Windler 2012: pp. 56–77). In the 7th century AD women's graves, the position of dress fasteners (such as brooches)

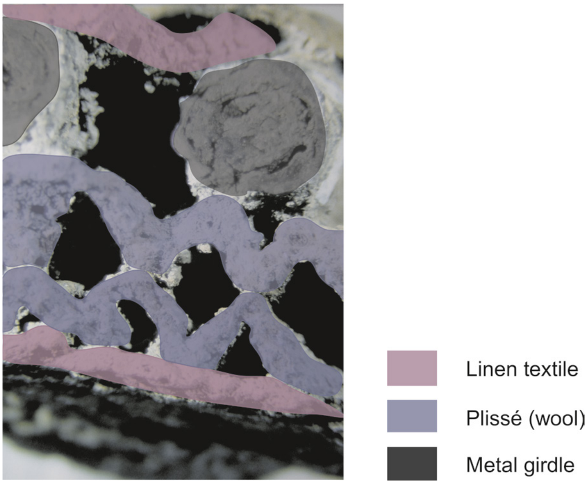

Fig. 13. Schleitheim (CH): cut through two layers of pleated textile under a chain from grave 504, 7th century AD (Photo: A. RAST-EICHER).

differ to those of the 6th century AD. We might interpret the evidence as such that even the type of garments fastened with them are different. Maybe the over-tunic with front opening from the 6th century AD, closed with two fibulae, was eventually replaced by a cloak closed by a single large fibula on the chest. In Schleitheim (Canton of Schaffhausen, CH) grave 504 (7th century AD), the woman wore a long pleated garment (fine knife pleats of about 7 mm), which has been documented all along the chain hanging from the girdle, delimiting this way the length of the garment (RAST-EICHER 2002a: pp. 211–228) (Fig. 13). Similar to this is grave 189 from Baar-Früebergstrasse (Canton of Zug, CH; 7th century AD); the pleated textile (here the barred damask type) has been found under the girdle (buckle), and under the objects hanging from the girdle. The reconstruction has been drawn according to the organic material found on the different objects (MÜLLER 2010: pp. 458–461) (Fig. 14).

In a man's grave from Meikirch (Canton of Bern, CH, dated to the end of the 7th century AD; BOSCHETTI 2004: pp. 183–200, fig. 201) a pleated textile was attached on top of the large girdle plate. The pleated garment was identified as a coat, because the textile formed the upper layer on the girdle. Iconography supports this interpretation; on a grave plate found in Zenica (BIH; CREMOŠNIK 1958: pp. 150–151), one woman and three men are depicted, each wearing a pleated garment (Fig. 15). The women's garment shows a sleeve and is therefore a tunic, while the men wear a garment fixed on the shoulder by a large late antique fibula (crossbow fibula) and hiding their arm – a coat. Later depictions of the 7th century AD in the church of Cividale, the "tempietto Langobardo" (especially to the right of the arch), confirms the Early Medieval use of pleated garments among the Lombards. North of the Alps, *phalerae*, like the one found in Hüfingen (D), are depicting Mary in a pleated garment (FINGERLIN 2012: pp. 7–26).

In the Early Medieval Period, written sources also mention pleated garments. Bishop Isidorus of Seville (AD 560–636) enumerates the garments in his *Ethymologies*, which

Fig. 14. Baar-Früebergstrasse (CH): reconstruction of Grave 189, 7th century AD (Drawing: Amt für Denkmalpflege und Archäologie Zug, Eva KLÄUI).

were probably worn in Visigothic Spain in the 6th century AD. Among the women's coats (Isidor Ethym. 19, 25, *De palliis feminarum*) he wrote about a pleated coat which *"sways its ripples in fluttering folds"*; *"...quod rugis vibrantibus sinuata crispetur"*. This is the only text of the period mentioning such pleated textiles. On later depiction of Isidor (AD 800, Monastery of Corbie), sister Florentina is wearing a coat with many folds (Fig.16).

During the Carolingian Period a written source from AD 899 informs us about pleated textiles: *phaltena* or *phalta, paltena* (the Old High German word *phalt* = *Falt* means "pleat"!). It is a textile for which the Francs of the East and the Slavic People have to pay taxes to the bishop of Würzburg (Germany); this means that this textile was of a local tradition and probably quite expensive (MÜLLER 2003: p. 90, footnote 144).

Discussion

As the survey on archaeological textile finds up to AD 1000 has demonstrated, during European history different textile types have been used to create three-dimensional

Fig. 15. Zenica (BIH): grave plate with persons wearing pleated garments, late Antique (Photo: Nationalmuseum Bosnien und Herzegovina, Sarajevo).

linear structures – some of them by the use of specific spinning and weaving techniques, some of them with the post-processing of a flat textile, *i. e.* plissé.

Chronological issues

The first attempts to create decorative structures on a woven textile can be traced back as far as European Neolithic and Bronze Ages, working with lines in twill structure on tabby weave for creating ribbed structures. Looking at early civilisations, pleated linens were common in Egypt from at least 2800 BC and onwards. Pictorial sources from the Ancient Near East and Bronze Age Greece also point to the use of pleated textiles; albeit there are no actual textile finds, we do not know which technique was applied to produce that structures. In Central Europe, pleated textiles appear from the Iron Age on, which is more or less the 1st millenium BC. At the same time, in Europe we find three-dimensional linear structures made with spinning and weaving techniques, as is demonstrated by three-dimensional spin patterns (combination of thinner, hard spun single yarn and thicker soft plied yarn) from the Hallstatt Culture. The specific effect of such textiles is also depicted in contemporary iconography.

The pleated and three-dimensional effects with wool are chronologically later than the production of such structures with linen textiles. The Egyptians had developed plissé

Fig. 16. Isidor presenting the work to sister Florentina, *c*. AD 800, Abbey of Corbie (Bibliothèque Nationale de France, Latin 13396 fol. 1v; © Bibliothèque Nationale de France).

textiles with fine linen, technically resembling the early wool patterns. This might have gone hand in hand with developments in sheep breeding, namely the appearance of wool with fine crimp, which can be identified from the Hallstatt Period onwards (Rast-Eicher 2013). Wool is more elastic than plant fibres and is therefore better suited for pleat structure creations. Wool with crimp, together with hard spinning, supports a crepe effect and, therefore, three-dimensional structures.

Interestingly, during the Roman Period this kind of pleated textile structure does not seem to be important in Central and Western Europe – the Roman textile industry is based on different design-principles. The plissé textile from a late antique grave in Trier might be of Germanic influence, but s-spun threads in warp and weft tend to come from regions south of the Alps – Italy and/or Spain – or Egypt. Plissé textiles and textiles with such pleated structures reappear in the Early Medieval Period, and then also a new textile structure, the barred damask type, was introduced.

The chronology of the barred damask type demonstrates that this weave type expanded from south to north (Rast-Eicher 2002b). The barred damask has been found at Roman sites in Egypt (1th–2nd century AD, see above), even as a variant of the 3/1 twill barred damask, which has not been found in Europe; however, a variant of this is known as block damask woven in silk (Wild 1970; Bender Jørgensen 1991: pp. 83–96; Ciszuk 2004; Reifarth 2013: p. 264). Block damask does not have a three-dimensional effect like barred damask. Nevertheless, it is interesting that block damask has not been found in the elite graves of the 6th/7th century AD in Saint-Denis/Paris – it seems to have been a typical Roman textile.

If we look at the chronological development in Europe, we can see that the barred damask appears in the late 6th and 7th century AD in Southern Germany and Eastern Switzerland. However, it is not present in Western Switzerland and France except the textile from Meikirch near Bern (Fig. 17). In these regions, the (Gallo)-Roman textile types such as the weft-faced wool tabby for tunics (found under the girdles) are present, but not in Germanic territories such as Germany, Northern France, and Eastern Switzerland. This data is important, especially because in Northern and North-Western France, among the many textiles seen in large and rich grave yards such as the royal tombs of Saint-Denis/Paris, barred damask is not present (Carré *et al.* 2015). This type, furthermore, is not present east of Central Austria, a territory inhabited by the Avars (Fig. 18).

Geographically, there are interesting differences in the Early Medieval Period. Plissé textiles can be found usually in France, Germany, and Switzerland; the exceptions concern one textile from Southern England and one from a Lombard (Germanic!) grave in Maria Ponsee in Austria (see Fig. 12). The latter is especially important, because the tribe of the Lombards migrated from the North of Europe towards the Danube region in Austria, and then finally after 568 towards Northern Italy (Lombardy!) where they founded a kingship (Menghin 1985). Also, a single find from Sutton Hoo in England underlines the Germanic tradition of pleated textiles (Crowfoot 1983: pp. 404–479, especially fig. 319). The 6th/7th century AD barred damasks are

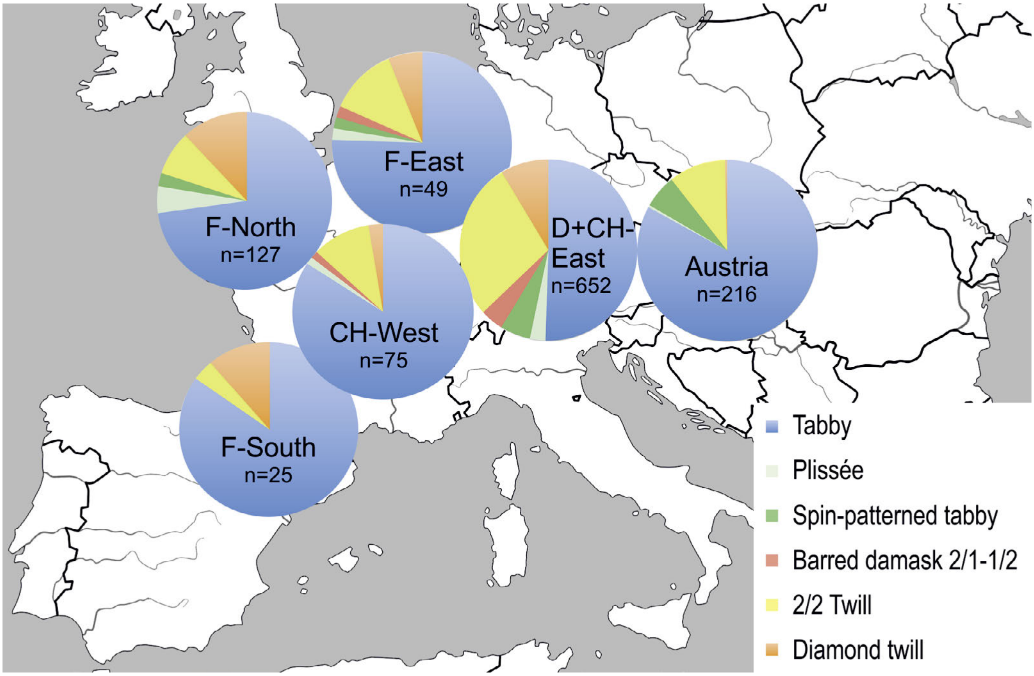

Fig. 17. Main textile types in Europe, 6th and 7th century AD (Drawing: A. RAST-EICHER).

restricted within the Germanic traditions geographically to Southern Germany and North-Eastern Switzerland.

In the later Early Medieval Period, after AD 700, textiles are not present in the graves in Western Europe; however, in the rising Viking towns such as Birka in Sweden fine pleated textiles (plissé, no barred damask) have been found in the back of large tortoise pins, fastening an upper tunic (GEIJER 1938).

Pleating had become, during later periods up to modern time, an important part in textile design, especially for costume and fashion. A quick overview through European fashion history (see *e.g.,* BÖNSCH 2001) informs us that, for example, pleated textiles were used in the Renaissance as well as in the 1920ies. This cloth type is also periodically reappearing in modern fashion design since the 1960ies, most recently in the winter season of 2017/18.

Visual coding – textile identities

Visual effects in woven textiles seem to be very old. Men and women tried to embellish the textiles used especially for garments. As we have seen, different techniques were introduced to transform a flat woven cloth into a three-dimensional one, or even to imitate such a structure by weaving. The effect of all of that – to apply the modern term

Fig. 18. Europe in the early Medieval Period, beginning 7th century AD.

"fullness" from the introduction again – had a specific variety. Three-dimensional spin pattern has less fullness than barred damask; the best technique to create 100 % fullness is plissé. There, pleats are created by post-processing of a flat textile by folding (pleating) and subsequent pressing, or the like, to make the folds durable. Early Medieval folds are of about 7 mm depth, carried out as round or sharp pleats.

Especially plissé and also barred damask is highly visible from a certain distance and shows the person in a very distinct style, as the longitudinal linear structure enhances the body silhouette when worn as a fitted garment. As explained in the introduction, textile structures as well as colours and patterns are part of a visual effect and thus a visual code within a specific society. Those visual codes transport non-verbal information about the wearer.

For the Neolithic and the Bronze Age Central Europe, our knowledge is too poor to make statements about who was wearing textiles with such pleated structures. On the Iron Age *situlae* we can identify a man in a tunic with pleated structure as well as a woman wearing a veil with the same structure. At the Iron Age sites of Giubiasco and Bulle, textiles with pleated structure appear in both male and a female graves. The plissé textile from Verucchio has been found in a rich man's grave. These few Iron Age examples show that men and women were using textiles with pleated structure in Europe at this time.

For the Early Medieval Period, we have much more evidence of garments with pleated structure such as plisse and barred damask. This offers a wider basis for a discussion about the social status and the gender of the persons wearing them. It is obvious that this type of textile was linked to the richer part of a community. In Schleitheim (canton of Schaffhausen, Switzerland) and in Baar-Früebergstrasse (canton of Zug, Switzerland) the richest women of the 7th century AD found in these graveyards wore pleated tunics (one plissé, the other barred damask). In these graveyards no men with pleated garments have been found, but in a late 7th century AD men's grave in Meikirch (canton of Bern, Switzerland), a pleated garment has been found on top of a girdle plate. The placement on the girdle suggests a coat instead of a tunic as in women's graves. The two women's graves (38 and 48) in the Basilica of Saint-Denis (Paris, France) with plissé textiles demonstrate that this type of garment was worn in the highest classes of the society, even by the royal family (RAST-EICHER in prep.). Early Medieval plissés have been used by men, women, and children. Such garments, plissé or barred damask, might have had a specific visual effect that surely was recognized by contemporary people.

In those cases it can be stated that barred damask is a weave type that is more time-consuming in production than simple tabbies or even simple coarse twills. Furthermore, to create 100 % fullness, plissé (pleated tabby), needed much more cloth than for a similar garment made of simple tabby – the amount is about three times higher than for a simple tunic (for each depth of the folds). Therefore, maybe the amount of cloth, as well as a type of cloth woven in a time-consuming technique, might be a hint for higher strata of society. Such mechanisms can also be detected in other cultures (*cf.* CORDWELL & SCHWARTZ 1979; FEEST & JANATA 1989: pp. 161–163, 225–226; LEVENTON 2008: pp. 184–223, 256–275). Different fabric types and qualities, as well as the amount of material used, can be an important tool for the differentiation of social ranks, even if the cut pattern of the garments remains the same in broad terms within a culture. In Early Modern India for instance, only the high castes and the nobles were allowed silk fabrics, sometimes pleated, whilst the lower classes were only allowed simple cotton and wool tabbies.

Additionally, the fact that in Early Medieval Europe barred damask as well as plissé fabrics can mostly be found in a well-defined geographical area (despite of very rare finds in England or Denmark) which was then inhabited by the Bajuvarians and Alamannic, could lead to the interpretation of a specific visual code. Are we able to trace the higher social classes of Bajuvarians and Merovingians? Future research with more data from graves will enable us to come to more conclusions for that question.

Effect with body movement and body language

As stated in the introduction, clothing, body movements, and body language are all part of a performance, communicating a message. It is an interesting challenge to look at pleated structures from a movement and performance perspective. Textiles with different kinds of three-dimensional linear structures have a great variant in how they interact with the body, especially in their use of space. Generally, it has to be stated that plissé with 100 % fullness has two different effects on body language – depending on the specific use. If worn as a wide swinging garment – a wide skirt, dress or the like – it supports movement, expands the shape of the garment, swinging wide. On movement, such a garment takes up space, and enlarges the body size of the wearer. The same type of cloth, worn as a fitted garment (or even as a narrow draped garment), behaves in a different way; it moves along together with the body, forming a distinct body silhouette, enhancing natural forms. Furthermore, such a garment must have been very comfortable. Pregnant women did not need another garment – a pleated garment is very elastic and provides enough room for the baby as well. And last but not least, as the textile is elastic, it looks quite erotic, taking up all the curves of the body.

Those effects described for plisse textiles can also be stated for other cloth types with pleated structure. It has to be taken into account that for barred damask, and especially on three-dimensional spin pattern, the effect is weaker than for sharp knife pleats.

It has to be asked, which of those effects – the wide flaring one or the enhancement of the body silhouette, was intended in prehistoric and Early Medieval societies. For Ancient Egypt it seems as if the accentuation of the natural body silhouette is an important design principle. That can be seen in various works of art, and also the plissé garments fit well into this context. The Iron Age evidence in Central and Southern Europe, especially the Verucchio garment and the Etruscan statuette, also point to the enhancement of a slim body silhouette. Situla art, like the example from Vače, is not that simple to explain. On the one hand, the depiction of pleated structure on the garment of the man sitting on the throne follows the lines of his body. On the other hand, the veil of the woman, decorated in the same way, covers and more or less encloses her.

For the Early Medieval Period, the use of cloth types with pleated structures involves fitted and flaring garments. The women' s pleated garment – the tunic or over-tunic can have a narrow cut or can even be wide. The men's cloaks are usually wide flaring, as suggested by various depictions in contemporary art (Ivory of the Carrand collection, Florence, Sangiorgi 1895: fig. 50).

To end with a modern example: Accordion pleats or knife pleats are a form of tight pleating which allows the garment to expand its shape when moving. Accordion pleating is also used for some dress sleeves, such as pleating the end of the elbow, with the fullness of the pleat gathered closely at the cuff. This form of pleating inspired the "skirt dancing" of Loie Fuller[6], a famous artist of the beginning of the 20th century AD.

Conclusion

Different techniques to create pleated textiles have been documented since prehistoric periods. There are surface patterns with lines of twill structures in linen textiles and lines with thick multiple plied yarns. An important step was taken when people discovered

[6] https://en.wikipedia.org/wiki/Loie_Fuller. 6/12/2016

that textiles with hard spun threads were especially well suited to create folds. This has been the case with the textile from Hallstatt, using in combination single yarns and plied yarns. Depictions of this period prove the use and desired effects of plissé. According to our current state of knowledge, the Verucchio (I) and Carmona (E) examples are the first plissés in Europe. The Hallstatt (A) textile shows a structure very similar to plissé; the technique is a bit different than pleating after weaving (plissé), but the intention of creating pleats might be the same. It is interesting that all three pleated fabrics of Hallstatt have been made with hard spun yarn, the same as the later plissé in the Early Medieval Period (see Fig. 9). It was obviously clear in early times, that wool textiles needed to be crêpe-like, so that folds would hold. The spinning of the Verucchio textile is not specified in the technical description, but Fig. 10.11 in Stauffer (2012) shows a crêpe textile.

In spite of the rare finds during the Roman Period for the plissé technique, the tradition goes on at least until the Viking Period. One of the scarce plissé textiles in Europe dated to the Roman Period is woven with s/s-spun yarn – a spin-direction which is traditionally south European or Mediterranean. The special barred damask, which is more demanding in weaving technique (twill instead of simple tabby) arrived in the Roman Period and was probably taken up in the Alamannic and Bajuwarian regions of South Germany/ Switzerland. However, in these regions it was mostly produced in linen and not in wool, as in the Roman finds. The linen barred damask, therefore, seems a development of the Roman wool barred damask.

The study presented also highlights that the pleated structure had a specific impact on the visual appearance of the garments made with such a cloth. Besides this, body language and body movement, together with expression of identity, were linked to such textiles. Compared to other textile types, more effort was put into making them (more time and know-how of the weaver for barred damask was needed). Especially for Early Medieval Europe, there is a link between pleated textiles and the richer strata of society – maybe serving as a specific connotational code for particular social and aesthetic values.

Even today, pleated structures are used in fashion design – sometimes for enhancing body silhouettes, and sometimes for flaring skirts, as seen at the 2017/2018 winter season fashion shows.

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8. RESEARCH ON CLOTHING: IMPLICATION ON SOCIETY

8.1. Clothing in Central European Prehistory

chapter of a monography

GRÖMER, K. (2016): Clothing in Central European Prehistory. In: The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe. Veröffentlichungen der Prähistorischen Abteilung 5, Verlag des Naturhistorischen Museums Wien, Vienna 2016, 319–448.

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E Clothing in Central European Prehistory

The use of clothing is deeply rooted in human behaviour, and is one of those types of behaviour that clearly distinguish us from animals. It is not known exactly what factors in the evolution of humankind caused us to cover our body with clothes. Was it purely the obvious, to meet the body's need for protection against cold, heat or other influences?

The sense of chastity (or shame) – for the development of clothing as allegorically reported in the Bible – was surely not the reason. This only occurs after the covering of the body has become an ingrained habit and the contrast between 'naked' and 'clothed' comes to consciousness, leading to nudity being perceived as immoral. Did the custom of clothing derive from wearing hunting trophies or from camouflage when stalking wild animals? It is not clear whether the natural hair cover all over the body assumed for previous species of mankind – similar to our closest relatives the chimpanzees – disappeared after the advent of clothing or whether the introduction of clothing is a result of the loss of the hair. Does the development of clothing reflect the interaction between biological and behavioural cold adaptions subsequent to the expansion of humans to colder climate areas? The question of when the first forms of clothing appear therefore is an exciting one. Using DNA analysis to trace the evolutionary split between head and body lice, researchers recently concluded that body lice evolved from head lice approximately 190,000 years ago. This means that the use of clothing can be traced back at least this far.[692]

The term clothing is also more than complex. In modern terms it encompasses everything that people use to cover their bodies. In a broader sense, clothing also includes headgear and footwear, jewellery and accessories, since they all shape the overall appearance of a person[693]. Archaeological research on costume and clothing generally deals with the evaluation of jewellery and clothing accessories made of metal (especially belt components, pins and brooches)[694]. Recently, a useful analytical categorisation for the study of dress in prehistoric archaeology has been established by Marie Louise Stig Sørensen[695]. She distinguishes between cloth, *i.e.* the textile itself, and clothing, that is the garment constructed from cloth. Items of clothing together with belts or brooches, *i.e.* dress fittings, footwear, headgear and in the broadest sense, even hair and beard style, are subsumed under the term 'costume'.

692 Hunting theory: Koenig 1978. – Cold adaption theory: Gilligan 2007. – Body lice: Bower 2010.

693 *Cf.* Eicher and Evenson 2015, 2–27. – Reich 2005. – For definitions in ethnography, see Cordwell and Schwartz 1979. – Feest and Janata 1989, 161–163.

694 *E.g.* Pabst-Dörrer 2000. – Ramsl 2002, 2011, 2014a. – Wels-Weyrauch 1994.

695 Definition of clothing and costumes in archaeology after Sørensen 1997; 2010.

When attempting to write the history of clothing before the Romans, one encounters limitations all too quickly. Very few complete prehistoric garments are preserved, which only allow sporadic insights into the costume of individual regions or certain narrow time periods. With the interpretation of human images, one has to question whether accurate pictorial representations of contemporary costumes were at all the intention of the image. Written sources, which may shed light on the names of certain garments, their production or their function, are not available except for the latest Iron Age. This chapter presents the sources and evidence that archaeologists can use to reconstruct prehistoric clothing, and the aspects of source criticism that have to be considered.

1 Sources for the history of pre-Roman costume

1.1 Complete garments

The complete garments from Bronze and Iron Age in Northern Europe are all too enthusiastically embraced by writers of costume history, as if the full range of prehistoric clothing could be reconstructed from these few pieces[696]. The alternative picture given in older books about costume history is that pre-Roman 'savages' are represented with fur and skins slung over their bodies.

It is essential to note here that complete pieces of garments are rarely obtained, and they come from different time periods, cultures and regions of prehistoric Europe. In addition, they derive from different find contexts, such as from graves or sacrificial deposits. This raises the question of whether it was everyday clothes or special pieces that were put into graves or sacrificed. Even with relatively complete ensembles that have been pre-

[696] *E.g.* Lenning 1982. – Bruhn and Tilke 2004, *e.g.* pl. 21, Bronze Age to Roman. – Leventon 2008, 38–39, 43. – Thiel 2000, with references and further sources.

served in rare cases, one must always bear in mind that even these may be missing significant parts through selective preservation conditions. Iron Age bog finds in northern Europe, for example, consist of only the organic raw materials that stem from animals, not from plants. We are thus well informed about various garments made of leather or wool fabrics, but largely ignorant of linen fabrics from these cultures. It is quite conceivable that the Tollund Man[697], strangled and dumped in a bog during the 3rd century BC, who was found wearing only a leather cap and a leather belt, might in fact have been wearing a linen tunic. The exact shape of this garment could theoretically differ substantially from contemporary woollen outerwear.

Only rarely has a prehistoric person in full costume been as immediately and directly encountered, such as the Iceman, found 3,210 m above sea level in the Ötztal Alps in Southern Tyrol in 1991[698] (Fig. 12). An unfortunate victim of either an accident or a hostile act, this Copper Age man's garments and belongings have survived in the ice since *c.* 3,300 BC. Due to his accidental death, his costume is an important example of mountain equipment used during Alpine crossings at that time.

A counterpart to the Stone Age alpine equipment of the Iceman is an ensemble discovered a year later, on the verge of the melting snow field of the Vedrette glacier in the Tyrolean Alps at 2,850 m altitude[699]. Here were found two pairs of leggings, leg warmers made of wool as well as socks and scraps of leather shoes. Again, this is warm, functional clothing for the alpine environments, in this case dating to the Iron Age between the 8th and 6th century BC.

However, the garments of the Iceman represent a specific, isolated case of clothing worn by a prehistoric man during his lifetime, found and observed in context. A large part of the complete garments or costume components with textile residues,

697 Van der Sanden 1996, 20. – Van der Plicht *et al.* 2004, 482–483. – *Cf.* Mannering *et al.* 2012, 104.

698 Spindler 1995. – Spindler *et al.* 1995.

699 Bazzanella *et al.* 2005.

however, are derived from burials, which warrants a few critical methodological remarks.

What about the bog bodies[700]? In Northern Europe, especially in northern Germany, Denmark and Ireland, people originating from different periods were discovered during peat digging in the 19th and 20th centuries. They ended up in the bog for a variety of reasons, whether accidental victims on their way through the bog, as intentional burials or, as is often assumed, they were the subject of the death penalty or human sacrifice.

Less than half of the bog bodies are equipped with clothes, but this is partly due to differential preservation conditions (page 28) or incomplete recovery. If garments were found with a bog body, the persons were not always dressed correctly. Some garments were found wrapped around the body, at other times the clothing was deposited under the head. The garments of the bog bodies could in principle represent clothing worn during their owner's lifetime, but for those people who came into the bog through certain rituals, such as the victims of sacrifice and punishment, their clothing might have been specially selected. This in turn might have expressed a certain status in society (that of a human sacrifice or criminal, for example). The same might apply in the cases where the person's head was partly or completely shaven, as for example the Yde Girl or the 'Windeby Girl'[701], who according to recent DNA analyses was actually a male; both bodies date to around the time of the birth of Christ.

Complete items of clothing are also known from offerings without associated human sacrifice. Between the 1st century BC and the beginning of the 5th century AD members of the West Germanic tribe of the Angles offered various objects into the Thorsberg Moor, Germany[702]. The offerings consisted of weapons,

700 Mannering *et al.* 2012. – Möller-Wiering and Subbert 2012. – Schlabow 1976. – For a summary on the bog bodies, see Van der Sanden 1996, clothing: 120–134, hair: 164, circumstances of death: 154 – 165, interpretations: 166–181.

701 Gill-Robinson 2006. – Windeby and Yde: Van der Plicht *et al.* 2004, 485–486. – Van der Sanden 1996, 32.

702 Schlabow 1976, 23, cloaks and tunics: 61–70, fig. 109–130, trousers 76–77, fig. 162–174, wraps 89–90, fig. 226–231. – See also Möller-Wiering and Subbert 2012.

Opposite side:
Fig. 172. Upflamör south of Reutlingen, Germany. Reconstruction of the burial with over-long needles and leg spirals connected by chain links, 14th century BC.

shields, horse harnesses, clothes, wooden objects, tools and jewellery. Amongst the most outstanding finds were a Roman cavalry mask, Roman helmets, coins and objects marked with runes. Among the textiles found in bogs there are a number of garments among the deposited offerings: five splendid cloaks, a tunic, two pairs of trousers and two pairs of leg wraps.

1.2 Textiles in graves

Although conditions are unfavourable for the preservation of organic material in the moist central European climate, textile remains are sometimes found in graves, preserved through contact with metal (see Fig. 9). Textiles preserved in such a way are usually very small in size and the surface structure often is only preserved as an impression in the corrosion layer. Nevertheless, they are an important source of information about prehistoric textiles. Through detailed observations of the find contexts, the role the textiles played in the grave may be evaluated, for instance if they were part of the garment of the deceased, a part of the shroud, or wrapped around an object[703]. It is important to decide if the garments in the grave represent the clothes worn during lifetime, or if they constitute a special costume for the dead[704], which was made only for the funeral.

In a study of the jewellery from Middle Bronze Age female burials in Central Europe, the prehistorian Bert Wiegel[705] found that the rings exhibited strong signs of wear. It can therefore safely be assumed that this was a costume worn during life. This means that these people wore their rings in their lifetime and took them to their grave. According to Ulrike Wels-Weyrauch[706], however, other evidence of jewellery and costume elements from the same time period suggest that they should, at least in part, to be regarded as costumes for the dead. She argues that the '*Beinberge*' (rings or cuffs with spiral ends) worn on the legs and connected

703 Compare Gleba 2012, 230; 2014b.

704 Sørensen 1997; 2010, 55.

705 Wiegel 1994, 165.

706 Wels-Weyrauch 1994, 59, fig. 55–56C. – *Cf.* Grömer, Rösel-Mautendorfer and Mückler 2012, 139–140.

by a chain of links could have hardly be worn during lifetime, as they make it impossible to walk. Similarly the extra-long pins which are frequently found in that period do not appear particularly advantageous and practical in everyday life (Fig. 172).

The large textiles found in the princely tombs of Verucchio in Italy[707] shed some light on this question as well. Two cloaks were found in tomb 89. Traces of wear, such as holes left by the fibulae, prove that they had been used previously. Numerous paired stitches were documented on the left shoulder of cloak 1, demonstrating that they were clearly not woven exclusively for the burial.

Ultimately it cannot be proven if the objects in a grave were part of the personal property of the dead and used during their lives, or if they constitute gifts from relatives and friends[708]. This applies as much to pottery grave gifts as to the jewellery. It is clear, however, that the grave goods, including the costume, mirror what the community wanted to express about the sex, the age and the status of a person.

What do we know about the clothing materials of the living? The textile remains from the Neolithic and Bronze Age lake dwellings or the textile finds from the salt mines of Hallstatt and Dürrnberg could (among other uses, see chapter D) represent remnants of clothing. Direct evidence that textile pieces from these contexts were formerly worn as clothing was found in the form of unwanted

[707] Stauffer 2012, 249.

[708] For methodological considerations, see Kurz 1997, 125–130. Clothing is there considered to be personal property in real life.

parasites clinging to the textiles of the Hallstatt salt mine. In several cases, the rags were recognised as former garments through the discovery of nits and human body lice[709]. The body louse is a parasite adapted to humans and lives most comfortably at human body temperature, preferably in the hair or clothing. The body louse is therefore only found in textiles that were in direct contact with the human body. It is currently thought that the textiles from the Iron Age areas of the Hallstatt salt mine were at least partly used as clothes before their secondary use; whether as everyday attire or special costume is uncertain.

In addition, insights can be gained as to raw materials of the textiles, their structures, qualities, patterns and colours. For instance by comparing the data from the Hallstatt salt mine with the textiles of culturally similar and contemporary cemeteries, such as those from the eastern Hallstatt area[710], it is apparent that they have the same range of weaves and subtleties. Although colour patterns can no longer be preserved due to the unfavourable preservation conditions by metal corrosion in graves, it is possible to observe patterns produced by spin direction. These matches indicate that the textiles used during a person's lifetime were similar to those in the grave. The local Hallstatt population, however, might not be typical in the sense that it was most likely a wealthy community based on salt mining and trade, as is inferred from the rich grave goods found in the Hallstatt cemetery. Similarly the textiles preserved in the Hallstatt graves also represent more affluent people. Under conventional conditions textiles are only – if at all – preserved in graves with sufficient metal objects, so that textiles have the chance to corrode onto them. Again, this is certainly not the poorest sector of society.

1.3 Clothing accessories and jewellery from graves

Before the invention of press studs, zippers and Velcro, clothing was fastened in a variety of different ways. These devices

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[709] Grömer, Rösel-Mautendorfer and Reschreiter 2013, 127–128; HallTex 32, 34, 40, 292. – For lice, see Ryder 2003.

[710] Compare Belanová-Štolcová 2012, 310. – Bender Jørgensen 2005. – Grömer 2012, 43–44.

are referred to in archaeology as dress fittings, dress fastenings and clothing accessories. These include belt buckles, buttons, brooches and pins. Clothing accessories are designed according to the characteristic style and design of the period, as they serve a decorative purpose in addition to their practical function. They sometimes even carry a symbolic content[711]. The symbolism may be inherent in the material, the shape, and the motives of the decoration or even in the positioning of the object on the body.

Archaeological costume research is primarily concerned with the evaluation of jewellery and clothing accessories made of metal[712], because finds of textiles in graves are so rare. Certain conclusions about the costume can be drawn from the position of dress elements, especially when the objects are positioned on the body according to their function as fasteners. Metal components such as belts, pins and fibulae in graves without textile preservation indicate which part of the body was belted, and where the clothes were held together by pins or fibulae (Fig. 173). The appearance of the corresponding piece of clothing (upper garment, tunic, cloak, dress, *etc*.) has to be inferred by comparison with pictorial sources or exceptional preserved finds. The analogies are frequently borrowed from geographically or chronologically distant places, which is of course problematic. Due to a lack of other evidence, the Neolithic and Bronze Age garments from Central Europe are most often reconstructed from the Nordic costumes from oak coffin burials as a reference, even though they belong to a completely different cultural context.

The interpretation of the positioning of the metal items in graves presents other problems. In rich graves there are often more dress elements present than strictly needed. They may at times be found in the correct location, but at other times may not have had a functional role as garment fasteners (Fig. 242)[713]. This can lead to confusing costume reconstructions[714]. In each individual case close observation of the objects in the grave is required

711 This is particularly well researched in ethnography, *e.g.* Feest and Janata 1989, 161–164.

712 *E.g.* Pabst-Dörrer 2000. – Wiegel 1994.

713 *E.g.* the cemetery of Münsingen, Switzerland, where surplus fibulae were found in a number of graves. Hodson 1968, 56–63, Grave 122, 132, 140, 149, 157, 161, 168 or 184.

714 *E.g.* Negroni Catacchio 2007, fig. 8–10.

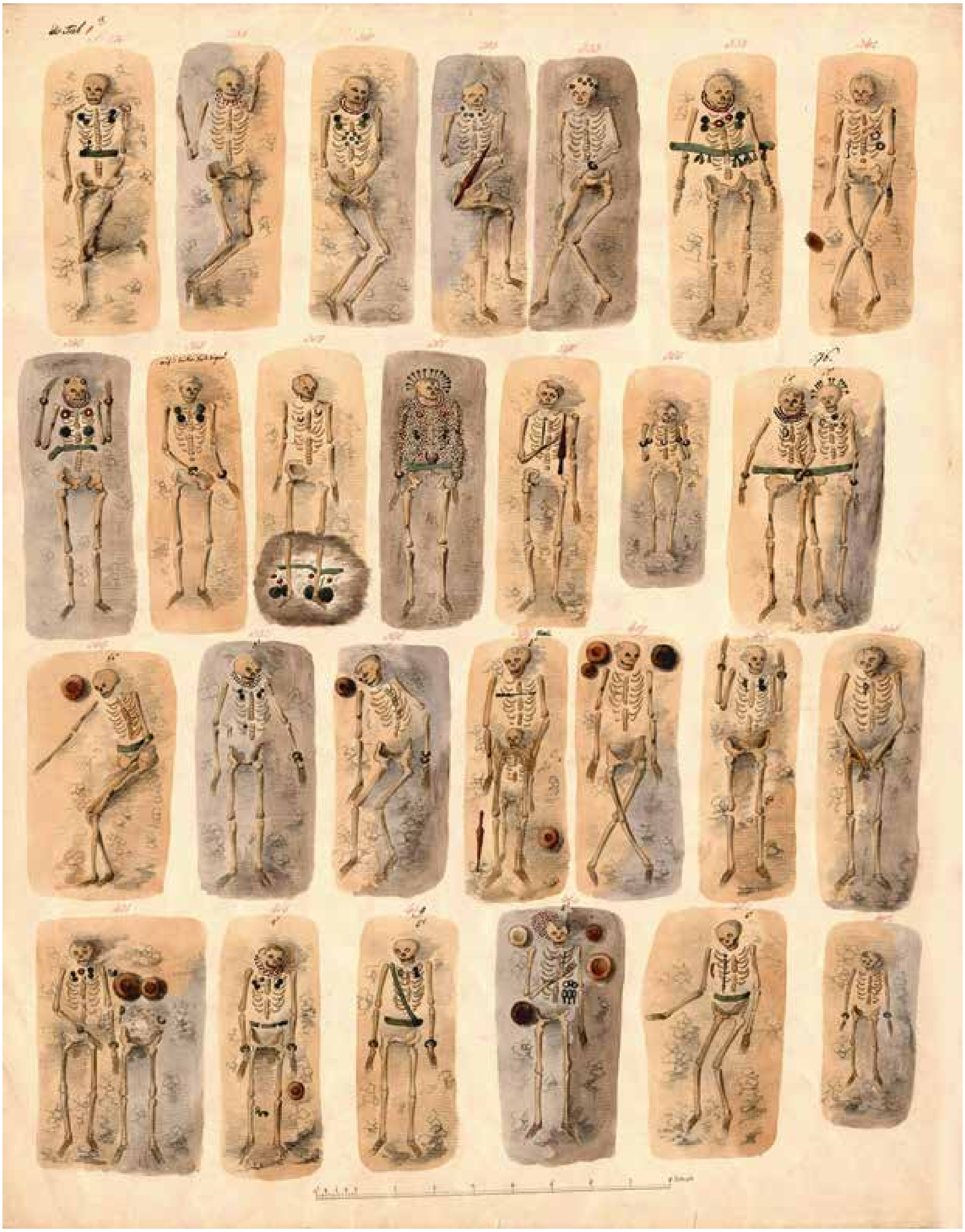


Fig. 173. Cemetery of Hallstatt, Early Iron Age: Watercolour painting of grave findings from Johann Georg Ramsauer's documentation in 1846.

to decide which dress accessories fastened clothing, which may be considered as grave gifts and which ones had other functions, for instance to fasten shrouds.

1.4 Pictorial sources

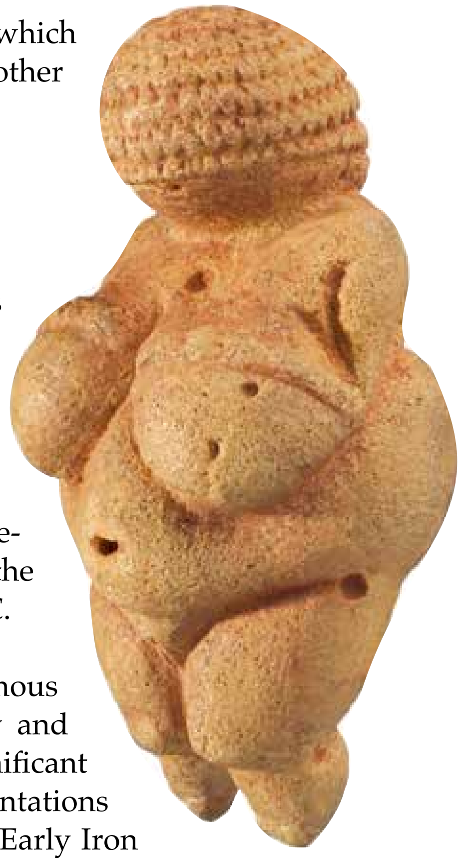


Fig. 174. Venus of Willendorf, Austria, *c.* 29,500 BC.

Pictorial representations of people in prehistoric times occur in many variants. This is just a short overview; detailed explanations can be found in the sections on the individual periods. Various types of idols, figurines and stelae made of clay, stone, bone, ivory or metal provide sources with the greatest time depth. Human images reach as far back as the Palaeolithic period, with one of the most famous examples being the Venus of Willendorf[715] (Fig. 174) dating to *c.* 29,500 BC.

Ceramic figurines made in Central Europe and the famous stone stelae from the alpine areas of northern Italy and western Switzerland and France are particularly significant for the Neolithic[716]. There are very few human representations from the Central European Bronze Age[717], but in the Early Iron Age figurative art occurs more frequently, for instance as metal figurines or monumental stone statues such as the Glauberg Warrior[718]. Iron Age fibulae with human representations complete the inventory of available pictorial sources.

Anthropomorphic images on pottery, found in the Stone and Iron Ages, provide another source of evidence. These images are executed in the typical decorative techniques of the time, such as incision (Fig. 175), relief, painting or impression. Iron Age sheet bronze objects were also decorated with human figures, both in punching and repoussé as well as using a chasing technique.

[715] Female figurine found in Willendorf, Lower Austria. Most recently: Antl-Weiser 2008.

[716] *E.g.* Hansen 2007. – Müller-Karpe 1974, pl. 602–603. – Wininger 1995, fig. 7–9.

[717] Bronze Age figurines with depictions of clothing are known from the Nordic Bronze Age (Broholm and Hald 1940, fig. 192–193) and from Hungary, Romania and Serbia (Müller-Karpe 1980, pl. 326–327).

[718] Exhibition catalogue Glauberg 2002, fig. 70–71.

Fig. 175. Sword scabbard from Hallstatt, Grave 994, Early La Tène period.

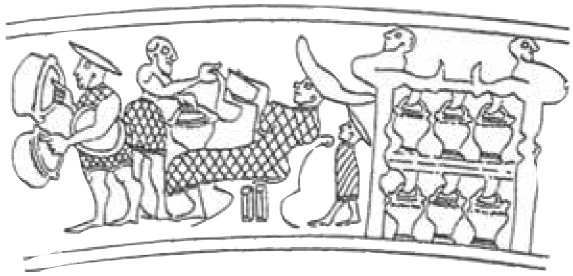
Prehistoric human figures sometimes provide immediate and direct insights of clothing. They may also be misleading, as they may not reflect everyday life, but instead may be standardised iconographic motifs, be influenced by religious aspects or represent extraordinary situations. Even if they depict everyday life sceneries, they are only snapshots and say more about the language of images than about the clothing of everyday life[719]. The attention to detail, with which clothing accessories and jewellery are depicted, varies depending on the intention of the artist when creating the image. It is necessary to take into account levels of abstraction, as well as the individual skill of the artists and the representational limits of the material in which the image is executed. These are crucial to the interpretation of pictorial sources.

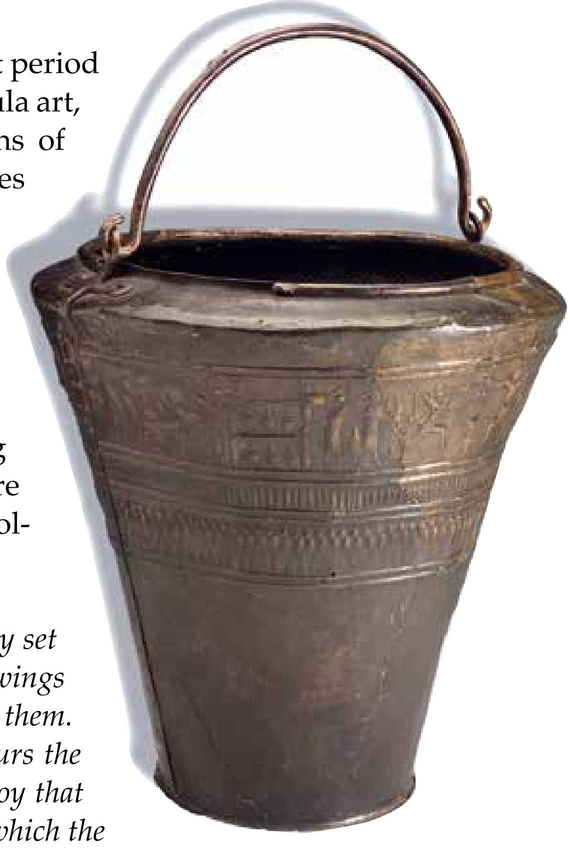
Particularly well-known are the pictures on bronze buckets, called situla art, which serve as good examples for the interpretations of human representations. The situlae (the Latin word for bucket) were used as wine containers, and are found between the Po River in northern Italy and the Danube between the 6th and 4th century BC[720]. The situla art was created following Medi-

[719] *E.g.* Paetz gen. Schieck 2013. – Schierer 1996, 6–8.

[720] Frey 2005. – Lucke and Frey 1962. – Turk 2005.

terranean models and shows detailed figurative friezes of processions and musicians, chariot drivers and competitors, riders and warriors, hunting and sacrifice scenes. Situlae were not the only bronze objects decorated with these picture scenes; other types of vessels such as cists (cylindrical bronze buckets), trays and lids as well as belt plates, belt buckles or helmets were likewise decorated. It is tempting to see the typical Hallstatt period attire in the wealth of detail represented in situla art, particularly when it comes to representations of clothing. However, Etruscan pictorial sources were generally used as models for situla art, although local traits may be detected.





How can these pictures be interpreted? As the situla from Kuffarn in Lower Austria was found in a grave in 1891 (Fig. 176), Father Lambert Karner from the nearby Göttweig monastery interpreted the images in a lecture to the Anthropological Society in Vienna as follows:

'… the whole scenery is, in my view, a funny story set in a pub. Slowly and ponderously the landlord swings two empty situlae, walking to the cellar to refill them. In contrast to the fat landlord, the thin waiter pours the guest a drink with a laughing face and the little boy that looks up to him is just waiting for the moment in which the hat falls from his head … ' [721]

Fig. 176. Situla of Kuffarn in Austria, Iron Age. Drawing of the 'tavern scene' described by Father Lambert Karner.

[721] Sitzungsberichte, Monatsversammlung der Anthropologischen Gesellschaft in Wien am 15. Dezember 1891. Vortrag von Pater Lambert Karner. Mitteilungen der Anthropologischen Gesellschaft Wien XXI, 1891, [68] – [71]:
'… die ganze Scenerie ist, nach meiner Ansicht, eine lustige Wirtshausgeschichte. Der behäbige Wirth schwingt zwei leere Situlen, er geht in den Keller, um sie wieder zu füllen. Im Gegensatz zu dem dicken Wirthe schänkt der dünne Kellner mit lachendem Gesichte dem Zecher ein, und das Büblein, das da emporschaut, wartet auf den Augenblick, in welchem ihm der Hut vom Kopfe fällt …'

Today the scene is interpreted as a princely royal household in which an enthroned member of the elite is represented. Otto Hermann Frey[722], a specialist for situla art, sees general representations of the lifestyle of the Early Iron Age nobility in the situla images. According to the dissent interpretation of Christoph Huth[723], however, the representations do not reflect an everyday or festive reality, but rather cosmological ideas. As such, they served the glorification of the dead as well as the religious legitimation of claims to power. Whether representing mythological transfiguration or presentation of the 'high society', the content of the images does not reflect everyday scenes among the general population. Instead, festive activities, most likely of the elite, are represented. Thus, the clothes shown on the situlae are most likely festive costume, possibly of the upper class, and probably incorporate symbolic elements.

1.5 Written Sources

Apart from a few dedications written in the Etruscan alphabet by the Raeti and Venetians, inhabitants of the south alpine area, there are no indigenous written sources from Central Europe[724]. In the Late Iron Age, however, there were repeated contacts between the Greeks (and later the Romans) and the 'barbarians' living towards their north; *i.e.* people who did not speak the Greek language and, in the ears of the Greek, only stammered. Writings of ancient ethnographers and historians such as Posidonius (135–51 BC) or Diodorus Siculus, who wrote a 'universal history' in 54 AD, include reports on these northern barbarians. The Roman general Julius Caesar, for example, detailed the steps he had taken during the 58–51/50 BC campaigns in the Gallic (now French) regions in his famous *Commentarii de bello gallico*, which are read in Latin in humanist schools in Austria to this day.

[722] Lucke and Frey 1962.

[723] Huth 2005, 522–527.

[724] Urban 2000, 323–325.

Reports of ancient authors sometimes discuss the clothing of peoples living towards the north[725] at the threshold of written history. It is very tempting to use precisely those written sources to reconstruct clothing and lifestyle of the Late Iron Age population of Central Europe. In doing so, the following considerations are important: What was the intention of the writer of the report[726]? Was the aim to provide the most accurate description possible about the Celts? Were individual items of clothing mentioned to stereotypically label a group regardless of what was actually worn in everyday life? Today, clichéd descriptions would mention the *sari* for Indian women or the *Dirndl* for Bavarians. For the Romans, it is particularly the trousers that differentiate northern peoples as '*gens bracata*' (people wearing trousers) in contrast to '*gens togata*' (people wearing the toga). Were platitudes used in the writings to convey a sense of the alien, barbaric and primitive to the readers? Julius Caesar used his *commentarii*, which include descriptions of people and geography, for political purposes. He wanted to stress the importance of his campaigns and the benefits of conquering these peoples. The emphasis on wildness, strangeness and savagery was used to justify Roman rule.

2 Clothing through the ages

Based on the considerations above, it is obvious that it is not possible to provide a comprehensive overview of clothing before the Romans. Also everyday clothing of the entire prehistoric population cannot be reconstructed. Examples of garments from specific regions, cultures and social classes may, however, be highlighted.

In the following sections, an attempt will be made to interpret archaeological textile finds in terms of the history of costumes, based on the existing source material and with considerable caution. As in this book as a whole, the focus here is on textiles

725 For a summary, see von Kurzynski 1996, 68–71.

726 For considerations on source criticism, see *e.g.* Fuchs and Oltrogge 2013.

from the Neolithic to the Late Iron Age in Central Europe[727]. The invaluable finds of complete garments from Northern Europe will also be discussed, as these are exceptional sources of information, at least for that region. It should be emphasized that only shadowy outlines can be sketched. The present work is not intended to be a comprehensive identification key for prehistoric clothes, since the current source material does not allow definitive conclusions.

Due to the lack of literacy, which denies us a glimpse on the names of items of clothing in most cases, standard modern English terms are used to describe the pieces, such as tunic, mantle/cloak, trousers and blouse. It is important not to imagine these garments too much like the modern forms. A Bronze Age 'blouse' does not have a button tab, but is more like a T-shaped shirt to slip on. Similarly, a 'mantle' or 'cloak' does not have any sleeves, and describes blanket-like coats, wraps and covers.

3 Neolithic

Let us begin our discussion with the Neolithic period from the 6th millennium BC. It is the time in which people in our region first became sedentary, lived in fixed settlements (villages), farmed and practiced animal husbandry – a way of life that in principle is still in existence today. The first indications of spinning and weaving in Central Europe exist from these early farming cultures in the form of spindle whorls and loom weights.

In this period evidence for clothes is extremely rare. Although we have a complete costume ensemble from the Iceman, remains of clothes and textile fragments are otherwise few and far between. Pictorial representations illustrate the appearance of clothing – at least for those garments that Neolithic people felt appropriate to represent on ritual figurines and anthropomorphic stelae. In this part of human history, metal was rarely used, and when it was, only in limited quantities. Bone dress elements

727 Primarily Austria and neighbouring countries Italy, Switzerland, Germany, Czech Republic, Slovakia, Hungary, Slovenia and Croatia.

in graves, however, can sometimes be used to help our understanding of clothing.

3.1 The first farmers in the Early and Middle Neolithic

The first farmers of the Neolithic in Central Europe represented humans in the form of small, highly stylized ceramic figurines[728]. The figurines of the Linear Pottery Culture (Fig. 180.1–5) *c*. 5,500–4,900 BC are usually found in settlements and are usually highly fragmented. The figurines are often ostentatiously decorated with angle, meander or triangle motifs. The same kind of incised decoration is found on pottery at the same time, so it appears familiar to the potters and was part of their skill set. It is difficult to identify clothing items on these figurines; angular designs are a frequent decorative element on the back of the figures, often interpreted as a costume element or as the representation of the ribs. A well-known representative of this type is the figurine from Bicske, Hungary (Fig. 180.3). Some incisions on the figurines may perhaps be interpreted as tops with V-neck, others as leg wraps (both feet are shown, indicating separate leg covers). A grave find from Hainburg-Teichtal in Austria[729], dated *c.* 5,100 BC, sheds a light on such a garment type, as shell beads were found around the knees of a 2–2.5 year old child. It also had a row of beads around neck, waist and both elbows. Did the child wear a tunic-like shirt with elbow-long sleeves and kind of leg covers, decorated with beads around the knees (Fig. 177)?

The makers of the small statuettes paid great attention to detail. The Linear Pottery figurines show some interesting hairstyles (Fig. 180.4–5), for example the 'curly head' of the female figure from Eilsleben, Germany. On the head of the Ostheim figurine,

728 Hansen 2007, pl. 498–509. – Kalicz 1998, fig. 5. – Lüning 2005, 213–268 with images. The very abstract images are here interpreted as realistic and a direct representations of clothing and sewn decorative elements, which is controversial.

729 Krenn and Krumpel 2008, KG Hainburg an der Donau. Fundberichte aus Österreich 47, 2008, 21–22. – Umgeher-Mayer *et al.* 2011, 7, fig. 9–10. Thanks to Alexandra Krenn-Leeb, UHA Vienna, for the permission to use the photos, who prepared a monograph about the site of Hainburg/Teichtal.

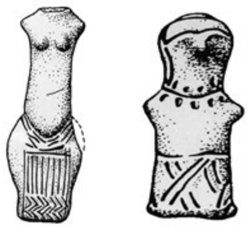
Fig. 177. Early Neolithic burial of a two-year-old child from Hainburg-Teichtal in Austria.

also from Germany, the incised lines might represent braids that were pinned to an exquisite hairstyle at the top and back of the head[730]. Are there other sources that tell us more about this creative manner in dressing the head? Hair combs and shells were found, for instance, in contemporary cemeteries in Bavaria[731] (Fig. 178 left), where they were found in the head area and were most likely part of elaborate and artistic hairstyles. The small shells were possibly worn in a hair net or sewn onto a cap.

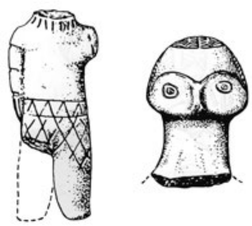
[730] Engelbrecht, Kühltrunk and Ramminger 2003, 317–323.

[731] Nieszery 1995, examples with clothing accessories in the head and pelvic areas: pl. 13, 26, 50, 52: Aiterhofen-Ödmühle Grave 32, 68 and 139, 143.

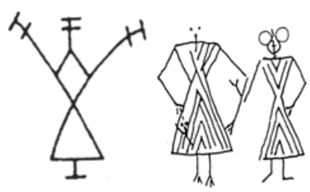
The ‘Sickle God’ from Szegvár-Tűzköves in Hungary[732] is a well-known example of a Tisza culture clay figurine. It is interesting in this context because of the belt around its waist. Other than the belt, this idol and another like it from the same site are ‘nude’.



A few human representations were found among the incised decorations on pottery[733] of the Linear Pottery Culture and Middle Neolithic cultures. One of the rare examples is an abstract human composed of two opposing triangles from Hausen in Germany, dated to *c.* 5,100 BC (Fig. 180.1). This type of representation is seen more clearly on the ‘beaker of Murr’ in Germany (Fig. 180.14) from the Münchshöfen Culture *c.* 4,000 BC. Again we see two triangles, but this time with a clear head, arms and legs. This form of representation may indicate a simple belted garment that was gathered at the waist, as shown by the significant drapery. This kind of dress could have served well as an everyday garment. Such a garment fits the findings from the Linear Pottery graves in Bavaria and Upper Austria, where shell fasteners are sometimes found in the pelvic area, indicating a belted item. In Aiterhofen-Ödmühle, Germany, for example (Fig. 178), spondylus shell belt closures with v-shaped angles were found in male graves, whereas females were buried with round mussel belt plates. The dress elements made of bone from the Middle Neolithic also show an emphasis on the waist, such as the ornate belt decorated with about 50 studs in the grave of an adult woman from Haid in Austria[734] (Fig. 178).



From the Middle Neolithic, the Lengyel Culture *c*. 4,900–4,300 BC, a large number of ceramic female figurines are known from Austria, Hungary and Moravia. These figurines are, however, consistently unclothed, which is unfortunate for clothes research. The figurines are frequently discovered in the circular ditches of sacred sites, which might point to their use in ritual. The figures might represent ancestors, priestesses or godlike figures; perhaps they served as votive figures for various ceremo-



[732] Csalog 1959. – Korek 1987. – Trogmayer 1992.

[733] Examples from Sondershausen and Murr in Neumaier 1996, fig. 26 and pl. XVI.

[734] Haid, Grave 75. Kloiber *et al.* 1971, fig. 6. – Lenneis, Neugebauer and Ruttkay 1995, fig. 44.

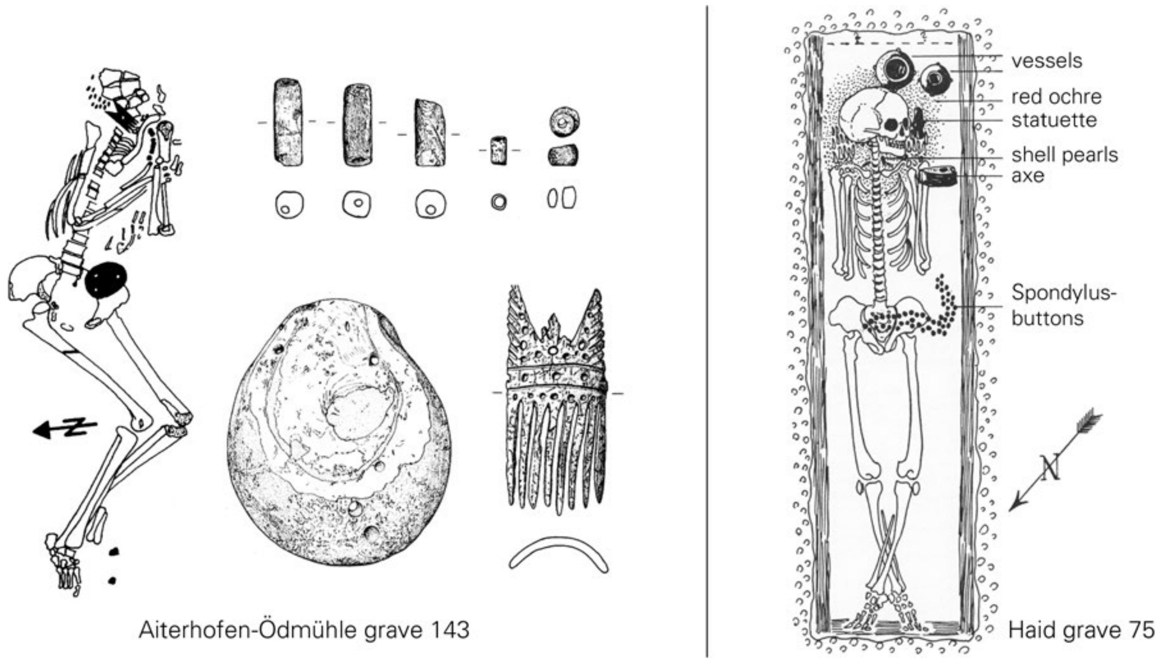


Fig. 178. Early and Middle Neolithic graves with costume components. Left: Aiterhofen-Ödmühle in Germany, right: Haid in Austria.

nies or rites. Interestingly, they are usually found (intentionally or accidentally?) broken[735].

Among the few figurines that provide further details as to their hair, jewellery and clothing, the ensemble from the circular ditch system of Sé, Hungary[736] (Fig. 180.7–10) is particularly striking. Researchers have discovered more than 130 mostly fragmented statuettes, some of which include representations of loincloths, aprons and belts.

A rather common hairstyle of the Lengyel figurines (Fig. 180.10) is hair combed back from the face to the back, with pronounced receding hairlines, which are rendered as three interlocking curved lines at the hairline. The lines at the back of the head and on the back, arranged as parallel zigzag lines, either indicate loose, wavy or curly hair, or possibly braids. As far as it is possible to ascertain from these fragmentary figures, the hairstyle

735 See *e.g.* Kalicz 1998 or Hansen 2007, 319–320 for interpretations.

736 Kalicz 1998, fig. 30–37.

seems to be typical of females which are recognizable by the indication of breasts[737].

Particularly noteworthy is the painted figurine of Falkenstein in Lower Austria[738] (Fig. 179). The hair is painted in black and there is a red (copper?) necklace with twisted ends. The red line around the waist can clearly be identified as a belt. For the black ornamentation in the leg area different interpretations are possible: it could be explained as body paint or even tattooing, but possibly also as a painted garment such as a loincloth or a painted dress.

The language of art of the Lengyel Culture is marked by colour. This is evident on magnificently painted ceramic vessels, painted in white, yellow, red and black (Fig. 122); the fineness of design is unparalleled. There are also indications that the walls of the houses were painted in a similar way as paint residue was identified on the clay plaster. It is therefore conceivable that clothes – whether made of leather or textile – were decorated with colour. Moreover, if we accept the case of the figure from Falkenstein, it would have been a belted, tight fitting garment, as the body contours are clearly visible. Whether the figure of Falkenstein wore a coloured piece of clothing or body paint, she definitely made a statement of creativity, which reflects the symbolic realm of ritual figurines (votives, ancestral representations, *etc.*) rather than the representation of everyday clothing and decoration.

Fig. 179. Figurine from Falkenstein in Austria, Middle Neolithic.

3.2 Late Neolithic – Copper Age

In the 5th millennium BC the Vinča Culture is widespread in Serbia, western Romania, Hungary and south-eastern Bosnia. The ceramic figurines[739] from the time between 4,500 and 4,300 BC are well known; they consist of mostly standing female figurines with large, protruding eyes and a triangular face (Fig. 180.11–13), which some researchers interpret as a mask. In the late Vinča phases, seated figurines also occur. Without wanting

[737] *E.g.* figurines from Strelice (CZ), Unterpullendorf (A) and Sé (HU) Hansen 2007, pl. 512–514.

[738] Lenneis, Neugebauer-Maresch and Ruttkay 1995, 100.

[739] Hansen 2007, pl. 246–249. Chronology: fig. 200–202. – Müller-Karpe 1974, pl. 449.

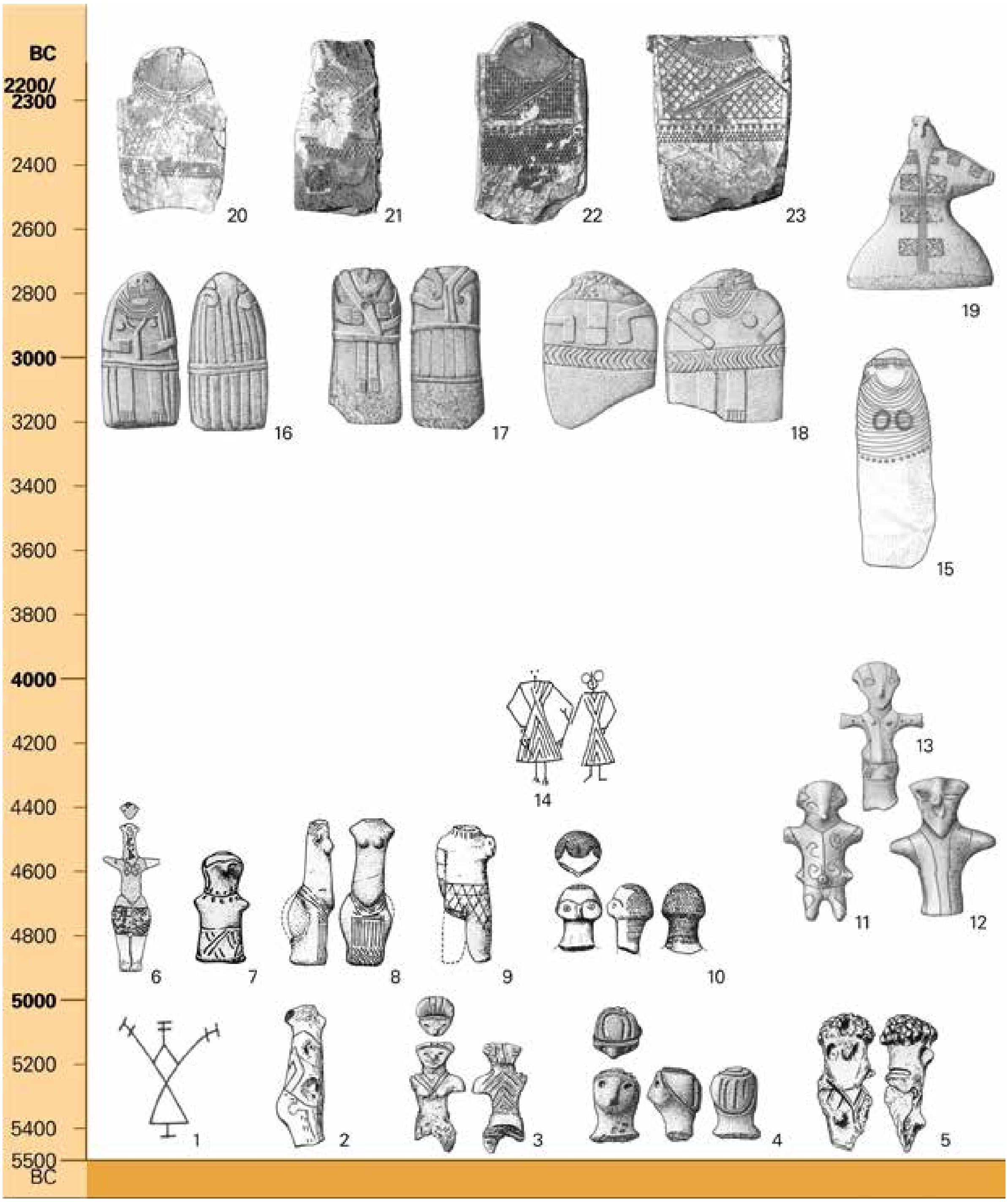


Fig. 180. Neolithic human figurines with garments: Sondershausen, Germany (1), Nerkewitz, Germany (2), Bicske, Hungary (3), Ostheim, Germany (4), Eilsleben, Germany (5), Falkenstein, Austria (6), Sé, Hungary (7–10), Vinča, Serbia (11–13), Murr, Germany (14), Arco, Italy (15), Stone stelae from southern France (16–18), Ceramic figurine from the Ljubljana Bog, Slovenia (19), Stone stelae from Sion, Switzerland (20–23). Not to scale.

to over-interpret these sometimes richly ornamented statuettes, it is striking that their silhouette is usually composed of a tight fitting top and a skirt or a belted dress, fitting the body shape closely. The top has a V-neck and various vertical lines. This could either represent the front opening of a garment similar to a caftan, or it may represent panel seams. Perhaps, however, this element is simply about decoration.

If these lines do actually constitute functional items of the clothing – as a garment openings and various composite parts – they would be of the same basic construction type of an item of clothing with front opening known from the composite garment of the Iceman *c.* 3,300 BC (Fig. 185).

A ceramic figurine dating to the end of the Neolithic from the Ljubljana Moor in Slovenia (Fig. 181.2)[740] represents this even more precisely. The figure is shown with a long, open front robe with long sleeves. The front opening is ornamented with squares with cross-hatching filled with dots. This representation could – if it indeed represents a contemporary robe – be interpreted as a decorative ritual dress. On the other hand, just this kind of button – square buttons made of bone with incised crosses and dots – is known from the Bell Beaker Culture in Central Europe, for instance from Giengen in Germany[741] (Fig. 181.1). The Ljubljana figurine might represent a garment that was open at the front and was closed with buttons and cords at the chest level. On the figurine, this fastening principle was perhaps shown in an accentuated way with enlarged buttons.

The Iceman

In Central Europe, the only complete ensemble of stone age clothing is the ensemble of the Iceman, found in the Ötztal Alps

[740] Korošec & Korošec 1969 dealt with the chronology and typology of finds from the Ljubljana Moor. She dates the figurines (pl. 1) to period Ig I (Laibach Vučedol Culture, *c.* 3,000–2,500 BC). After the decoration and finds of Bell Beaker buttons with the same decoration pattern as on the figurine, a dating to period Ig II is equally conceivable (Bell Beaker Culture, *c.* 2,400–2,200 BC).

[741] Seidel 1995, 34.

Fig. 181. Bell Beaker buttons from Giengen in Germany (1), figurine from the Ljubljana Bog in Slovenia (2), Late Neolithic. Different scales.

in Southern Tyrol[742] at *c.* 3,210 m above sea level. The Iceman was fully clothed at time of death *c.* 3,300 BC and lay face down on a large stone block. As the ice that had covered him for five millennia melted, the head and back first became visible and vulnerable to wind and weather. The garments of the chest and stomach area as well as on the legs are thus better preserved. When the ice mummy was recovered in 1991, he was still wearing parts of the leggings and shoes on his feet. The other clothes were fragmentary and found scattered all over the site. They were restored in the Römisch-Germanisches Zentralmuseum in Mainz in painstaking detail and examined together with other objects and the mummy itself by an international team of experts. The bearskin cap was not discovered until a year later when further excavations of the site were carried out.

The clothing of the Iceman included the following items (Fig. 183): the leggings, one for each leg, were made of goat skin, for

[742] Egg and Spindler 2009. – Fleckinger 2011, 23–27. – Spindler 1995, for clothing see 153–170. – Wininger 1995. http://www.archaeologiemuseum.it/en (last accessed 9th May 2014).

which the sections were stitched together finely with animal tendons[743]. In principle they are two individual leggings, which came up to the thigh to a height of around 65 cm and were held with double straps on a belt of calf leather. Deer fur straps were sewn on the foot of the leggings to prevent them from slipping when walking. These in turn were held in place by the shoes.

Fig. 182. The Iceman. Reconstruction by Kennis.

In addition to the leggings, the Iceman wore a loincloth made of goatskin. When dressing, this was slipped between the legs, drawn up to the waist and passed under a belt, the ends then hung down freely to the knee level. Such combination of leggings and loincloth is reminiscent of certain recent styles of Native American clothing. Iceman's loincloth was stitched together with overstitch using animal sinews and long, narrow goat leather thong; it is about 33 cm wide and was originally about 1 m long.

The belt that held both leggings and loincloth was originally about 2 m long and 4 to 4.8 cm wide and was worn wrapped twice around the body. A pouch in the belt contained and kept dry various tools such as an awl, a flint scraper and other flints as well as a tinder fungus. This finesse in itself highlights the ingenious and well thought out design of every detail in the Iceman's clothing.

The shoes deserve special attention as they are composed of a sophisticated three-layer construction with exterior shoe, inte-

743 Egg and Spindler 2009.

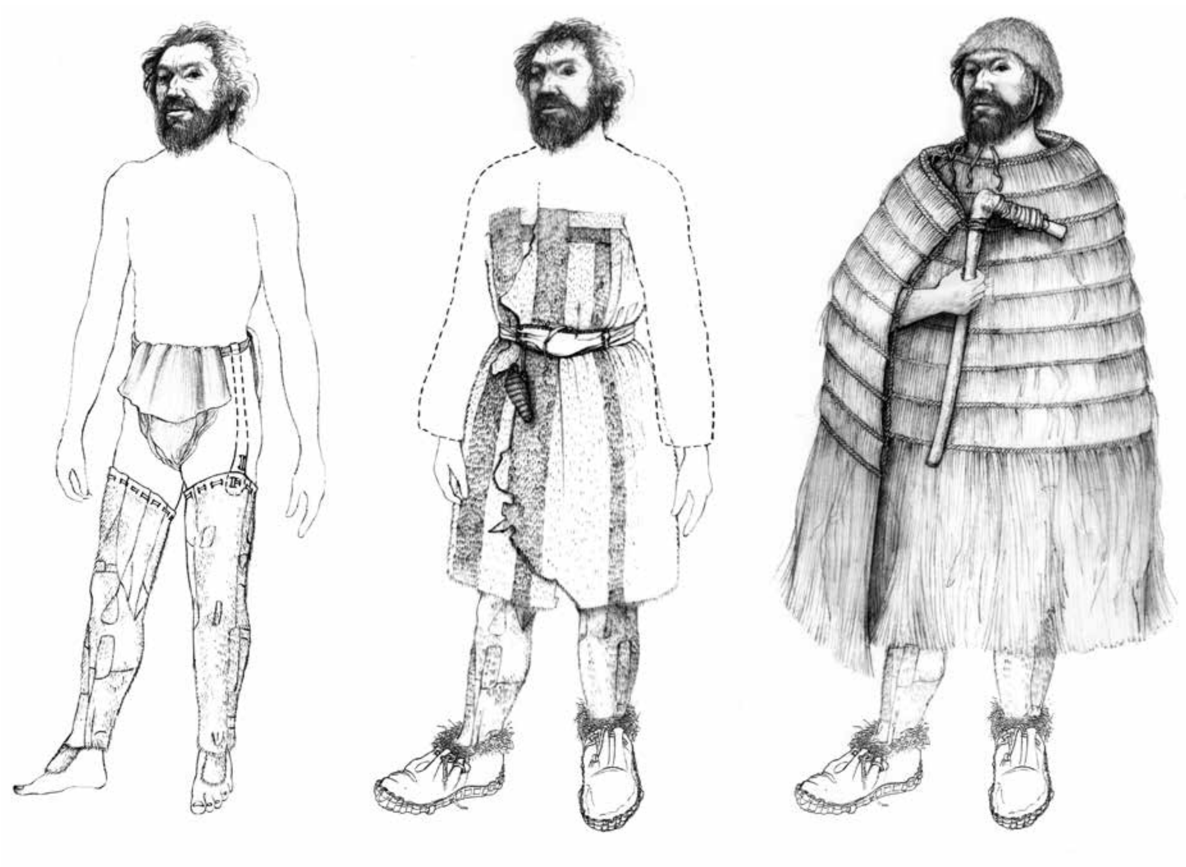


Fig. 183. The Iceman: layers of clothing: leggings, loincloth, shoes, upper garment, cap, grass cloak.

rior shoe and padding (Fig. 184). The oval-shaped sole is made of brown bear fur with the hair side turned inwards. The upper part consists of red deer fur. Inside, closest to the foot, a net of lime bast cord is fixed to the sole with two wide leather straps. Since the upper leather is secured by the same slots but offset, on the sole, a gap of approximately 1.5 cm is formed between the net and the upper leather. In this space a layer of hay was inserted, which served as thermal insulation and padding. Both the internal net and the upper leather are attached to the sole with leather straps. The ankle opening was wrapped with cord of bast to finish it in the upward direction and to prevent water getting in. The shoe design is understood through the impressive reconstructions by Anne Reichert; these have been tested in practice.[744] In fact, it was found that the shoes are very functional, comfortable and warm; in rainy weather, however, they were not waterproof. The leather strap that runs across the sole

[744] Reichert 2013, 95–96, fig. 6.31–6.34.

Fig. 184. Reconstruction of the Iceman's shoes by Anne Reichert. Left: interior construction with twined nets.

constitutes a kind of 'profile' and prevents slipping on stony ground.

The upper body of the Iceman was covered by a caftan-like upper garment made of goat skin (Fig. 185), which was worn with the fur side out: When it was made, light and dark fur strips were assembled in a pleasing manner with fine seams. The garment is now highly fragmented and the back and shoulders are especially poorly preserved, so it remains unclear just how the sleeves were designed. It was probably worn open at the front or held together with a belt, as there are no alternative closing devices.

A hemispherical cap of bearskin served as headgear and was worn with the fur side out. It had been stitched together from several pieces of fur and two leather straps were used as a chin strap.

In addition to the clothing and clothing components made of fur, there are a number of items of plant materials. Parts of a twined textile of Alpine grass were discovered, which are either interpreted as fragments of a grass cloak (Fig. 186), a resting mat or a rain cover worn over the head, and their interpretation remains controversial.

The pair of leggings have clear traces of use-wear and plenty of scuffs. The upper garment was equally used for a long time, indicated by dirt on the inside and significant traces of perspiration. The garments were originally sewn together with animal tendons

Fig. 185. The Iceman: upper garment made of goatskin.

in fine stitches, but they show multiple marks of repair, sometimes with hasty bast cord or grass stitching. All in all, the Iceman's clothes are a very functional ensemble, which prove how well equipped this person was to the high altitude environment.

Another find from the alpine region is evidenced for this type of clothing. In 2003, parts of further leg coverings were discovered under a melting glacier on the site of Schnidejoch[745] in the Bernese Alps in Switzerland at an altitude of 2,756 m. They are leggings of similar type to those of the Iceman, made of leather pieces sewn together neatly with lime bast. Remains of one-piece shoes have also been discovered.

745 Suter, Hafner and Glauser 2006, 499–522.

Fig. 186. Grass cloak of the Iceman according to the exhibition at the Museum of Archaeology in Bolzano, Italy.

Finds from Lake Dwellings

Our knowledge about garments of the late Neolithic is significantly enhanced by the discoveries from the waterlogged lake dwellings of northern Italy, southern Germany and Switzerland, where textiles made from plant materials were found[746].

[746] For Switzerland, see *e.g.* Médard 2010; 2012. – Rast-Eicher 1997. – Northern Italy: Bazzanella *et al.* 2003; 2012. – South Germany: Feldtkellner and Schlichtherle 1987.

A wide variety of textile craft products was unearthed in the Neolithic lake dwellings including plaited baskets and baskets made in wickerwork, sieves, fish traps made in twining techniques, various knotted nets and mat-like basketry of coarse and fine quality. These findings clearly show the extent to which textile products from plant materials were present in all areas of daily life.

Among the identifiable clothing components[747] from the Late Neolithic in Central Europe are shoes from plant material (Fig. 187). The settlement of Allensbach on Lake Constance in Germany included the remains of various sandals made of lime bast worked in basketry techniques. Fragments of bast sandals were also found in Sipplingen on Lake Constance as well as at Lake Zurich and Lake Neuchâtel, Switzerland.

Of particular interest to textile research are the cone-shaped baskets, made water repellent with pile of oak and lime bast that have been found in Hornstaad and Wangen on Lake Constance and dating to *c.* 4,000 to 3,200 BC. They have the appearance of conical hats, although they are usually found incomplete (Fig. 188). This form of hat is known from later periods as well, for example from the hat made of twigs from the Bronze Age lake-dwelling of Fiavè in northern Italy[748] and the conical hat

Fig. 187. Different shoes of the Neolithic period. Reconstructions by Anne Reichert.

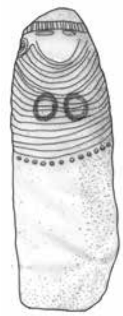
[747] Feldtkellner and Schlichtherle 1987, hats: fig. 2–3; shoes: fig. 5–8. – Experimental Archaeology see Reichert 2013, 86–89, hats: fig. 6.13–6.20, shoes fig. 6.24–6.25.

[748] Bazzanella *et al.* 2003, 146–147.

made of birch bark of the 'Celtic prince' from Hochdorf[749]. Other larger textiles in twining techniques and plaiting with similar pile from the Swiss lake-dwellings might have belonged to capes that functioned as rain protection. Overall, the fabrics made of plant fibres in various twining techniques are so fine that they could easily have served for clothing purposes alongside woven textiles.

Fig. 188. Reconstructions of Neolithic hats from Seekirch and Wangen in Germany. Model: Moriz Mautendorfer. Reconstructions by Anne Reichert.

Late Neolithic stone stelae



The art of the Neolithic offers more imposing and monumental pieces than small figurines and carvings on pottery. Large stone sculptures[750] representing humans are known from the Copper Age (Fig. 180).

The stone stele of Arco IV, South Tyrol, dating to the first half of the 3rd millennium BC, is particularly interesting. It shows a woman with a veil artfully draped around the head, shoulders and upper body (Fig. 180.15). This veil is fitted with round decorative elements at the hem and is held in place with a wide headband, which is additionally decorated with spirals around the

749 Biel 1985, 44–45.

750 For monumental statues see Bocksberger 1978. – Müller-Karpe 1974, pl. 602–603. – Pedrotti 1995. – Wininger 1995, 128.

ears. Copper spirals are known from the beginning of the Copper Age, for example those recovered from Stollhof in Austria, dating to *c.* 4,000 BC[751]. Other stelae from Southern Tyrol, from the sites of Arco and Laces, show that the back was covered by a garment element composed of long rectangular strips. This may be interpreted as analogous to the clothing of the Iceman, as a fur tunic or coat. Both a belt and leg wear are sometimes depicted in the hip region, which is structured with wide stripes.

Amongst the best known carved stone representations of people are the stone stelae from southern France and western Switzerland (Fig. 180.16–18), which were made in the 3rd millennium BC, slightly after the time of the Iceman. Men and women can be distinguished in the representations by breasts and the addition of male attributes such as bows and arrows as well as battle axes. These stelae most likely represent high-ranking persons or ancestors. In the male statues, stunning belt buckles and shoulder straps across the right shoulder representing a baldric are interpretable as clothing components. Below the abdomen, the body is only represented schematically, and the legs and toes are indicated by vertical bars. The belts are sometimes decorated with a herringbone pattern, which might indicate a textile origin. For women, broad necklaces and striped cloaks are striking (Fig. 180.16). These suggest heavy drapery rather than garments composed of stripes. Again, images of belts and jacket-like upper garments occur. Markes or lines next to the legs suggest some kind of clothing below the abdomen.

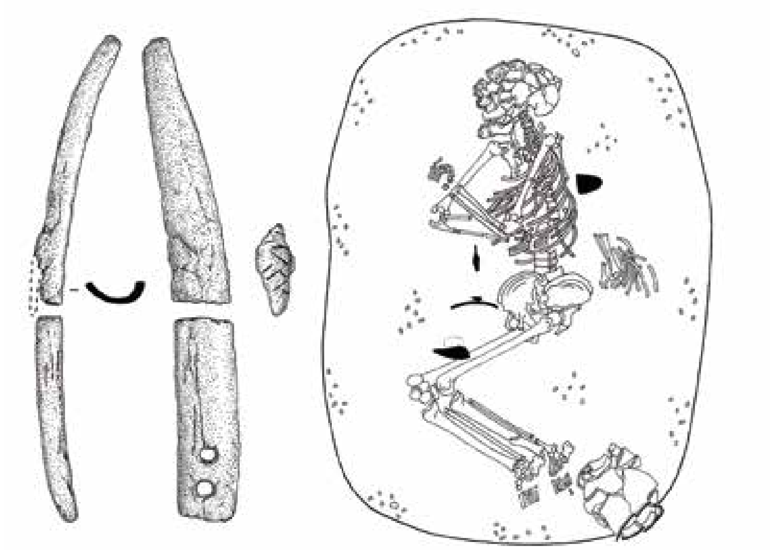
Other stone stelae, for instance the stelae representing abstract human figures excavated in Sion-Petit Chasseur in Valais, Switzerland and dated to the end of the 3rd millennium BC, are even more difficult to interpret in terms of clothing (Fig. 180.20–23). The stelae of Sion have no obvious indication of sex, such as female breasts, so the gender is assigned via recognizable objects and attributes. Those monuments that are provided with daggers, battle axes or bows and arrows are interpreted as male; the anthropomorphic stelae with necklaces, belts with looped ends and belt bags are viewed as female representations. The abstract design of the stelae hardly permits statements

[751] Urban 2000, 102–103.

about the clothing; at best, belts are discernible. The figures do, however, show rich ornamental patterns in the areas that should obviously be covered by clothing (especially clothing of the upper body). These patterns correspond in turn to the ornamental schemes of contemporaneous ceramics of the Bell Beaker Culture. There are attempts to connect the representations on the stelae with patterns on textiles[752]. Above all, such patterned textiles as shown on the representations have been in use in the Early Bronze Age in northern Italy. A specific example is the 2 m long linen band from Molina di Ledro, which is decorated by two woven rhombic patterns at one end (Fig. 48).

We do not know very much about how clothes were fastened in the Neolithic period. Various forms of belt buckle appear again and again from the Linear Pottery to the Bell Beaker Cultures, especially in the Corded Ware Culture around 2,700–2,500 BC[753]. A bone hook was found in the waist region of a male's grave from Franzhausen in Austria (Fig. 189)[754].

Fig. 189. Bone hook from Franzhausen in Austria, Late Neolithic Corded Ware Culture, and reconstruction.



[752] Rast-Eicher 2005, 125–126, fig. 19.

[753] For a summary of belt fasteners, see Peška 2001.

[754] See Neugebauer-Maresch 1994, fig. 6/4. Grave Verf. 1301. The copy was made by Wolfgang Lobisser within the framework of the project 'The Neolithic period in Traisental' (FWF, project number P18131-G02, Daniela Kern).

Different designs of buttons made of ceramics or bone appear now and then in the Late Neolithic of Austria, Bavaria, Czech Republic, Slovakia, Switzerland and Hungary[755]. We do not know exactly what purpose the numerous buttons in Bell Beaker graves served. They may have been clothes fasteners or purely decorative trimmings. The textile researcher Antoinette Rast-Eicher succeeded in finding a button hole[756] on a textile fragment from Switzerland dated to *c.* 2,600 BC.

3.3 Neolithic clothing: conclusion

Which materials were used for clothing during the Neolithic? Woven textiles are known from the Linear Pottery Culture, but only as impressions of tabby woven textiles. Although textiles preserved from the Neolithic period (for instance from the Late Neolithic lake dwellings of Switzerland and southern Germany) are usually no larger than about 15 cm wide bands[757], one can assume from layers of loom weights that larger fabric widths were also achieved. These would be suitable for the production of woven garments. In general it can be stated that textile production during the Neolithic was largely focused on plant fibre[758] processing. Based on the available evidence, it was only during the Bronze Age that the manufacturing of clothes from wool became prevalent in Central Europe.

Until the 1990s, it was assumed that woven clothing was predominant during the Neolithic because of the textile and tool evidence, particularly the spindle whorls and loom weights found along with early farming cultures. The discovery of the Iceman in 1991 changed this picture dramatically. A completely preserved ensemble of garments of a person from the Neolithic period was discovered – without a single woven clothing item! The Iceman wore tanned furs and skins as well as fabrics of grass and bast, made in netting and twining techniques. Perhaps

755 Swiss finds: Rast-Eicher 2005, fig. 18. – Bell beaker finds: Kern 2006, with a list of known sites.

756 Rast-Eicher 2005, fig. 17.

757 Wininger 1995, 181–182, fig. 51.

758 *Cf.* Médard 2010. – Rast-Eicher 2005.

this is because he was hiking wearing high alpine equipment. Just like today, in the Neolithic different climatic conditions and the changing seasons required various forms of clothing. The obvious differences between the footwear of the Iceman and the light bast sandals from the lake dwellings emphasise this fact.

An array of garments made of leather, fur and plant fibres of various kinds was in place in the Neolithic. The latter are supported by ample evidence, especially from the pile dwellings in the area around the Alps. Plant fibres were processed in various techniques such as plying, twining and braiding of fine yarns and fabrics. Weaving did not necessarily play the main role in the design of garments. However, it is important to stress that the technical bases for the production of woven clothing were developed in the Neolithic period (see chapter B).

It also should be noted that although there are plenty of human representations from the Neolithic – engravings on vessels, clay figurines and large stone sculptures – we must recognize a high level of abstraction in them in addition to the expression of symbolism. This means that representations of clothing cannot perhaps be taken as direct evidence for the appearance of garments[759].

4 Bronze Age

From the Bronze Age onwards, the increasingly frequent use of metal – especially bronze – provided ample opportunities to adorn clothing. An increasingly differentiated social system emerged between *c*. 2,300/2,200 and 800 BC, in part through the use of bronze. New craft techniques evolved, and this was a time of many innovations in textile production (see chapter C).

We find evidence for clothes in different regions of Bronze Age Europe, and we must consider, of course, that they come from different cultures. The various kinds of sources – complete gar-

[759] As a negative example, the clothing reconstructions in Milicevic 1984 may be cited, which interpret every detail of the figures in a naturalistic way.

Fig. 190. Women's costume from Borum Eshøj in Denmark, dendrochronologically dated to 1344 BC.

ments from the graves of the Nordic area in Denmark, dress accessories in tombs in Central Europe and figurines from the Balkans and Carpathian area – represent challenges in terms of interpretation.

4.1 Garments of the Nordic Bronze Age

The complete garments recovered from oak coffin graves in Denmark and northern Germany enable the identification of concrete differences in the clothes of women, men and children[760]. The burial and grave goods indicate that we are dealing with important members of society. The oak coffins are dated by dendrochronological investigations of the tree rings to the time between 1,468 and 1,266 BC[761]; the great majority of oak coffins date between 1,390 and 1,340 BC, which represents a narrow time frame.

In general, the Bronze Age garments are of coarser wool fabrics and made in tabby weave. Although the individual garments appear to be of a relatively monotonous brown hue due to their preservation in the soil, decorative textile items such as cord embroidery or the incorporation of metal elements have been used to visually enhance the textiles. In part, the garments show strong traces of use, so it is assumed that they were also worn during the lifetime of the deceased – whether as every day or festive costume can no longer be determined.

Women's clothing from oak coffins

The women's graves usually contain an ensemble consisting of a blouse and a long skirt reaching to the ankles. The latter has a rectangular shape and is gathered and held at the hip with a woven belt. The upper part of the skirt is folded and thus partially obscures the belt. The skirt is long and drags on the ground. Some of the finely woven belts from northern European graves

[760] For the garments of the Nordic Bronze Age generally, see Bergerbrant 2007. – Broholm and Hald 1940. – Hald 1980. – Mannering *et al.* 2010; 2012, 97–102; 2015. High quality images can be found on the website of the National Museum Copenhagen: http://oldtiden.natmus.dk (last accessed 8th May 2014).

[761] Randsborg and Christensen 2006, 115–117.

are decorated with elaborate tassels at the ends. Leather shoes or sandals complete the attire. Long, elegant coiffuring of hair was apparently typical for women who wore the skirt-blouse combination. The hair was frequently covered by a sprang hairnet (Fig. 190)[762].

The fitted women's blouse of the Bronze Age deserves special attention (Fig. 191). It was made especially efficiently from a rectangular piece of cloth; a few cuts through the fabric and two seams on the back and under the arms were sufficient to shape the garment. In some items, more strips of fabric were joined as an extension at the hip. The neck and the shoulders are sometimes finished with stitching and embroidery, with the blouse of Skrydstrup, Denmark[763] as an example. The analyses of Hans Christian Broholm and Margarethe Hald have revealed that the cut, the dimensions and also the sewing techniques of these blouses were derived from leather and fur processing technologies.

A particularly interesting ensemble comes from the grave of a 16–18 year old woman who has become known as the 'Egtved Girl' (Fig. 192). A female's blouse, a corded skirt, a woven belt with tassels and a large spiral-ornamented and spiked bronze plate were found in a *c.* 1370 BC grave from Denmark. The young woman wore woollen shoes on her feet. The corded skirt is a garment that looks extremely extravagant in both production and appearance to today's viewers. A solid waistband was produced in repp, from which cords of 38 cm length hang down in close succession. The skirts cords are formed by a fringe extended along the length of the repp waist band and were held together at the bottom with other cords. This skirt is wide enough to allow it to be wrapped around the waist twice, so that a relatively dense garment is created that nearly reached to the knees. Remnants of such corded skirts were found in further 30 graves in Denmark and Schleswig-Holstein. The cords were also sometimes adorned by bronze sheet metal tubes, such as the one

762 Sprang is a technique used to produce textiles by lifting and lowering parallel stretched threads, consequently interlinking, intertwining or interlacing these threads. This produces a net-like, elastic braid, highly flexible and stretchable, a characteristic equally useful in clothing and for other purposes (bags *etc.*). *Cf.* Seiler-Baldinger 1994.

763 Broholm and Hald 1940, 88–95.

from the burial of Ølby in Denmark. It has recently been demonstrated that corded skirts were an arena for individual craftspeople to display their personal taste and skill[764]. Contemporary figurative depictions of this garment come from Itzehoe (Beringstedt) in Germany, and Grevensvænge and Fårdal in Denmark[765]; the latter in the form of a knife handle, the others are bronze figurines.

The corded skirts have inspired a range of interpretations as to their function, origin and symbolism[766]. Elizabeth Barber even goes back to the Palaeolithic to search for the origin of these garments, which she traces to the Venus figurines such as the one from Gagarino in Russia. Inga Hägg[767] sees precursors of the corded skirts in some bast fabrics of Neolithic lake shore settlements. Representations of ornamental aprons on statuettes of the Neolithic Lengyel and Vinča Cultures also contribute to interpretations (*e.g.* Fig 180.8).

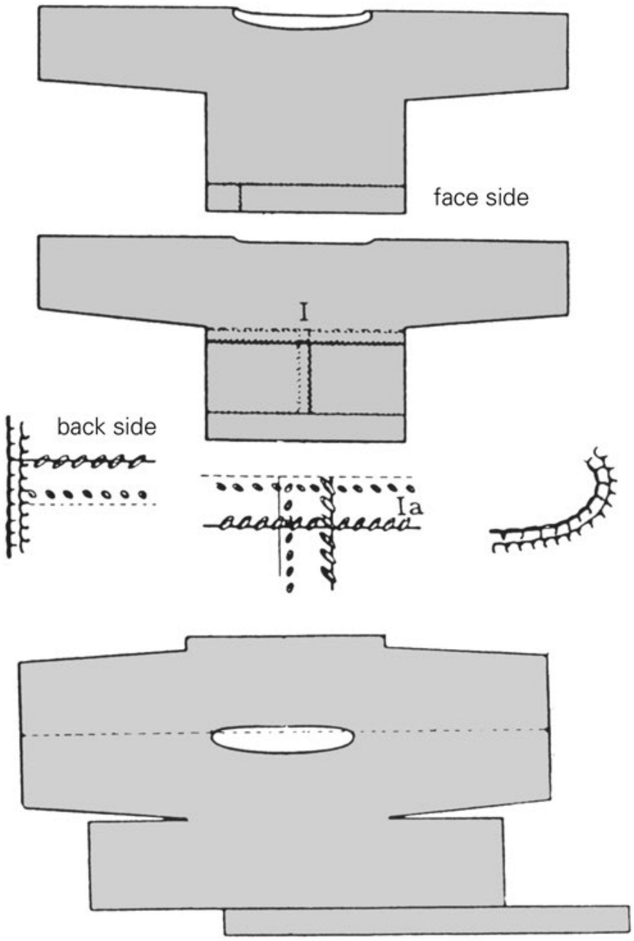


Fig. 191. Dress pattern of a Bronze Age woman's blouse.

No dress pins were found at the shoulders of women's graves of the Nordic Bronze Age in Denmark. The use of a tailored blouse that stays close to the body makes an additional fastening unnecessary. Cloaks appear to be uncommon in women's oak coffin burials from the early Nordic Bronze Age. Only in later times is a fibula sometimes found, which shows that a cloak was added to the costume just as in men's graves. Otherwise, various accessories such as big belt disks and combs worn at the

764 Fossøy and Bergerbrant 2013.

765 *Cf.* Broholm and Hald 1940, fig. 192–193.

766 Barber 1991, 256–257, fig. 11/5. – Hägg 2006, 111.

767 Hägg 2006, 111.

belt completed the appearance of women. Furthermore, Bronze Age women loved to adorn themselves with neck, arm and finger rings.

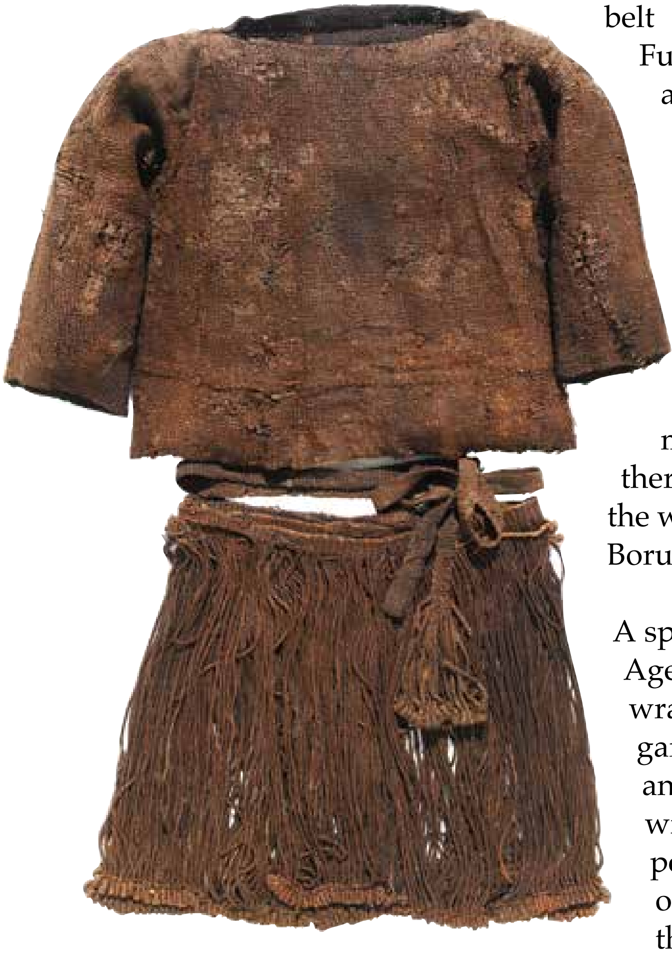


Fig. 192. The garments of the Egtved Girl from Denmark, *c.* 1370 BC. Blouse and string skirt.

Men's costume from oak coffins

Two different forms of clothing are known for men from Northern Europe, both of which were supplemented by a cloak and cap. Men wore either a wrap-around garment worn around the waist, or a loincloth, such as the one from Borum Eshøj (Fig. 193).

A special clothing item of the Nordic Bronze Age is a men's garment worn like a mini wrap-around dress (Fig. 194). Complete garments have been found in Trindhøj and Muldbjerg, Denmark. The cloth was wrapped under the arms around the upper body and held on the body diagonally over one shoulder by leather straps on the two upper corners of the fabric. Due to the short length of the wrap-around this garment only covered the torso, hip and thigh to just above the knee. The garment was designed as an approximately rectangle, which was composed of several pieces of textile. An experimental reconstruction of this garment[768] made it clear that a high level of comfort and flexibility was achieved by the arrangement of the various pieces of textile.

An oval-shaped cloak was used in Scandinavia, placed on the shoulders in a self-supporting way. For the cloak of Trindhøj, the Bronze Age crafts people used a thick, felted woollen fabric, which additionally incorporated *c.* 10,000 wool pile stitches to achieve a fur-like appearance.

[768] Broholm und Hald 1940, 147, fig. 188.

Footwear in the form of foot wraps and leather shoes as well as various forms of caps complete the ensembles. The example of a round cap with pile stitches (*Krimmerbesatz*) is worth mentioning. This cap has a hemispherical shape and consists of three layers of felted and stitched fabric; hundreds of threads were knotted onto the outside. There were also hemispherical caps with pile stitches made of heavily felted textiles in several layers that obscure technical and constructional features. Simpler caps are undecorated, constructed of small pieces of woven cloth sewn together.

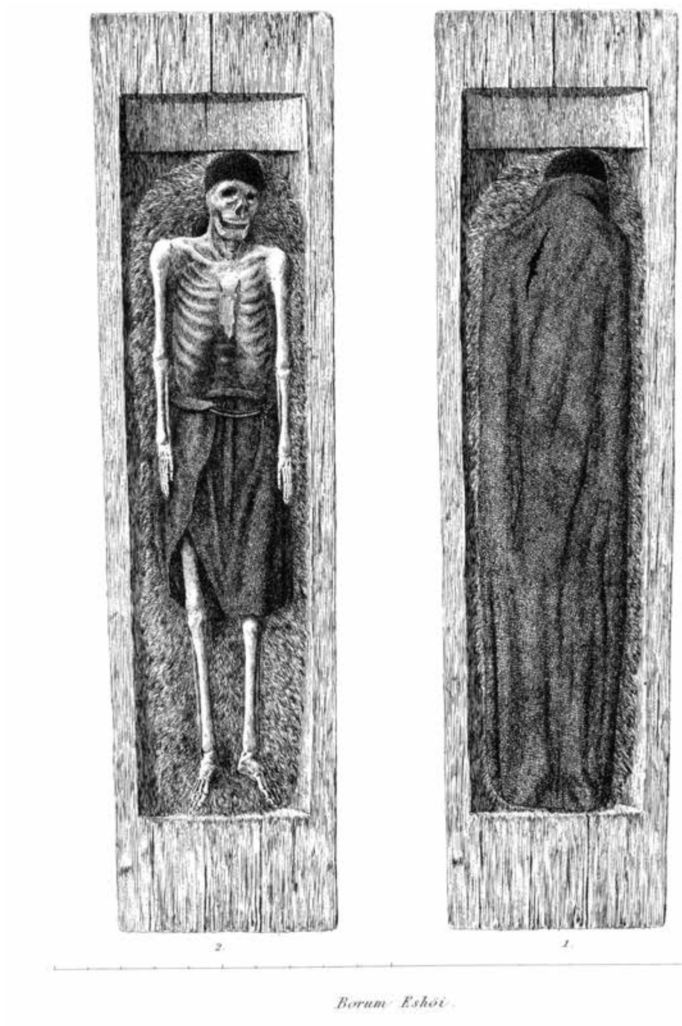


Fig. 193. The grave of a man from Borum Eshøj in Denmark, dendrochronologically dated to 1348 BC.

Textile fragments similar to the Muldbjerg wrap-around were found on a male bog body from Emmer-Erfscheidenveen, in the Netherlands, dated to 1,370 – 1,215 calBC[769]. They are sewn and hemmed with darker yarn than the cloth. A sheep-skin cap and a shoe made of deer skin were found in direct relation.

Dress pins are repeatedly found in men's graves, always a single one that was probably used to fasten the cloak. The belt is indicated by a belt hook that can be found in the pelvic area. Other components of men's graves of the Nordic Bronze Age include toiletry items that serve body and hair care (razor and tweezers) and underline the value of a well-groomed appearance. The appearance of men is completed by weaponry of varying composition, including swords, daggers, axes or spears. Metal ornaments such as individually worn arm rings or one or two

[769] Comis 2003, 193–196. – van der Plicht *et al.* 2004, 482 and 487.

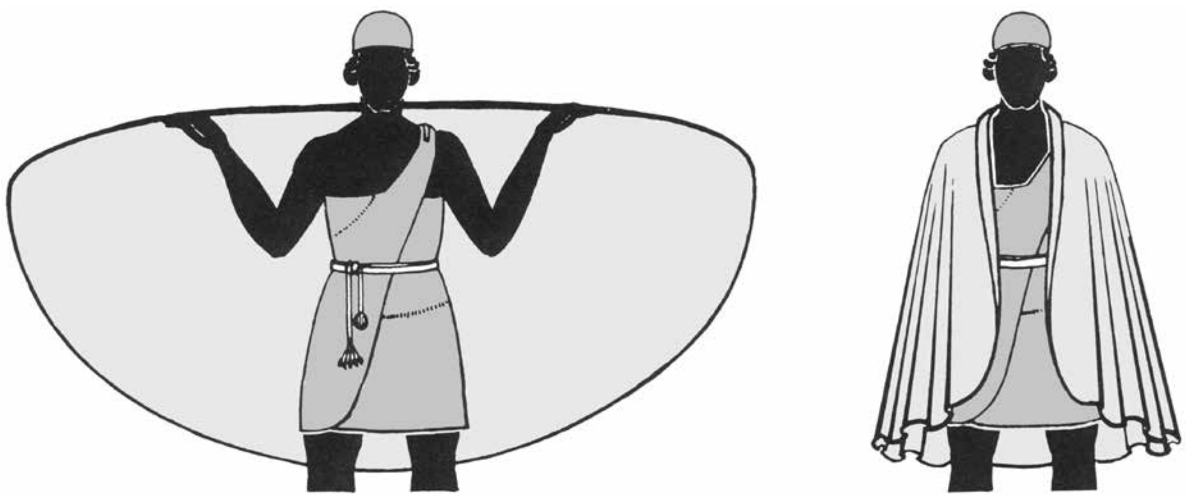


Fig. 194. Bronze Age men's clothing from Northern Europe: wrap-around garment, cloak and cap.

gold wire hair spirals are rare in men's graves and may have to be understood as symbols of status and rank.

4.2 Evidence for Bronze Age clothing in Central Europe

Complete garments from the period between *c.* 2,300 and 800 BC are absent in Central Europe. The textile fragments that have survived stem mainly from the northern Italian lake-dwellings or the Bronze Age salt mines of Hallstatt, and give us an approximate idea of cloth qualities in this region. Amongst them are primarily simple and coarse fabrics, but also some finer flax or wool fabrics in tabby weave; dyed fabrics or twill sometimes occur, but decorated pieces are rare. At the end of Bronze Age, gold threads were found, pointing to the luxury textiles used by the wealthy.

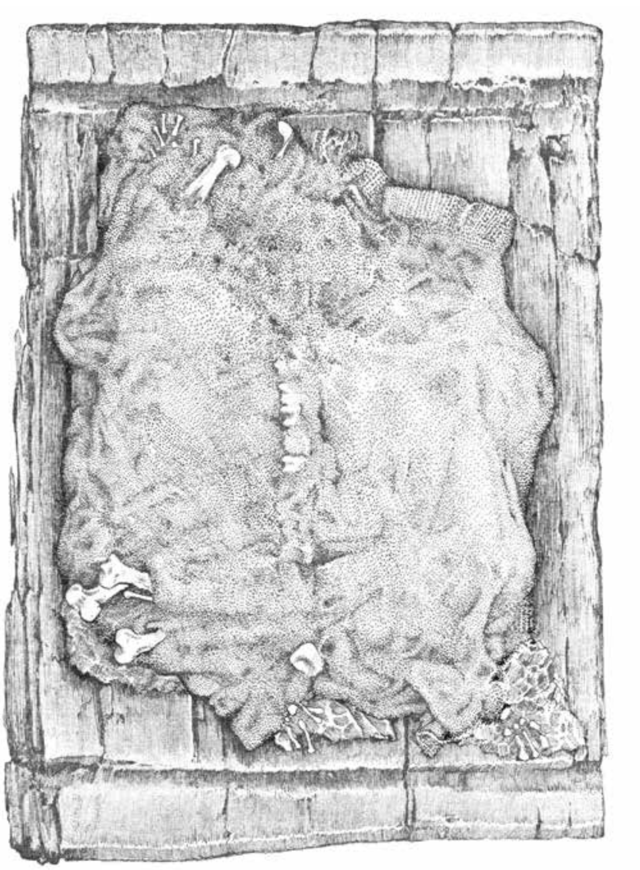
In South-Eastern Europe a technically complete woollen textile was found in Pustopolje, Bosnia and Herzegovina[770], where it was used as a shroud in a male grave (Fig. 195). Recent ^{14}C dates suggest a date of 1,495–1,435 calBC. The textile is 3 × 1.7 m in size and rectangular; it was woven in plain tabby with repp starting and end borders. The textile is best described as a blan-

770 Benac 1986. – Bender Jørgensen and Grömer 2012, fig. 4. – Car 2012.

ket but may have been used as a draped garment, held in place by pins and belt. It does not show any evidence of tailoring.

Pictorial representations of people are almost absent from this period. Small clay figurines from the Middle Bronze Age, however, were found in South Eastern Europe, in Hungary and the areas of Serbia and Romania (Fig. 196)[771]. In their expressiveness, exuberant décor and level of abstraction, these figurines are similar to the ones known from the Neolithic in this area. The Romanian figurines in particular are only realistic in part, and probably have to be interpreted in terms of cult and ritual. In the cemetery of Cîrna in Romania, they are frequently found in urns, and, when an age classification of the cremated bone has been attempted, the figurines occur primarily in graves of children. Since the figurines resemble adults with pronounced hips, it is rather obvious that the figurines do not represent the deceased. It seems that these human representations are no children's toys, but idols or images of gods[772].

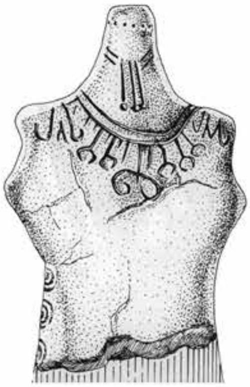
Fig. 195. Large textile from Pustopolje in Bosnia and Herzegovina, Early Bronze Age.



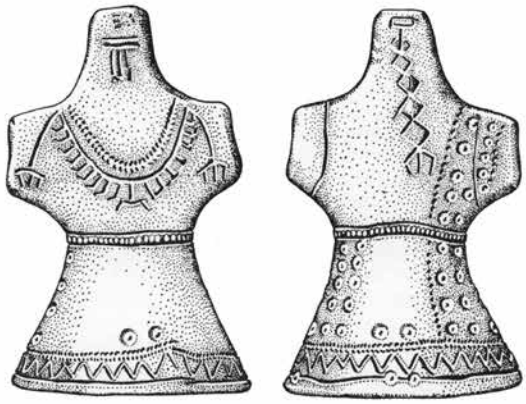
Some general observations about the nature of the clothing can be made, however, regardless of whether the pieces are to be interpreted as cultic or profane. The overall silhouette of female figurines of the Middle Bronze Age displays a tight top and a wide, flaring skirt. Feet and footwear are not visible. Patterns in the chest area, which can easily be identified as typical contemporary ornaments (Fig. 208), are striking in statuettes from Hungarian, Serbian and Romanian find spots. A heart-shaped pendant as shown on the figures can also be found in the cemeteries of the region. But how do we

[771] Kovács 1977, 58–59. – Müller-Karpe 1980, pl. 326, 327.

[772] Müller-Karpe 1980, 689–693.



Babska



Lower Danube Region

Dubrovac

Klicevac

Dupljaja

Cîrna

interpret the lush decor of the 'skirt' such as the one seen on the figurines from Cîrna? This kind of decoration mirrors typical contemporary sets of motif, which are also found on pottery and bronze objects of the same region[773].

Opposite side:
Fig. 196. Middle Bronze Age figurines from Hungary, Serbia and Romania.

Textile finds from the northern Italian lake-dwellings, particularly from Lago di Ledro, and the splendid Swiss textile from Irgenhausen, radiocarbon dated to 1685 – 1493 calBC, are more or less richly decorated[774]. Dyed fabrics and twill weaves do occur, although the majority of Bronze Age textiles are produced in tabby. The fabric from Irgenhausen with triangles and checkerboard design to some degree mirrors the décor system of the Klicevac figurine – despite the fact that it was found in a different part of Europe.

A rich source of information on Bronze Age costume in Central Europe is offered by the Early to Middle Bronze Age necropoles in which several metal clothing components were placed in the graves. In contrast to the subsequent Urnfield Culture, necropoles contain inhumation burials. Therefore, the exact location of the objects in the grave is generally known, and can provide clues to the clothing used in the grave. As mentioned above, it is not clear whether the clothing in the burials represents daily attire, summer or winter clothing, or dress for special occasions, or specific costume of the dead. A difference between richer and poorer grave furnishing is noticeable, which suggest a certain stratification of society. The fact that this status is acquired not only through merit, but also inherited, is evident from the fact that some child burials already display a certain level of wealth.

In the framework of this book, there is not enough space to discuss fine details of chronology, typology and spatial distribution of the individual jewellery and costume components. These have been dealt with at length in many scientific papers and no doubt there are many regional peculiarities of note. However, certain basic trajectories may still be recognized in the Central European Bronze Age, for instance certain rules by which the

773 Müller-Karpe 1980, pl. 317–320, 324–325. Jewellery, metal objects and decorated ceramics comparable to the figurines.

774 Bazzanella *et al.* 2003. – Vogt 1937.

ornaments were placed on the body, as well as combinations of individual costume items.

Early Bronze Age

In the Early Bronze Age of Central Europe between *c.* 2,200 and 1,600 BC, the metallic dress accessories especially emphasise the head, neck and chest area of women[775]. The dress accessories in Bronze Age men's graves, in contrast, are much more modest. Rich women's costume jewellery in the hip area is known from Bavaria, where *tutuli* (bronze tubes), cones, spirals or bronze sheet rolls were used to decorate a belt or even a piece of garment around the neck.

An Early Bronze Age male grave from Sion, Petit Chasseur, Switzerland[776], is extraordinary (Fig. 197). Small bronze tubes were located in the front and at the back of the body, indicating where a border or reinforcement of a textile has originally been. Pins seem to have closed the garment, which made it possible to reconstruct how the textile was worn. In this case the reconstruction was based on the wrap-arounds known from Bronze Age.

The large Early Bronze Age cemetery of Franzhausen I in Lower Austria[777] serves as an example from the Danube region. Its more than 700 inhumation graves allow plentiful insights about population, social ranking and of course about clothing components and jewellery. Both men and women wore neck rings, ornamental pins, arm rings and finger rings. Whereas men normally only have one pin in the chest area, women are equipped with two decorative pins and arm rings. Children received the same ornaments as adults, only in a smaller version. The men were equipped with weapons such as bronze and stone axes; boys of the elite also had daggers. It is an interesting social statement that even children were buried with the representative artefacts of adults. This indicates that wealth and status need

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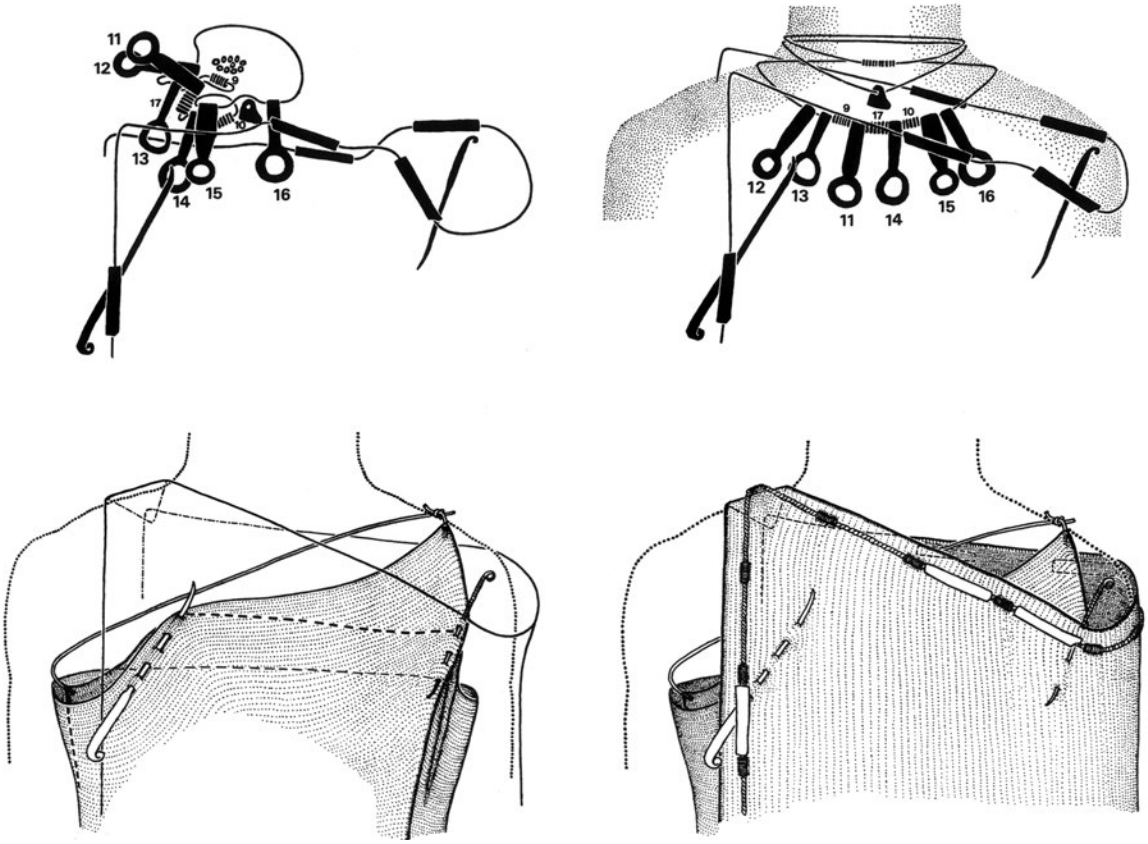
[775] *Cf.* Seidel 1995. – Sørensen 1997, 100.

[776] Bocksberger 1978, fig. 28. – Rast-Eicher 2012, 382–383.

[777] *Cf.* Neugebauer 1994, 80–89, fig. 36–41. – Neugebauer and Neugebauer 1997.



not have been acquired personally, but that once acquired, it had repercussions on the family and was inherited. These children were privileged and intended to take up higher responsibilities within the community[778].

Fig. 197. Early Bronze Age grave find from Petit Chasseur in Switzerland.

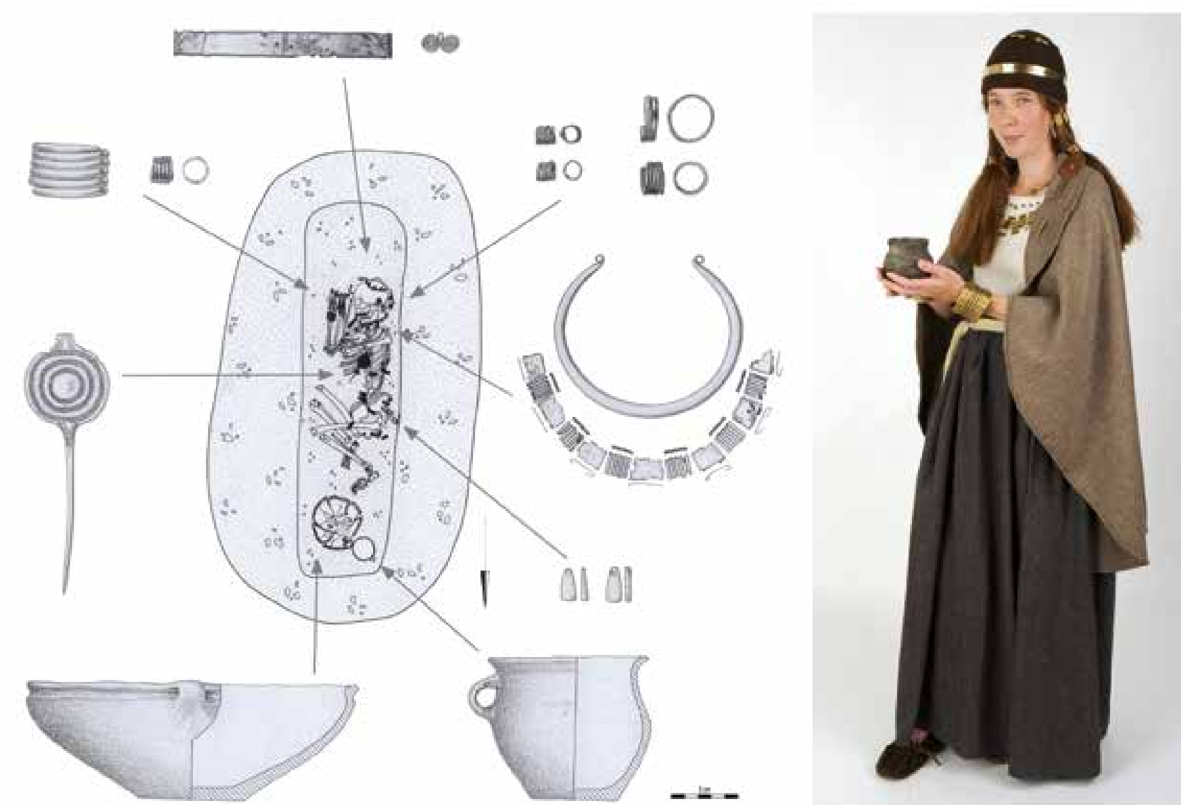
Particularly striking is the headdress of women in the form of headbands or leather caps, of which the ornate bronze metal strips are still preserved. Decorated sheet metal pieces also partly lined the neck segments of the dress. In some cases, many small snail shells were sewn onto the garment. Studded rings were used for the elaborate hairstyles of women and girls. Bronze ornaments, and bone and stone beads were popular as jewellery items. The metal ensemble of the women of high status can be well demonstrated by reference to two graves from Franzhau-

778 Children in historical times were normally encouraged to take over functions of the adult world as quickly as possible. Sofaer 2006b, 87–96.

sen. The woman in grave 747 (Fig. 198) wore a leather cap that was lined with spiral pendants. As in other women's burials, the hair was held together with bronze spiral rings. At the neckline the robe was decorated with sheet metal applications. She further wore a neck ring (*Ösenhalsreif*) as well as massive arm and finger spirals. Two large pins with disc heads were found at the shoulders, which most likely held a cape or cloak at the shoulders.

The rich woman from grave 110 was buried with a similar set of jewellery and costume components, but had an even more elaborate and conspicuous headdress (Fig. 199–200): a bronze cap ornament with bronze boss decoration. It consists of bent sheet metal strips held together with U-shaped bronze parts. The headpiece has a front- and backside (the first marked by a human representation), so it is thought to have been worn with its long side facing to the front. Within this elaborate bronze headdress the remains of a striped textile were found (Fig. 98), which

Fig. 198. Franzhausen, Austria: Early Bronze Age Grave 747 with bronze objects and reconstruction. Model: Andrea Krapf.



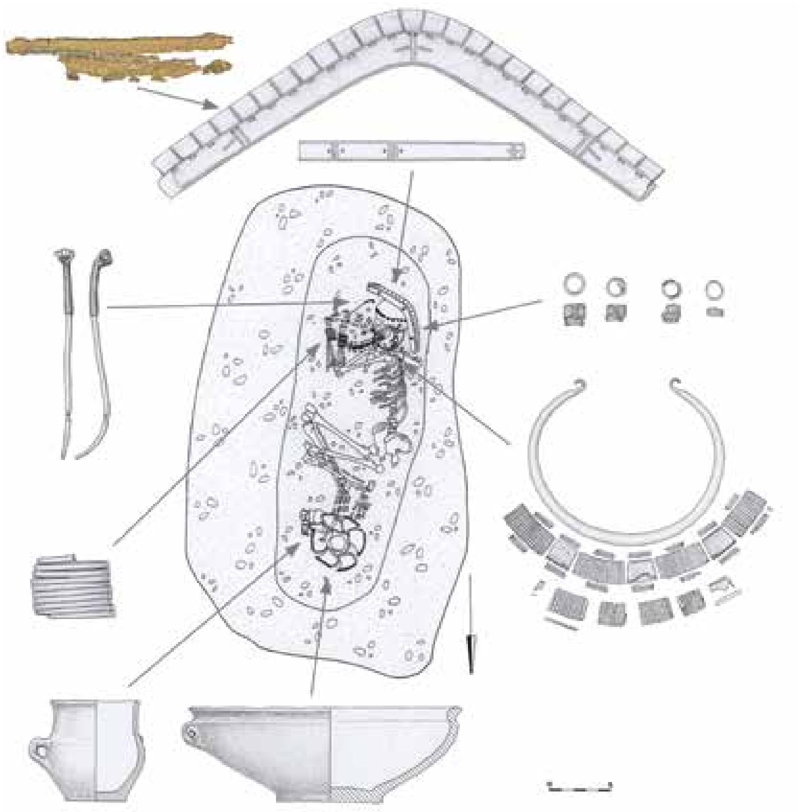


Fig. 199. Franzhausen, Austria: Early Bronze Age Grave 110 with bronze objects and reconstruction. Model: Susanne Mayrhofer.

probably belonged to a veil or other textile head cover attached to the headgear.

Middle Bronze Age

An in-depth analysis of jewellery and metal dress accessories from the Middle Bronze Age Tumulus Culture in Central Europe, that is found across Hungary, Bohemia, Austria and Southern Germany[779], observed a trans-regional pattern of costume, in which women are regularly equipped with two large pins in the shoulder/chest area (Fig. 201); it is rare that only one pin is encountered in women's graves. The question is whether different numbers of pins reflect a different style of clothing (different cut, different silhouette) or whether a similar garment was simply put together in another way.

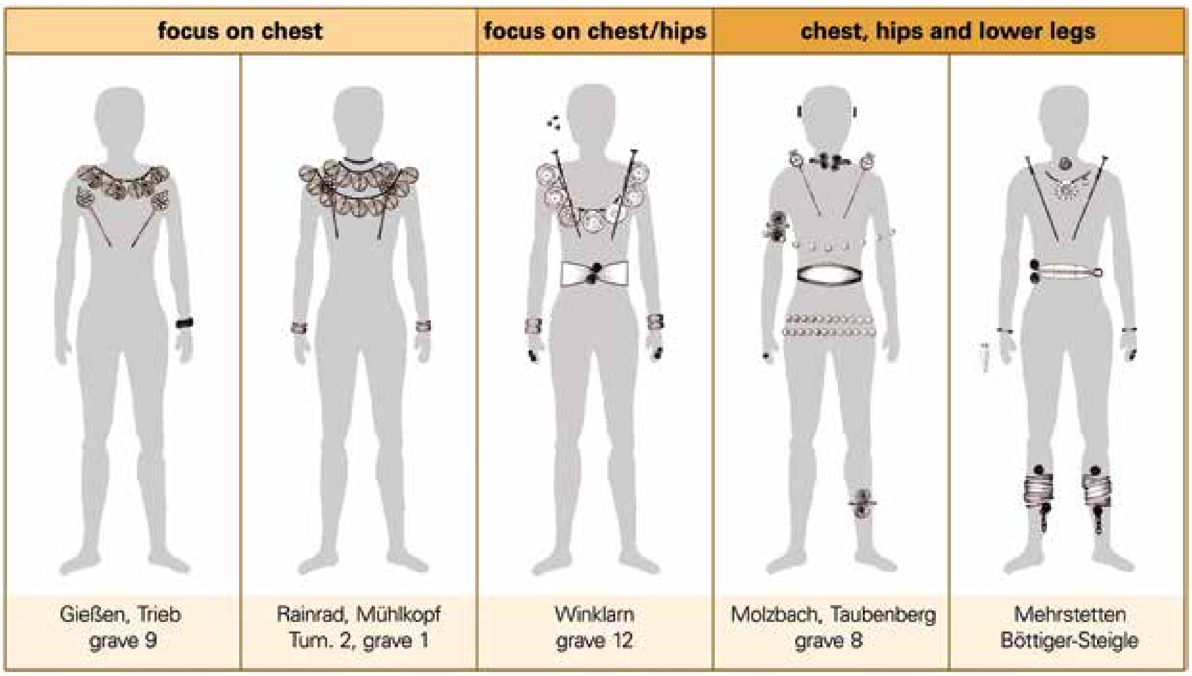
779 Sørensen 1997. – Wels-Weyrauch 1978, 1994. – Wiegel 1994, 165–218.

Fig. 200. Franzhausen, Austria: Excavation context of Grave 110 with elaborate headdress.

Some wealthy Middle Bronze Age female burials include massive sheet bronze spirals (*Beinberge*) that covered half the lower legs. Bronze rings worn on both upper and lower arms are also often found in the graves. The small, perforated decorative trim pieces (*tutuli*) are exclusively found in the pelvic area of female burials. The leather scraps sometimes found on their back indicate they were attached to some carrier material. There are also wide sheet bronze belts. Rich jewellery on neck and chest in female graves may sometimes appear outstanding (wheel pendants or spiked disks Fig. 202, heart shaped pendants Fig. 208), for example the massive spiked disks found in a grave in Winklarn, Lower Austria[780].

In isolated cases, a special headdress can be reconstructed from the metal constituents of Middle Bronze Age burials. Sometimes small fabric remnants are found which indicate a veil that was fastened with small bronze pins; at times a bonnet or cap is assumed. A representative headdress was, for example, found in one of the largest Middle Bronze Age necropoles of Central Europe, Pitten in Lower Austria[781]. For the women, most richly adorned with bronze items and buried within this necropolis, a prominent position in society can probably be assumed. Two graves of 30 to 35-year-old women are at the top of the social pyramid, each carrying a magnificent diadem with neck plate. The ornamentation on these outstanding objects with bow and spiral decoration is an allusion to ancient Mycenaean art, which was formative for the European craft style of the middle 2nd millennium BC.

Fig. 201. Middle Bronze Age dress fittings and jewellery from woman's graves in Southern Germany and Austria.



780 Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013, 222–224.

781 Urban 2000, 180–184, with figures.

Fig. 202. Middle Bronze Age jewellery assemblage from Winklarn, Austria.

Middle Bronze Age male graves[782] normally only had one belt hook and a single pin as clothing accessories. The pin is up to 35 cm long and located on the chest. The garment can thus be reconstructed as a belted robe closed by a pin over the chest – the massive pins suggest a cape or cloak of coarse material.

Late Bronze Age (Urnfield Culture)

A recently discovered grave from Grundfeld in Germany[783] offers a glimpse on Late Bronze Age clothing. In the inhumation grave of a woman were found a necklace, bracelets and anklets as well as remains of a garment, covering the upper body and reaching to the legs. The garment was made of a simple tabby cloth. Around the neck, small beads of different colour were attached for decoration. Remains of a belt were found around the hips. The belt was made of a textile band, which was lined with tree bast to stabilize the item. Additionally the belt was adorned with nine big bronze buttons.

However, in the Late Bronze Age Urnfield Culture the dead were typically no longer interred in inhumation graves; rather the bodies were cremated and the remains deposited in urns. What kind of changing beliefs were behind this burial rite is not entirely clear[784]. For the reconstruction of clothing the new custom of cremation involves the problem that the exact location

782 Wiegel 1994, 179–180.

783 Bartel and Voß 2005, fig. 50–52.

784 Rebay-Salisbury 2012.

of the dress elements on the body can no longer be analysed. From Neolithic onwards, no other prehistoric period is as difficult for textile research as the Late Bronze Age. The location of the dress elements in graves does not allow any conclusions on the way garments were worn. The bodies were either cremated with their clothes or in a special costume for the dead. Either way, the clothing is not accessible to us. Unburnt dress accessories and jewellery, however, were also added to the graves as grave gifts; they were either deposited in the urn or in the grave pit that contained the urn and other funerary vessels.

Characteristic jewellery sets[785] that indicate certain clothing customs for Southern Germany and Austria can be worked out as following: Belt hooks and pairs of pins were still worn by women in the Urnfield Culture, just as in the preceding Early and Middle Bronze Age and the subsequent Hallstatt period, maybe worn on the shoulders. Female burials with just one pin are known from the late Urnfield period. In addition to the various belt components only one fibula is present in male graves, which could have closed the chest area of the garment or cloak at the neck, in analogy to the preceding and succeeding times.

4.3 Bronze Age head coverings and shoes

Considering all the Bronze Age costume components in Central Europe – from head to toe – only sparse information is available for headgear and shoes. A Bronze Age headdress is unique amongst the finds from the salt mines of Hallstatt[786]. A cone-shaped fur hat was discovered in the Hallstatt-Grünerwerk site (Fig. 203), which was sewn together of several parts with careful stitches. The hat was worn with the fur side inward. This piece can most likely be interpreted as a specific part of the clothing of Bronze Age miners.

Another conical headdress, made from branches, is known from the Bronze Age lake-dwelling Fiavè in northern Italy (Fig.

[785] Lochner's contribution in Neugebauer 1994, 194–223.

[786] Popa 2009, 102.

204)[787]. This piece also has a narrow brim, which typologically transforms the cap into a brimmed hat. It is a headgear of a relative complex structure, conical with a narrow brim, located about 1 cm above the lower margin. The brim was probably intended either as decoration or as a reinforcement of the circumference of the headgear. For the making of the spiral structure, a framework was made of pine twigs, sectioned at the sides, straightened and bent in a circle. The framework was covered by a compact and continuous spiral coiling of twigs. This headgear is interpreted as a prestige or ceremonial object (helmet).

Fig. 203. Cone-shaped hood from the Bronze Age salt mines in Hallstatt.

A vessel in the form of a shoe dating to the Late Bronze Age has been found in Unterhautzenthal in Lower Austria[788], which gives us some insight into the footwear of the time. It has the shape of an ankle-high boot (Fig. 205). The areas of the toes and the instep are decorated by strokes which may indicate the folding of the leather or the lacing, which is actually characteristic for all shoes made of one piece of leather.

The discovery of a leather shoe is reported from much further north. The shoe comes from a bog at Buinerveen[789] in the Netherlands, and is radiocarbon dated to the time between

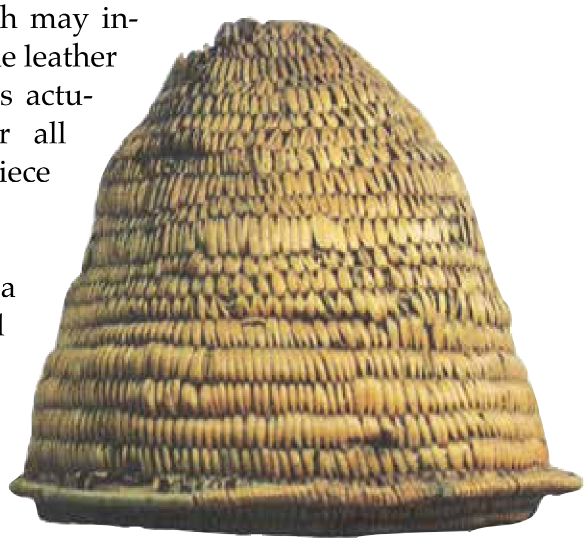


Fig. 204. Conical headdress from Fiavè in northern Italy, Bronze Age.

[787] Bazzanella *et al.* 2003, 146–147.

[788] Lauermann 1991, fig. 2.

[789] Groenman-van Waateringe 1974.

c. 1,500 and 1,300 BC. It is made from an oval piece of leather; a leather strap is threaded into slits close to the cut edge, it can be pulled to gather the leather over the instep. This type of a shoe can be worn either on the right or left foot without differentiation. Experiments[790] suggest that the shoe was enclosed with a wide strap fed across the sole and which thus held the shoe to the bottom of the foot.

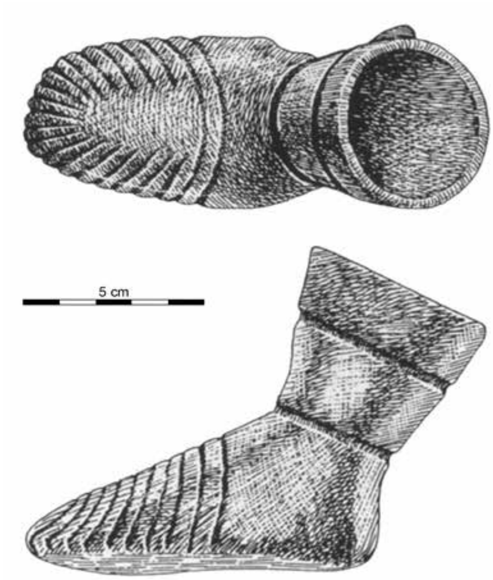


Fig. 205. Late Bronze Age boot vessel from Unterhautzenthal in Austria.

4.4 Interpretation of Bronze Age sources in terms of costume history

Archaeologists can analyse Bronze Age jewellery and dress accessories in terms of regional and temporal differences. Shapes and styles, as well as the combinations of certain clothing accessories and jewellery items, change during the Central European Bronze Age. In the period between *c.* 2,200 and 1,600 BC, jewellery and clothes fasteners worn in Bohemia and Hungary were different from those of the Danube region of Lower Austria. Likewise, the shape and decoration of the jewellery changed in every region from the Early to the Late Bronze Age. Nevertheless, certain general patterns can be worked out as indicated above[791]. The basic features include the head and chest (shoulder) area as main body areas to display jewellery and several ways of belting the robe. These features are the same in the various regions of Central Europe. Does this mean that the basic design of the garments was similar in design and cut and only the

790 Personal comment from Anne Reichert, 2010.

791 Sørensen 1997, 100. – Wels-Weyrauch 1978, 1994.

(metal) accessories were subject to changes of fashion that allow us to assign specific types to a particular time or region?

Women's costume

What did the women's costume look like? What can we deduce from these rule-based basic sets known from Bronze Age graves in the Danube region? The length of the clothes can be indirectly traced by the clothing accessories on the arms and legs. It might be assumed that the representative ornaments worn on arms and legs were not completely covered by a cloth, because they were made to be seen. The skirts or dresses were probably not floor length. The rings on the upper arms may indicate that, at least at times, short sleeved garments were worn. Or were the upper arm rings simply worn over a long sleeve?

The Early Bronze Age findings from Großgmain, Austria, provide interesting insights to answer the question of the sleeve length[792]. A wide arm spiral was discovered on the forearm of a woman's grave, on which remnants of both the skin of the deceased and a medium-fine tabby woven textile were found (Fig. 206). The skin remains of the deceased indicate that the sleeve reached just above the mid-forearm, and that the arm spiral was partly slipped over the sleeve.

Bert Wiegel's[793] observations of funerary finds of the Danube region demonstrate that the shafts of the pins were bent in different ways and thus adjusted to individual needs by those who wore them. Interestingly, some pins were found in the graves with the tip pointing upwards, towards the head, some downwards. Does this reflect the way they were used during life? What kind of garment could have been closed by these Early and Middle Bronze Age pins? The shafts of these pins are sometimes very thick, averaging a diameter of 5 to 7 mm. Fine textiles would have probably been destroyed by the multiple piercing with such thick pins. It is thus quite conceivable that coarser

[792] Grömer and Höglinger 2010, fig. 20.

[793] Wiegel 1994.

materials such as capes and cloaks were fastened with such pins (Fig. 207).

Do the few ritual figurines from the Balkans dressed in long belted dresses reference the appearance of contemporary garments? The jewellery pieces worn in various positions around the neck would match the illustrations (Fig. 208). A complex pattern is further known from the cloth from Pfäffikon-Irgenhausen, Switzerland[794], which can also be found on the figurines. However, important dress elements – the pins with which the upper garments were fastened – are usually missing on the human representations. These shoulder dress accessories are

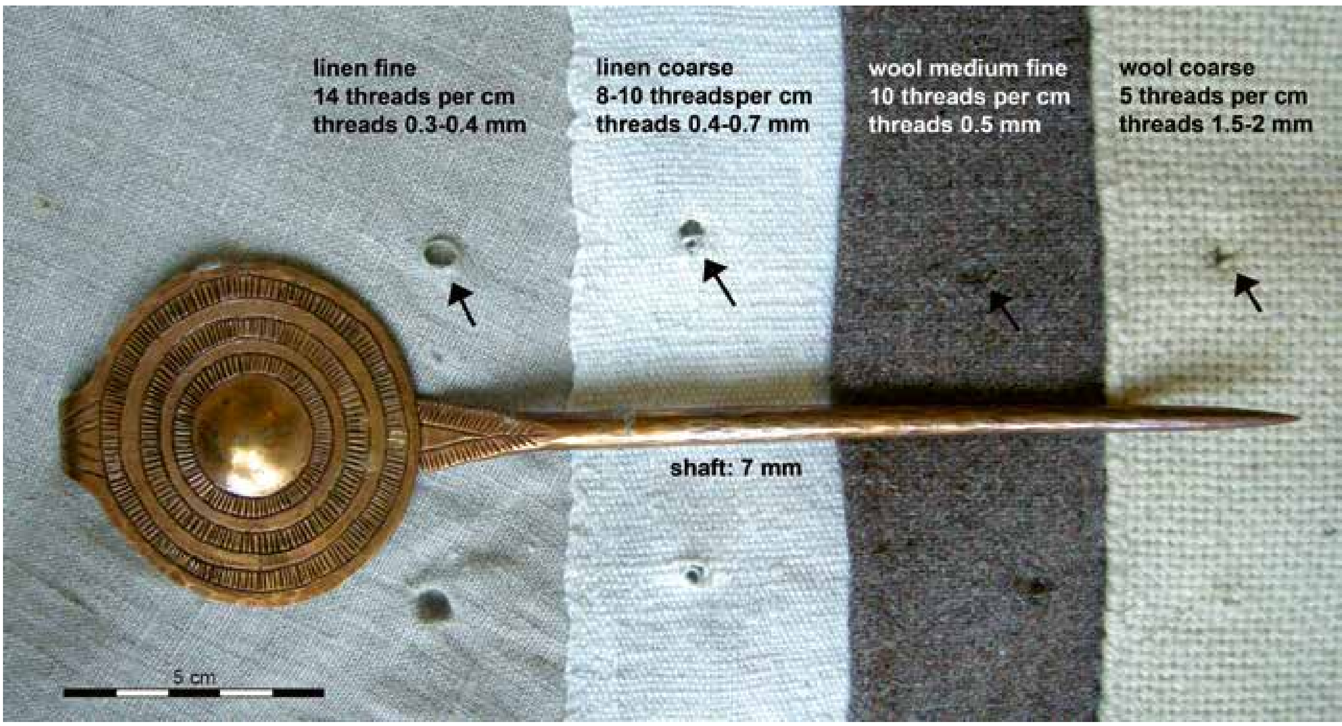
Fig. 206. Early Bronze Age spiral arm ring from Großgmain, Austria, with mineralised textiles and human skin.

794 Vogt 1937, 76–90. – Rast-Eicher 2012, 380–381.

regularly found in the graves, but were not represented on the figurines.

According to these considerations, the Bronze Age representations and the finds from the graves do not completely line up. Perhaps what is found in the graves is a festive costume or a dress for the dead, and what is depicted on the figurines is a dress reserved for ritual functions. Could the typical women's costume of the Early and Middle Bronze Age be the blouse and skirt combination known from Northern Europe? Earlier Bronze Age textile research frequently combined the ensembles such as the one from Franzhausen or Winklarn in Austria with garment forms known from the oak coffins of the Nordic Bronze Age (see Fig. 198) to reconstruct complete costumes[795]. The two pins were interpreted to mean that the cloak was pinned to the blouse. It should be noted, however, that in the Nordic Bronze Age the cloak was neither fixed by two pins, nor worn by women, according to complete grave ensembles.

Fig. 207. Damage by a thick pin shaft to textiles of different qualities. Reconstruction of the Early Bronze Age disc pin found at Franzhausen in Austria.



[795] See *e.g.* the reconstructions in Neugebauer 1994, fig. 41.

An alternative interpretation of the custom of closing a garment by means of two pins, which appears around 2,000 BC in Central Europe, is that a new type of garment was introduced – perhaps a tubular dress draped around the body, similar to the *peplos* of the Iron Age.

Important findings for the difficult interpretation of dress shapes are known from Schwarza in southern Thuringia[796], where not only the metal dress components, but also the textiles have been preserved in the Middle Bronze Age barrows. Again, pairs of pins were found at the shoulders in women's graves. Analyses confirmed that the paired pins held together a rough cloth, although whether that of a *peplos* or a cape or cloak is unfortunately unclear. Underneath the cloth, an undergarment was apparently worn (a woman's blouse such as the ones known from the Nordic Bronze Age?). With the Thuringian finds, we have a connection between the Nordic clothing elements and the finds from the Danube region, by the coarse fabrics that have been fastened with paired pins on the shoulders.

The grave finds from Winklarn in Austria[797] (Fig. 202 and 209) acted as a model to take up the challenge of recreating the costume of a wealthy Middle Bronze Age woman. She was buried with jewellery and dress fittings that appear almost theatrical, such as a wide belt of bronze, extremely long pins and a collar consisting of fourteen spiked bronze pendants. A series of different sources emphasize what her clothing might have looked like: the placement patterns of jewellery in Bronze Age graves

Fig. 208. Ceramic figurine from Babska in Hungary (1), compared to a Middle Bronze Age heart-shaped pendant from Asparn/Zaya, Austria (2).

[796] Feustel 1958.

[797] See Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013.

Fig. 209. Experimental reconstructions of Middle Bronze Age costumes, based on the grave of Winklarn in Austria. Model: Sandra Fellner.

from Central Europe, Bronze Age iconography, the textures of Bronze Age textiles, including a group of completely preserved garments from Denmark, and general tailoring principles. Each of these sources has its own rules and pitfalls. The variants of are educated guesses rather than factual certainties.

Men's costume

But what about male costumes? The pattern observable in the Central European graves, consisting of a belt and a single pin worn on the chest fits much better to what is known from the Nordic Bronze Age. Some of the textile remains from the Bronze Age part of the salt mine of Hallstatt[798] in Upper Austria are very similar in design to those of the Nordic tree coffins – even the arched seams of the men's wrap-arounds and the finishing with buttonhole stitches are the same. Perhaps the Nordic men's costumes were also common garment forms in Central Europe.

798 Grömer 2013. – Rösel-Mautendorfer 2013. The textiles from the Bronze Age parts of the salt mine of Hallstatt are partly interpreted as remnants of clothing and partly as woollen sacks.

5 Iron Age

The Iron Age in the Danube region (between 800–15 BC) overlaps with the written history of the ancient Greeks and Romans. This era is characterised by the production of iron as the most modern and advanced working material, and by a very complex and differentiated social system with a high degree of craft specialisation. Textile crafts in the Central European Iron Age display a variety of techniques, patterns and colours. The innovations of the Bronze Age peak in the Hallstatt period (Early Iron Age, 800–400 BC) before simpler, mass-produced textile types began to prevail during the La Tène period (Late Iron Age, 400–15 BC) in the northern and north-eastern Alpine region – a harbinger of the Roman standardized production (see chapter C).

The available sources for reconstructing the history of Iron Age clothing are more plentiful than for previous eras in various parts of Europe. Again, it has to be emphasised that different types of sources come from different cultural groups and allow different interpretations. In contrast to the Bronze Age, figurative representations increase during the Iron Age, especially in the area of the eastern Hallstatt Culture. Direct encounters with prehistoric people are again made possible through their graves. After a time of almost exclusive cremation in the Urnfield Culture, the rite of inhumation is gradually reintroduced during the Hallstatt period. At the very end of the Iron Age, however, do ancient authors report directly on aspects of Celtic clothing. Moreover, only a few complete Iron Age garments have been found in Central Europe. Concrete examples of Iron Age garments have been discovered in the bogs of North Germany and Denmark.

5.1 Complete Iron Age garments from Northern Europe

The complete garments and ensembles from the pre-Roman and Roman Iron Age of Northern Europe represent a special treasure of European prehistory. Widely published in the major publications of Margarethe Hald and Karl Schlabow[799] during the 20th century, they now offer a tangible insight into the garments of the pre-Roman peoples at the edge of the Roman Empire, who were previously often imagined as 'primitive'. The quality of the garments, their richness in shapes and forms, and their diversity of patterns are astonishing.

The circumstances of their discovery – the pieces were frequently discovered during peat cutting in the bogs – formerly led to a somewhat uncertain dating. In early publications, they were commonly classified as belonging to the Iron Age. Some of the pieces that were first thought to date to the pre-Roman Iron Age, such as the tunic of Bernuthsfeld, had to be correctly placed in the early Middle Ages[800].

The fact that such well-known findings still offer surprises has recently been proven by researchers at the National Museum in Copenhagen and the Centre for Textile Research, who are currently reanalysing and evaluating the Danish bog finds[801]. New radiocarbon dates and dye analyses have been performed on the textiles, so that we now have a clearer picture of the age and original appearance of the garments. Many of the known finds, such as those from Huldremose, Borremose, Elling or Tollund were confirmed to date between the 4th and 1st centuries BC. Isotopic tracing[802] hints at the origin of some of those important objects. The finds from Thorsberg in Northern Germany also have been the focus of a research project[803]. The Thorsberg place of sacrifice includes the discovery of long, narrow trousers with attached booties and five superb cloaks, one tunic and two pairs of calf wraps.

799 The following descriptions of finds are based on this literature: Danish finds: Hald 1980. – Mannering *et al.* 2012, 104–114. – Mannering 2015. – Finds from Schleswig-Holstein and Lower Saxony: Möller-Wiering and Subbert. – Schlabow 1976.

800 New dating of bog finds: Mannering *et al.* 2010, 261–268. – Van der Plicht *et al.* 2004.

801 Mannering *et al.* 2012. – Van der Plicht *et al.* 2004. New data and high quality images from the National Museum Copenhagen: http://oldtiden.natmus.dk

802 Frei *et al.* 2009. – Frei 2013.

803 Möller-Wiering 2011. – Möller-Wiering and Subbert 2012.

Garments for the upper body: tunics and cloaks

Shirt-like tunics[804] ('*Kittel*'), sleeveless or with attached long sleeves, are frequent finds. The construction of the tunic, such as the one from Oberaltendorf in Germany, is usually very simple: rectangular pieces of cloth were sewn together at the shoulders and sides. The tunic was held with a belt around the waist. A very well preserved tunic is known from the Thorsberg Bog (Fig. 210). It was made from a 58 cm wide fabric in fine wool lozenge twill with reinforced selvedges; two larger pieces with 95 cm length were used as front and back parts. The tunic was sewn together at the shoulders, fitted with a slightly rounded, carefully finished neckline and long sleeves of 58 cm. It was not closed at one side from the sleeve downwards, but could be fastened by cords at a distance of *c*. 5 cm.

Square to rectangular textiles with careful finished edges served as cloaks in the pre-Roman and Roman Iron Age, as they appear in images of defeated Germans on Roman victory columns[805]. According to these pictures, the cloak was placed over the shoulders and closed with a fibula on the right shoulder. The edges of the cloaks were worked very sumptuously, with up to 18 cm wide tablet woven bands. This is attested by the most prominent examples, the splendid cloaks ('*Prachtmäntel*') from Thorsberg and Vehnemoor in Germany dating to the 4th century AD. As both the original finds and the Roman pictorial sources demonstrate, they were also adorned with fringes. The cloaks sometimes measure a surprising size of up to 3 m in length and 1.8 m width. One of the two complete cloaks, which were wrapped around the bog bodies of Hunteburg in Germany (dated around 300 AD), had this size. With such a length the cloaks were folded over and worn doubled up. They thus offered better protection against rain, wind and snow, and could be used for many different purposes, for example as an additional blanket. The cloak of Dätgen, Germany, is smaller with dimensions of 1.62 by 1.46 m.

[804] *Cf.* Schlabow 1976.

[805] Schlabow 1976, 48–49.

Fig. 210. Tunic and trousers from the Thorsberg Bog, Germany, 4th century AD.

Leg wear

Different types of trousers are known from the pre-Roman and Roman Iron Ages of Northern Europe[806]. Long tight trousers were found in Damendorf, short loose trousers in Marx-Etzel (all in Germany). The trousers from Marx-Etzel were made from one piece of diamond twill, which was cut and sewn firmly. They are the simplest form of trousers. All other trousers were composed of several different tailored parts. The form has little in common with the usual cuts of men's trousers in the Western fashion today. A remarkable feature is that early trousers are without a side seam. Each leg is wrapped by a piece of fabric with the seam pointing towards the inside of the leg. A square base piece is inserted for the required width at the buttocks. To have a comfortable fit, the base piece must follow the rounding of

806 Kania 2007. – Möller-Wiering and Subbert 2012. – Schlabow 1976. – van der Plicht *et al.* 2004 (dating).

the body. Sometimes wedges were inserted for the construction of Iron Age trousers or cuffs attached. The well-known trousers from Thorsberg (Fig. 210) are even fitted with belt loops. This singular piece of clothing is a pair of long, tight trousers with attached booties. The study of the pattern cutting of the Dätgen[807] trousers, however, obtained that the cut differs from the other wool trousers found in Northern Germany, which have a more developed cut. It is more similar to linen trousers from Egypt and Syria (6th to 7th century AD).

In addition to trousers, there are foot wraps, which were wrapped around the calves to protect against cold and wetness. Two 1.05 m long and 10 cm wide woollen bands of twill were found with a bog body at Damendorf, dating to the first centuries AD. At the time of discovery, the deceased was stripped of all clothes and only covered by a cloak. The other items of clothing, the trousers, the foot wraps and shoes were found tied up in a bundle at his feet. We thus do not know how exactly the foot wraps were worn. The foot wraps from Søgårds Mose, Denmark, however, dating to the 2nd century BC were found at the legs of a bog body. The shins of the body were wrapped in bandages of 36 by 27–31 cm made of twill, which were tied with two woollen cords. Different types of shoes made of cow leather[808] served as footwear in the Iron Age in Northern Europe, and have also been recovered in the bogs. Tunic, trousers and cloaks are attributed to men's clothes, even if not all of them were found with male bog bodies. The finds from Thorsberg[809], for instance, were deposited as offerings in the bog.

Skirt, tube dress '*peplos*' and various capes

Clothes from the Ruchmoor near Damendorf in Germany represent what girls would have worn in the past. The finds were found near a 14-year-old girl discovered in a bog and included a woollen skirt of 30 cm length. It is worked in tubular form with a base circumference of 1.65 m and was strongly gathered at the

807 Zink and Kwaspen 2015. – Egyptian trousers: Kwaspen 2013.

808 *Cf.* Groenman van Waateringe 1974. – Mannering *et al.* 2012, 109, 112, fig. 3.17.

809 Möller-Wiering and Subbert 2012. – Schlabow 1976.

Fig. 211. Bog finds from Huldremose (II) in Denmark: tube dress '*peplos*', 180–50 calBC.

waist; the way the skirt stuck out from the waist of the wearer created a bold silhouette. In addition to this skirt, a cape made of deer fur was found near the bog body. According to the bog specialist Wijnand van Sanden, the garments of Ruchmoor date to the 9th century BC[810].

Women's clothing is known mainly from the Danish bogs. This includes scarves and capes worn with the fur side inwards. Particularly interesting are tubular garment pieces that are categorised either as ankle-length skirt or *peplos* dress depending on the length. These garments are either made of square pieces of cloth sewn together at the sides or worked in tubular form on a two-beam loom. The most famous example of such a tubular garment is the *peplos* from Huldremose (Fig. 211), which was discovered in a Danish bog, but unfortunately not in situ on a woman's body. The way the garment was worn was reconstructed by Margarethe Hald[811] through analogy to the Greek *peplos* as follows: the tubular garment was folded, fixed at the shoulders with fibulae and belted. In fact, we do not exactly know how the find from Huldremose was worn; alternative interpretations are equally likely.

Not only was the famous dress found at Huldremose (Huldremose II, 180–50 calBC[812]), but also a complete dress ensemble dating somehow earlier (Huldremose I, 192–61 calBC). It consists of a checked woollen skirt of 81 cm length, gathered at the waist, a scarf and a fur cape (Fig. 212). Various hair nets as parts of female clothing are also known from the Danish bogs.

A tube-dress pinned directly at the borders to create the neck and arm openings was found in a grave at Hamerum, Denmark, 1st century AD (Fig. 213). Unfortunately,

810 Van der Sanden 1996, 167.

811 Hald 1980, 358–365.

812 Mannering *et al.* 2012, 105, fig. 3.9 and 3.11.

no remains of the buried person except an elaborate coiffure were preserved, but the burial is interpreted as belonging to a young female. The dress was made of balanced 2/2 wool twill of red colour, is 95 cm long and 146 cm in circumference and may have reached to the knees of the deceased person[813]. The textile is most likely woven on a warp-weighted loom, and the starting and finishing borders were sewn together to form a tube. At each shoulder the front of the cloth is gathered with the back. How both parts were kept together cannot be determined, because no (metal) pins are preserved. On top of the dress and around the back a more fragmented textile was found (second fabric), as well as a third fabric in the area of the knees. The use and shape of both cannot be determined.

Fig. 212. Bog find from Huldremose (I) in Denmark: skirt and fur cape, 192–61 calBC.

5.2 Evidence for Early Iron Age clothing in Central Europe

Let us now turn our attention from the northern European region with garments dating to around the beginning of Common Era to Central Europe at the beginning of the 1st millennium BC.

Complete garments

What is the situation in the Central European Iron Age in terms of complete, intact garments? In 1734 a clothed prehistoric body was discovered preserved in salt during a visit to a sink work in the Hallstatt salt mine. A chronicler writes: '… *seen a strange corpse of a dead man, who presumably and to judge by his appearance must have been trapped and buried more than 400 years ago,*

[813] Mannering and Ræder Knudsen 2013.

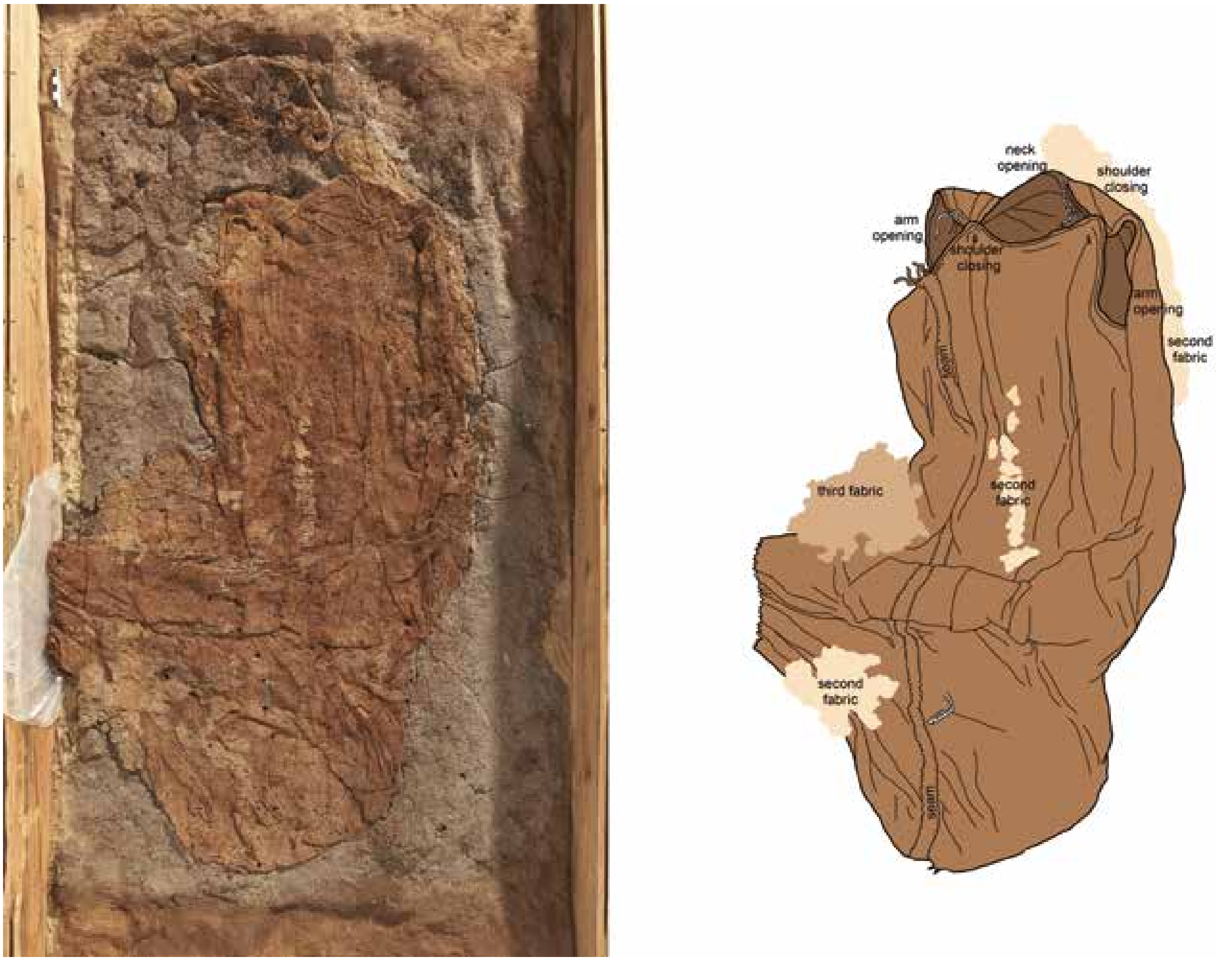


Fig. 213. Woman's grave from Hamerum in Denmark, 1st century AD.

completely grown together with the mountain, but one still sees parts of his upper garments, and also some shoes on his feet …'[814]. This 'Man in Salt' was most likely an Early Iron Age miner. He was, after having been recovered from the mine, buried in the Christian cemetery of Hallstatt – what a loss for scientific research! Similarly, the salt mummies discovered in 1577 and 1616 in the salt mines of the Dürrnberg are no longer available. Unfortunately, we can therefore no longer speak of completely preserved gar-

814 Weekly report (Werkerfaszikel, Wochenbericht) from the salt mine Hallstatt, 1734, 13th week, 1st quarter. Cited after Barth 1989, 9. '*… einen nadierlichen Cörber von ainem Toten menschen gesehen, welcher muedtmaslich und deme ansechen nach, vor mehr als 400 Jahren mueß verschidtet sein worden, massen Selbiger in das Gebirg föllig verwachssen, doch sicht man noch von seinem rockh etlich flöckh, wie auch die S.V. Schuech an denen füeßen …*'

ment ensembles found directly on the body for Iron Age Austria.

A few single pieces of clothing are, however, available for study from Central Europe. Parts of work clothes, various caps and shoes[815] have been recovered from the two salt mining locations of Hallstatt and Dürrnberg.

Fig. 214. Vedrette di Ries, South Tyrol in Italy: Iron Age leg warmers 'under-leggings', 8th–6th century BC.

From the Vedrette di Ries glacier (Rieserferner Gletscher)[816] on the border between Italy and Austria we know of two pairs of leg warmers (over-and-under-leggings) made of goat wool, as well as a pair of sewn woollen socks and remnants of shoes made of leather. The ensemble dates to the period from the 8th to the 6th centuries BC. It was found high in the Tyrolean Alps on the edge of a snow field, where they were left by Iron Age people over 2,500 years ago. These pieces, incredibly important to the Central European costume history, are exhibited in the South Tyrol Museum of Archaeology in Bolzano, along with the Neolithic Iceman. They are evidence for body attire most probably adjusted to cold periods.

The leg warmers (Fig. 214) have a common basic design, but differ in little details. They each consist of tubes of woollen fabric with a seam on the side. At the bottom end a tab is incorporated, which draws on the instep and protects this part of the foot from the cold, even when wearing shoes. The edges of the lower part of the protective and warming tabs are reinforced; the edges of the under-leggings are hemmed with a twill band. In each case a cord has been found in the area above the heel. The cord was used to securely attach the legging to the foot. The

815 *Cf.* Barth 1992. – Stöllner 2002.

816 Bazzanella *et al.* 2005; 2012.

over-leggings are 55 cm long and 16 cm wide, and consist of dense, thick, woollen material in herring-bone twill. A carefully stitched patch of thin woollen cloth was found at the height of the knee on the left legging. The under-leggings are 62 cm long and 16 cm wide, with a slight conical shape, and are made in tabby weave. The right under-legging has a simple side seam, while the left one incorporates a 1.5 cm wide ribbon in diagonal plaited braid consisting of two parts of different colour sewn together; the lower part is grey, the upper part brown. The obliquely elastic construction of this band lends elasticity to the narrow leg tube made in tabby weave. A good fit is thus just as ensured as an easy slip through.

The socks ('inner shoes') (Fig. 215) were made from twill fabric of beige brown to grey wool; the fabric is felted on the inside and outside. The weave is somewhat finer than that of the over-leggings. On a very well preserved sock it can be recognized that it was composed of ten different parts, including the sole. The sole is reinforced by additional pieces of fabric sewn onto the inside; on the outside, patches of dark brown woollen twill are fixed to the toe and heel area. Where the foot slips in, the sock can be closed by a lateral flap to which a band is sewn; the flap and band can be wound around the ankle joint.

A number of Iron Age cloaks and capes of different forms are known from the pre-Etruscan Villanovan Culture (*c.* 1000–700 BC), in particular from Verucchio, Italy, dating to *c.* 700 BC[817]. The ceremonial garments from Tombs 85, 89 and *tomba del trono* include two large, semi-circular cloaks with a size of about 260 by 80 cm. They are twill woven with spin patterning and carry broad, decorative tablet woven borders, which were added to the garment after the completion of the ground weave. Due to their semi-circu-

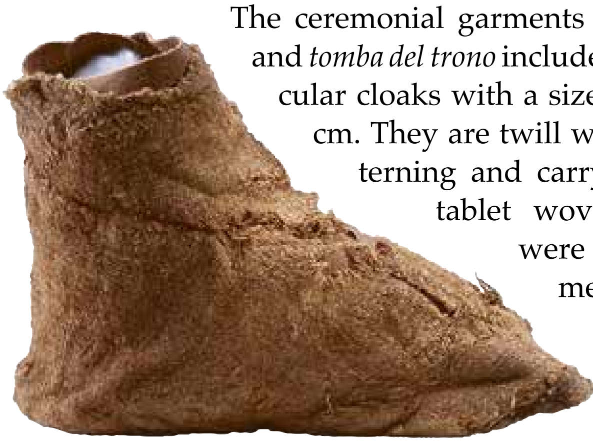


Fig. 215. Vedrette di Ries, South Tyrol in Italy: Socks sewn from wool fabric, 8th–6th century BC.

[817] Stauffer 2002, cloak 1: fig. 64–65, cloak 2: fig. 72–73, cape: fig. 77–78. – Stauffer 2012, discussion about the term *tebenna*: 251.

lar shape, these *tebennae* are considered to be the prototype of the Roman toga. Some further more or less complete garments were found as well. Garment 3 is woven with four curved edges and a neck opening in the central part and a size of 103 by 105 cm; it might have been worn like a long shirt or a tunic with short woven-to-shape sleeves.

Design of Early Iron Age textiles

We are generally very well informed about the appearance of textiles during the Hallstatt period in Central Europe, which constitute the material basis of clothing. Numerous textiles have been recovered from graves. The princely tomb of Hochdorf, Germany[818], plays an important role for textile research. An analysis has revealed various splendid textiles, which were prepared especially as grave goods for the Celtic prince. These are mainly in red and blue; imported dyes, such as the red of the scale insects (*Kermes vermilio*) have also been used. The resourceful textile craftspeople not only used sheep's wool or flax, but also badger hair and hemp bast. The materials from the royal grave are characterised by their high quality and decoration of various checked patterns, weave types such as diamond twills and tablet woven bands. The gorgeous patterns including swastika or meander motifs suggest connections to the Mediterranean civilisations south of the Alps, although the production was probably carried out locally.

The salt-preserved textile finds from Hallstatt, Austria[819], were left behind in the mountain after having been used in a number of different functions (see chapter D). Twill weaves were particularly popular, along with tabby and basket weaves, which were dyed and decorated. Stripes and checks are indeed characteristics of this period, although they are not found on every textile. Far more common are spin patterns that form a very exquisite type of tone-on-tone décor effect. Colourful tablet woven bands and repp borders are further characteristics of the Hallstatt period. It should be emphasised that strong, dark co-

[818] Banck-Burgess 1999.

[819] Grömer *et al.* 2013. – Hundt 1987. – von Kurzynski 1996.

lours like shades of blue and black were preferred and achieved through dying. The bronze jewellery, bright and shiny when polished, must have created a nice colour contrast. It is also interesting that there is much evidence for tailoring, particularly in Hallstatt (see chapter B). Panels of fabric were cut and then sewn together. The careful trimming of the edges was especially emphasised, not least for practical reasons in order to increase the durability and wear-resistance of the garments.

Grave finds

As is the case for the Central European Bronze Age, the graves of the Iron Age offer an important source of information when it comes to interpreting the clothing that was worn on the last journey of the deceased. For this purpose, only costume items and accessories in their original context are used. The funerary rites of the Hallstatt period include both cremation and inhumation. Frequently, as in the cemetery of Hallstatt, the richer graves (*e.g.* those equipped with bronze vessels) are cremations[820].

Particularly impressive are the finds in the elite burial mound X of Mitterkirchen in Upper Austria[821], one of the earliest graves from the eastern edge of the western Hallstatt Culture to contain a ceremonial wagon. Two grave chambers and a pit burial dating to the 7^{th} century BC (Ha C) were discovered in this imposing burial mound. Chamber 1 contained vessels of the drinking and feasting set, such as cups, bowls, plates and large storage vessels in addition to an ornate ceremonial wagon, on which a woman's body was laid. This kind of burial with wagon was reserved for the elite of the Hallstatt period. The double burial of a 30-year-old woman and an 18-year-old man was discovered in Chamber 2. Here, the excavators found a striking context (Fig. 216): the woman's skeleton, clearly the more important person in the grave after her equipment, was covered with thousands of little bronze buttons in the upper body and leg regions. Between the knees and toes they were lined with a double zigzag row of tiny bronze rings. Among these metal

820 *Cf.* Kern *et al.* 2009a, 130–133. – Kromer 1959.

821 Pertlwieser 1987, 55–70.

trimmings, remnants of leather and animal hair were preserved through oxide penetration, which suggest a flamboyant cloak made of leather, and perhaps in part made of fur. In addition, this rich woman wore a spiral headed pin, five pairs of bronze rings above the ankles, amber necklaces with multiple rows of bronze and amber beads, which may have once belonged to a magnificent bonnet.

Leaving the level of the richest burials, one is faced with a large number of graves quite handsomely equipped with jewellery[822]. Although there are numerous variants and combinations of decorative and costume elements in Hallstatt period graves, some general patterns can be discerned: men are frequently equipped

Fig. 216. Grave X, Burial Chamber 2 from Mitterkirchen in Austria, Early Iron Age. Context drawing and reconstruction of the cloak.

822 Rebay 2007, 134–156.

with a long pin on the chest or shoulder and an element of a belt (belt hook, belt plate or sheet bronze belt), which characterises the 'civilian' costume[823]. They also appear together with spear-heads and swords or daggers in warrior graves. Some protective gear such as helmets may also complete the set.

The most important metal item used in the Iron Age as a clothes fastener is the fibula[824]. In principle, it functions like a safety pin. In addition to their practical purpose as fasteners they were flashy jewellery and subject to fads of fashions, more or less like the design of pins changed during the Bronze Age. The shape and ornamentation of fibulae can be studied to reveal cultural connections and chronological trends. The spatial and temporal distribution of the fibulae will not be discussed in detail in this book; here, we are interested in the positioning on the body in which these clothes fasteners appear in the graves.

Female graves are often difficult to compare with each other because of their extraordinary wealth and variety. Except for the abundance of grave goods, there are few general patterns or common denominators. In Hallstatt period women's graves paired fibulae or pins are commonly encountered in the upper body / shoulder region. Most clothes fasteners are symmetrically arranged left and right of the shoulders. Sometimes the two fibulae are also arranged in parallel on the right shoulder. Further jewellery such as bracelets or anklets, hairpins and various necklaces completed the ensemble. Belts in the form of belt fasteners or belt plates[825] emphasised the waist.

The shape of the fibulae is subject to regional variation. The cemetery of Hallstatt[826] (Fig. 217) contained numerous fibulae with double bronze spirals as the main body and sheet metal rattling pendants, combined with sheet bronze belts in rich graves. Many finds from the rich burials give us an impression of splendour,

823 *E.g.* Hodson 1990. – Kromer 1959.

824 For an overview on types and stylistic development of fibulae in different times and cultures, see Müller *et al.* 1994, 411–607.

825 Pabst-Dörrer 2000, pl. 3, 4. – Hallstatt: Kromer 1959, plates.

826 Kromer 1959. – Hodson 1990. – Kern, Lammerhuber and Schwab 2010.

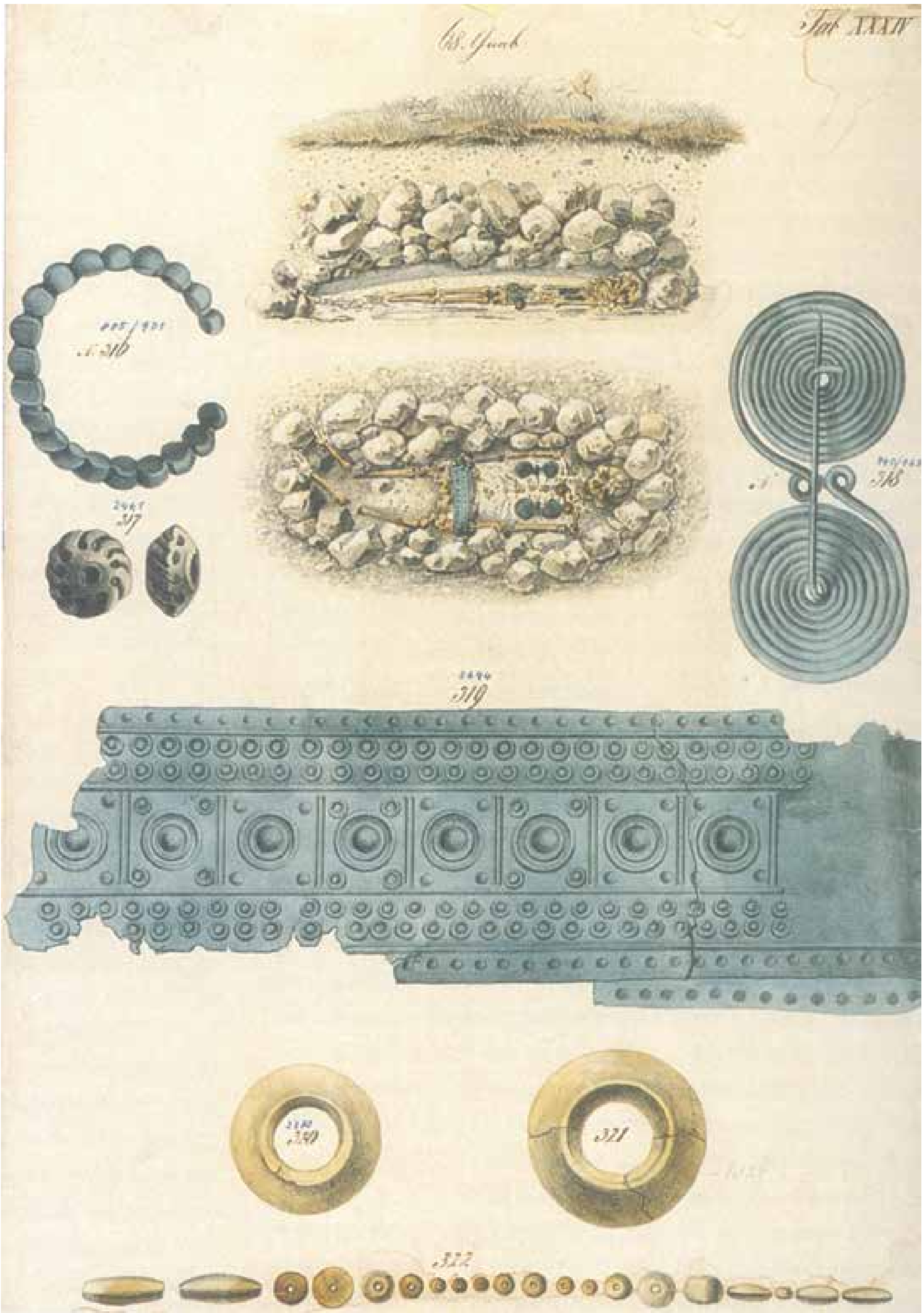


Fig. 217. Woman's grave from Hallstatt with belt plate and spectacle fibulae, Early Iron Age. Watercolour painting from Johann Georg Ramsauer's documentation of the cemetery excavations in 1846.

as do the 19th century watercolour paintings, which illustrate the positions and contexts in which the items were found.

When several fibulae were present in one grave, they could have in principle also belonged to several garments. The shapes and sizes of the fibulae found within a grave may vary, which possibly indicates under and over garments of different cloth qualities (coarse and fine ones). In the late Hallstatt period in Northern Württemberg[827] the woman's costume consisted of up to three fibulae; in addition to the symmetrical pair at the shoulders, a smaller third fibula is found in the centre of the chest. This most likely reflects the custom of wearing an under and over garment, fastened at the neck.

Overall, it can be noticed that there is a tendency towards increasingly smaller forms of fibulae as the Iron Age proceeds, in tandem with finer and finer textile qualities. The spectacle fibula of the early Hallstatt period are still very coarse and have very thick pins (which are better suited to fasten coarse fabric materials); in the late Hallstatt and especially in the La Tène period there are very lightweight and delicately designed small fibulae with tiny catch plates. These are ideal for fine fabrics, since thicker pins would damage the textiles (see Fig. 207).

In addition to fibulae and belts, there are also other clothing fasteners. We know some examples of buttons made of ceramic or deer antlers from the Hallstatt period. These are usually serrated or star-shaped and occur mainly in southern Moravia, Lower Austria and Slovakia. Austrian sites in which such buttons have been found include Leopoldsberg near Vienna and Unterparschenbrunn[828] (Fig. 218). Compared to fibulae, buttons are very sparse. The button as a primary means of fastening clothes apparently did not become popular until the Middle Ages, although it appeared again and again from the Stone Age onward. Because no buttons have been found in grave contexts, it is unclear what exactly had been fastened with them. The buttons all stem from archaeological excavations in settlements, where they were lost by the people who wore them.

827 Müller *et al.* 1994, 441.

828 Griebl 1996, 95–114. With further examples from Slovakia.

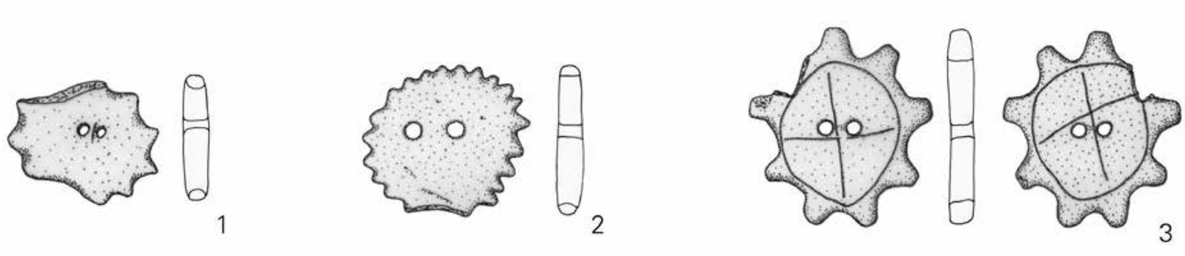


Fig. 218. Early Iron Age ceramic and antler buttons from Austrian sites: Leopoldsberg/Vienna (1), Unterparschenbrunn (2), Horn (3).

The clothing fastened by fibulae as we know it from graves cannot be directly related to contemporaneous illustrations, as unfortunately no pictures of garments with fibulae can be identified from the Early Iron Age in Central Europe. Even buttons in the correct position to fasten a garment are never shown on images. What the garments might have looked like, which were represented by the clothing components in the graves in situ, will be discussed below.

Pictorial sources for clothing

Figurative art[829] of the Hallstatt Culture is generally not very naturalistic. From the western Hallstatt area representations of clothed people are rare, while several images are known from the eastern Hallstatt area. Sets of small ceramic figurines were found, for example, in Gemeinlebarn or Langenlebarn in Lower Austria. They were most likely arranged in scenes on small ceremonial wagons or conical necked vessels (Fig. 219). The various human and animal figurines told a story inaccessible to us today. The human figurines are flat like a wooden board. Women are represented with breasts and dresses with wide swinging skirts, the hem reaching only up to the knees. Most figurines from Central Europe, however, represent people without clothes.

More human representations have been found in the area of the Kalenderberg Group at the north-eastern edge of the Alps (in Lower Austria, Burgenland, western Hungary, Slovakia), which belonged to the eastern Hallstatt Culture. In the 7th century BC, it was customary to decorate pottery with elaborate geometric patterns as well as with representations of people[830] (Fig. 220).

829 Huth 2003. – Rebay-Salisbury 2014. – Reichenberger 2000.

830 Dobiat 1982. – Reichenberger 2000.

Fig. 219. Early Iron Age figurine from Gemeinlebarn in Austria and reconstruction of the conical necked vessel.

In these images, the people are abstracted and drawn very schematically. The representation was reduced to the mere signalling of what was represented; a simple triangle with a dot as a head, and perhaps strokes as arms and legs was enough to represent a human being. Scenes including wagon rides, music and dancing and hunting are also shown. The clothing remains mostly reduced to differently designed and decorated triangles. The images are far from accurate representations of clothing, but they reveal several interesting details (Fig. 221). There are 'women' who were obviously dressed in a skirt and top, while the garment of others represented with a continuous triangle from the head to the legs could rather be interpreted as a dress. The skirt fitted to the waist comes in different shapes, but is usually depicted as a triangle. The skirt depicted on a vessel from Sopron-Várhely (Hungary), Tumulus 28[831] (after Eibner 1980), is even a bell-shaped skirt that in its dimensions evokes associations with the crinoline skirts popular in the 18th and 19th centuries AD. In this case, however, it is more likely that the particular shape indicates a rotating movement – a dance[832].

[831] After Eibner 1980.

[832] Eibner 1997, 129–145.

Fig. 220. Conical necked vessel with incised decoration featuring human figures from Sopron-Várhely in Hungary, Early Iron Age.

'Men' are usually drawn as stick figures (Fig. 221.9), but there are also unique representations of trousers. People with narrow triangles as dresses are also often interpreted as male. In the famous weaving scene on the conical necked vessel from Sopron, Tumulus 27, the thin triangular person with lyre is interpreted as a man (Fig. 221.6), whereas the people spinning, weaving and dancing are represented with wide triangles and interpreted as women.

There are a few monumental statues[833] dating to the late Hallstatt and early La Tène periods, for instance the warrior of Hirschlanden in Germany. The stone statues are confined to the western Hallstatt area and can be traced back to Mediterranean models. In their symbolism they are strongly linked to the representation of rulership. Amongst the usually naked representations (with only a pointed hat and a torque) the Glauberg statue stands out with his ornate composite armour decorated by a meander motif (Fig. 231). Again, the head is an important zone of ornamentation; this time, a leaf crown is represented. Interestingly, the wire frame of such an unusual headdress has indeed been detected in a burial mound on the Glauberg[834]; the representation can thus be classified as quite realistic. Otherwise, the monu-

[833] Frey 2000.

[834] Bagley 2014, 415, Kat. Nr. 118.

mental statues of the Celtic Iron Age do not add much to the question of clothing.

5.3 Representations of clothing on situlae

The most detailed representations of clothing can be recognised in the late Hallstatt / early La Tène period situla art[835]. The works of situla art were produced between the 6th and the 4th centuries BC in the alpine and south-eastern Alpine region between the Danube and Po rivers, the areas of the eastern Hallstatt as well as the Este Cultures. The images on the early La Tène scabbard from Hallstatt, grave 994[836] are designed in a different technique. They also show stylistically similar imagery, especially in the way people and their clothing are represented, which is why this particular find is also treated here in this context. As with the illustrations on ceramics, which are largely derived from rich graves, situla art is clearly linked to the lives of the elite, who presented themselves in this medium.

Although both style and content of these early images show southern influences, it is certain that the artists adhered to local models in terms of the details of weaponry and tools: the objects represented have good parallels in graves of the same area. It is thus assumed that the items made of organic materials, such as the clothes, equally correspond to the circumstances of time and place. The clothes represented in situla art also might be partly inspired by Etruscan templates[837], just like other parts of the image content (*e.g.* animal representations, various forms of helmets). As mentioned in the introduction to this chapter, situla art probably shows symbolic themes as well as the ideas, lifestyle and festivities of the elites.

The **women** in these pictures (Fig. 221) usually wear long dresses reaching to the calves with elbow-length sleeves. These garments may have a straight or uneven hem and are partially decorated with borders. The dress may be gathered with a belt

835 Frey 2005. – Lucke and Frey 1962. – Rebay-Salisbury 2014. – Turk 2005.

836 Barth und Urban 2007. – Egg *et al.* 2006.

837 Bonfante 2003, *e.g.* fig. 2–18, 72–75.

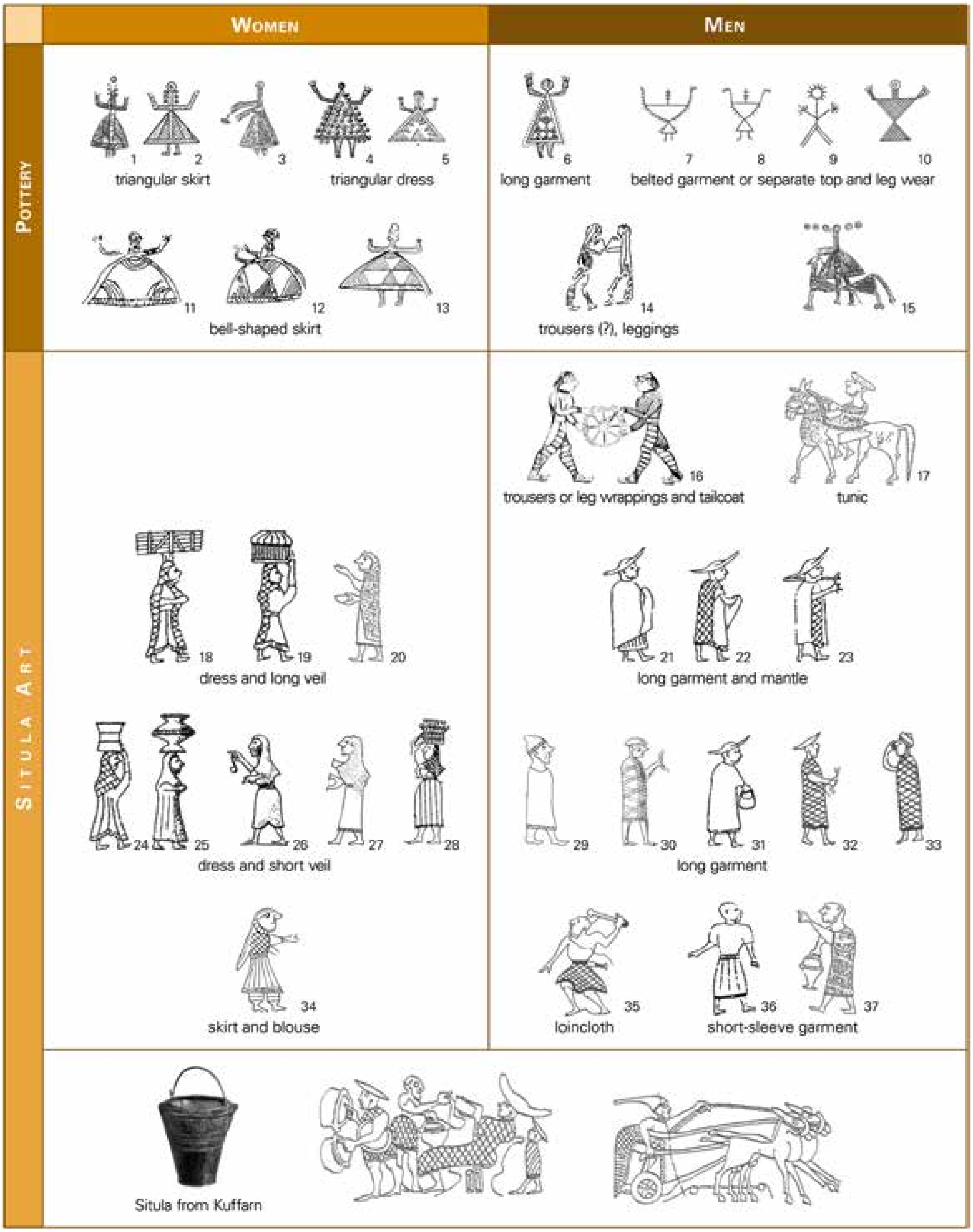


Fig. 221. Human representations on Early Iron Age pottery and situlae. Sites with pottery: Sopron (1–6, 11–15), Nové Košariská (7–8), Klein Klein (9), Dietldorf (10). Sites with situla art: Hallstatt (16), Vače (17, 20, 37), Certosa (18–19, 21–25, 31), unknown find spot, situla stored at Providence, USA (26), Welzelach (28, 32–33, 35), Magdalenska Gora (27, 29), Moritzing (30), Carceri near Este (34).

around the waist. A veil or a headscarf of different lengths is always combined with the dress. Sometimes the veil is longer and extends approximately to the knees or calf. These long veils are also sometimes slashed, so that one part covers the front of the chest, whilst the other covers the back and the arms can move freely (Fig. 221.18). The extra-long veils could perhaps also be cloaks drawn over the head.

Particularly interesting is the representation of a woman on the belt buckle of Carceri near Este in Italy (Fig. 221.34). In this scene, a man reclines on a couch and a woman serves him; she hands him a double-handled cup whist holding a beaked flagon in the other hand. The woman does not wear the long dress like other women on objects of situla art, but is dressed in a combination of skirt and blouse. The short sleeved top is checked, while the skirt is held by a belt and decorated by radial strips as well as a border at the hem. It is not necessarily possible to clarify whether the strips are supposed to represent a hint of ornament or drapery. A veil extending as far as the buttocks completes the ensemble as in the usual manner. In addition, however, something unusual is represented: a thickening on the legs indicates the lady was wearing leggings or trousers.

Men's clothing in situla imagery (Fig. 221) largely consists of a tunic or shirt-like garment, either sleeveless or with elbow-length sleeves. The garment is not belted and falls smoothly down from the neck, extending to the calf or to the ankle. The garment is on occasion depicted as checked or striped; the hem is often decorated with a border. The garment covers the body so completely that any underwear is not detectable. Sometimes a cloak is worn over it.

Warriors (both infantry and mounted soldiers), such as the ones depicted on the scabbard of Hallstatt (Fig. 222), wear variously designed helmets and long-sleeved, shorter garments; they sometimes also wear sleeveless armour, which is decorated with stripes or checks. Quite likely, this represents composite armour made of leather or linen, similar to the one shown on the monumental statue from Glauberg. Men engaged in physical activity, such as the 'waiter' on the Situla from Kuffarn (Fig. 176), who serves the enthroned person wine, have clothing reaching only

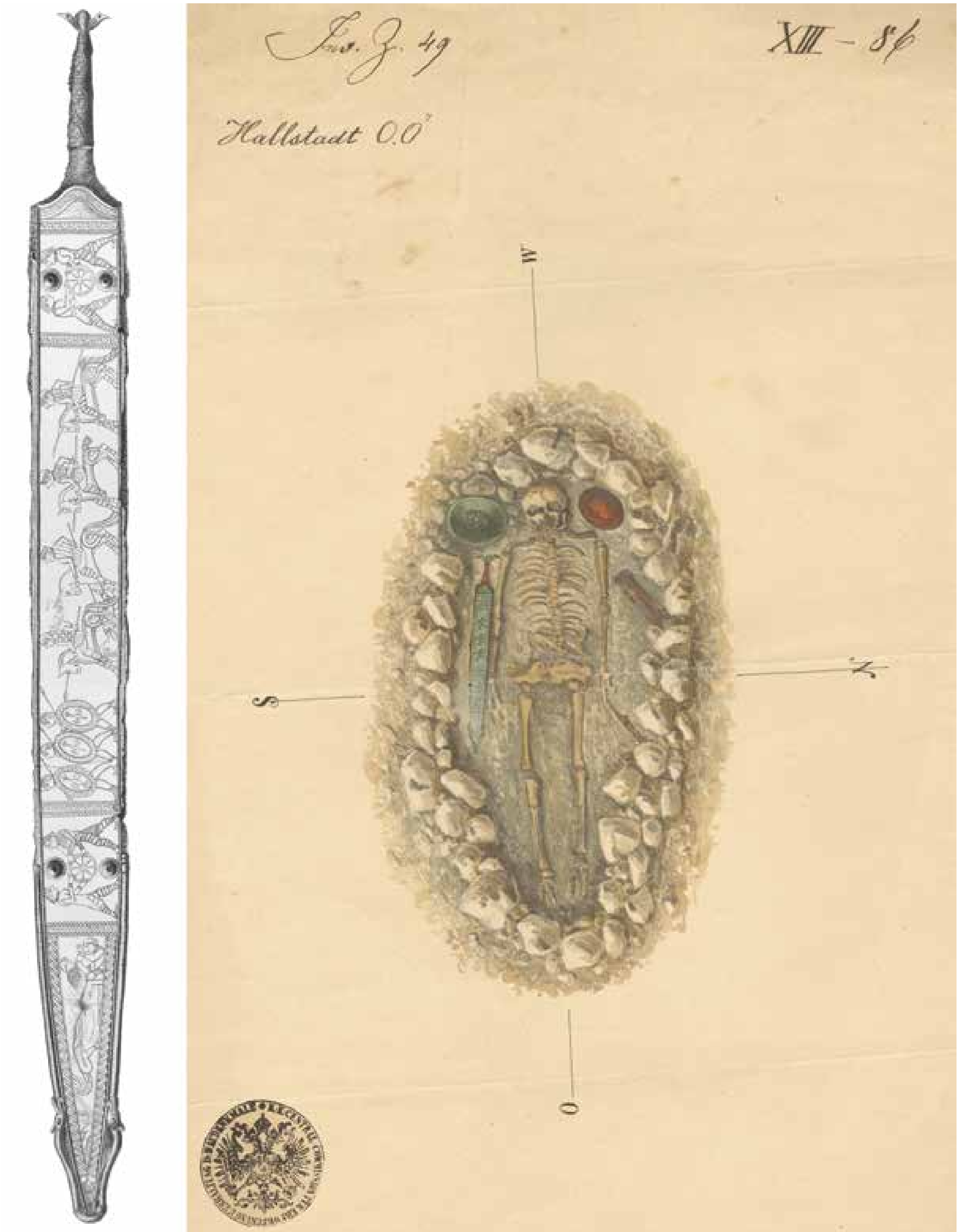
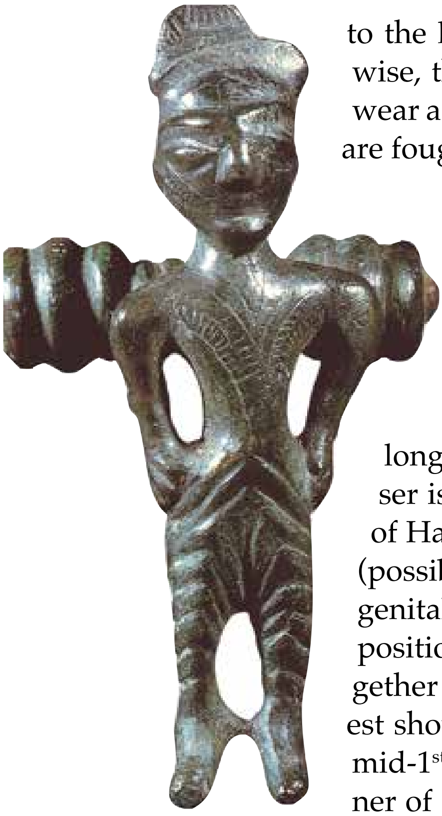


Fig. 222. Sword scabbard from Hallstatt, Grave 994, early La Tène period. With water coloured drawing of the grave.



to the knees – if they are not only wearing a loincloth. Likewise, the 'hunters' on the Situla from Welzelach (Fig. 221.35) wear a loincloth and are otherwise shirtless. Sportive fist fights are fought completely naked.

Representations of legwear, probably trousers, can be found on the early La Tène scabbard from Hallstatt and on the belt plate of Molník in Slovenia[838], dating to the 6th or beginning of the 5th centuries BC. In this image, the striking 'archer' wears wide trousers with a barely visible, incised fabric pattern, plus a long-sleeved shirt and a pointed cap. Another type of trouser is depicted on the 'wheel bearers' on the scabbard from of Hallstatt. There are tight-fitting trousers with rich pattern (possibly with laces and wraps), reaching to the hip. Since no genitals are shown, which should actually be visible in this position, it can be assumed that the trousers were sewn together at the crotch. These representations are among the oldest showing trousers in Central Europe; they are dated to the mid-1st millennium BC. Nowadays this garment and its manner of construction are so common that it is rather difficult to imagine how humanity could ever have lived without it.

Fig. 223. Dürrnberg-Eislfeld in Austria, Grave 135. Fibula in human shape, Late Iron Age.

On the scabbard from Hallstatt, the fitted, patterned trousers are combined with a dress coat with folded-back tails. Thus, the outer garment has an extended back, while the front legs remain uncovered to the hips. This strange attire can be found on other representations of the early La Tène period as well. The chariot drivers on the Situla from Kuffarn (Fig. 221), for example, or the figurine on the early La Tène fibula from Dürrnberg-Eislfeld, grave 135[839] (Fig. 223), in which this 'tail suit' is combined with wide, heavily pleated trousers.

The famous scene of four men with trousers on the scabbard from Hallstatt has inspired different interpretations. It was first interpreted in terms of the local salt mining industry. The wheel, which two of them hold, was declared a windlass used for heavy lifting in the mines. Accordingly, the people in the im-

[838] Turk 2005, fig. 87.

[839] Zeller 1980, 126, fig. 17.

age were interpreted as miners and the unusual tails on the upper garment would have represented '*Arschleder*'[840] ('arse leathers') designed to protect the trousers of the miner from fraying. According to a recent reinterpretation by the Hallstatt specialists Fritz-Eckart Barth and Otto H. Urban[841], however, the scene does not depict mining history, but illustrates the three types of armed forces important to the early Celts: cavalry, infantry and chariots with drivers. The men holding a wheel between them thus symbolise the chariots (on the situla from Kuffarn, however, they are depicted at full speed). According to this interpretation, the garment with tails is the protective gear of a chariot driver. If one pictures such a fight scene, the purpose of this clothing becomes clear. According to Barth and Urban, the back of the chariot driver was defenceless after breaking through the battle line, particularly to every type of thrown weapon. Without infringing on the legroom – vitally important for chariot drivers – the extended back cover could have ensured effective protection, even if it consisted only of relatively thin material.

5.4 Evidence for Late Iron Age clothing in Central Europe

No uniform costume existed for all Celts. The various Celtic tribes lived in widely dispersed areas throughout Europe and had different points of contact with other cultures. Therefore, it is likely that they adopted different clothing habits. The archaeological source material is scattered over Europe, similarly to that of the Hallstatt period. The written sources are a novelty, which, for the first time, provide concrete names and concepts for the archaeological data.

Design of La Tène period textiles

Archaeological discoveries inform us well about the appearance of textiles in the La Tène period. Over 600 textile remnants from

840 *E.g.* Egg *et al.* 2006, 194.

841 Barth and Urban 2007.

the salt mines of Dürrnberg near Hallein[842] in Austria offer a colourful picture of what was common in the textile sector during the early La Tène period. As before, fine fabrics are present, but now tabby weave is predominant and twill is found in simple versions. Both wool and linen were detected as raw materials during analyses; both materials were dyed as already known from the Hallstatt period. Stripes were preferred, but checks and spin direction patterns that characterize the textile work in the Hallstatt period are rare. Exceptional individual pieces were produced applying checkerboard, diamond and meander motifs in different techniques with floating thread systems and in tablet weaving.

A large number of simple tabby weave textiles have also been obtained from La Tène period graves in Austria, the Czech Republic and Slovakia[843]. The magnificently embroidered fabric from Nové Zamky stands out particularly. It should be noted however, that the textiles from La Tène graves in Central Europe often do not have a direct contextual relationship to the clothes, but fulfilled other functions. For example, there are many fabric scraps in secondary use, such as a filling for hollow arm rings (see Fig. 167) or as wraps of objects. In any case, however, the textiles reflect the types of fabric quality that were in use at the time.

Antoinette Rast-Eicher[844] ascertained on the basis of textiles from La Tène period graves in Switzerland that women in the early and middle La Tène period wore a belted linen garment (dress), whereas in the late La Tène period a coarse to medium cloth, held together by a pair of fibulae at the shoulders, was popular; the garment probably looked similar to the dress of Menimane, shown on the famous grave stone from Mainz-Weisenau in Germany, dating to the 1st century AD[845].

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842 Grömer and Stöllner 2011. – Stöllner 2005. – von Kurzynski 1996.

843 Belanová 2005; 2012, pl. 15.2–15.4. – Grömer 2012, 46–47, pl. 1.1.

844 Rast-Eicher 2008, 177–188, 191; 2012.

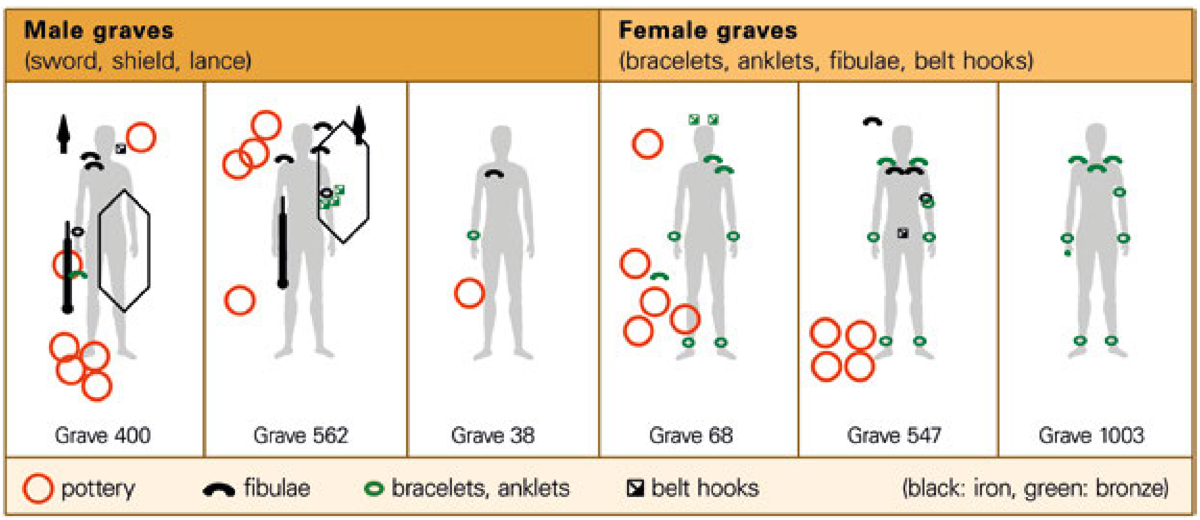
845 *Cf.* Böhme-Schönberger 1997, fig. 18.

Grave finds

One most directly encounters the clothing of the people of the La Tène period in their graves. Especially the fibulae are important metal dress accessories that fasten the clothes worn on the body; they are found in graves of the early to middle La Tène period from the 5th to the mid 2nd centuries BC. The style and décor of fibulae as well as the way they were worn differs from region to region[846]. In Baden-Württemberg, for example, male graves tend to contain an almost 6 cm long iron fibula worn at the left shoulder. Women are usually found with two fibulae, one placed symmetrically on each shoulder. In southern Bavaria and Switzerland, fibulae are so popular that men are usually buried with two fibulae and women with up to seven, although two or three pieces are most common. In excavations these are usually recovered in the shoulder or chest area, distributed either on both shoulders, or all on the right shoulder. A single fibula is 5 cm long or larger. If several fibulae are discovered in one grave, they are often a combination of one large and several small fibulae.

La Tène woman from Austria[847] wore a similar combination of fibulae (Fig. 224). In addition to the pairs of fibulae worn on the

Fig. 224. Graves with fibulae from the Late Iron Age cemetery at Pottenbrunn in Austria.



[846] Lorenz 1978. – Maute 1994, 458–467.

[847] *E.g.* Ramsl 2002; 2011; 2014b, fig. 15.

Fig. 225. Late Iron Age belt chains worn on the body, reconstruction. Model: Gloria Lekaj.

shoulders, there are also cases in which two fibulae were found close together on one shoulder. Men typically have only one fibula in the grave, usually worn on the right shoulder. In the Czech Republic and Slovakia men usually wear a 6 cm long fibula on the right shoulder, the women normally only one or two in the shoulder or chest area, rarely more. Two fibulae are predominantly found close together on a shoulder.

Additional clothing accessories found in graves show that the garments were also belted[848]. Early La Tène male and female graves contain elaborately designed belt hooks, which probably fastened a leather belt. Belt chains became popular in the middle La Tène period for women, and were wrapped around the body in a decorative way. The chains were longer than the waist circumference of women in general, so their length was adjusted by hooking a hook end into a chain link (Fig. 225). In the middle La Tène period, men preferred sword chains in addition to the simple leather belts with metal hooks.

The belt had several functions. On the one hand it gathered the material of the garments at the waist, but on the other hand, it was useful for carrying various items on the belt. Typical for the women's costume was a bag worn on the right side. Its metallic components are sometimes discovered as characteristic accumulation in the graves.

The Celt's preference for jewellery is well known. Even the ancient authors report about it in detail and further enlightening evidence comes from graves. The torque became almost a symbol of Celtic identity (Fig. 226); it is a neck ring open at the front, with often elaborately decorated ends of various shapes. Virtually no representation of Celts from antiquity[849] lacks a torque. It

848 Müller 1999, 159–166.

849 Thiel 2000, 73–76.

Fig. 226. Golden torc from Oploty, Czech Republic (reconstruction) and bracelets, Late Iron Age.

was mostly worn by warriors, but the torque also appears especially in middle La Tène period women's burials[850].

Occasional pins in the chest or head area of women's graves can be linked to the fixing of a head covering such as a veil (Fig. 227). In addition, a variety of decorative elements, especially necklaces made of glass beads, finger rings, arm, foot and neck rings[851] may be found in the graves. The composition of the ring jewellery in women's graves follows certain regular patterns, in terms of where on the body specific varying numbers of rings occurred. The ring jewellery patterns differ from region to region, but they may also include statements about the social position of the wearer – just like today a ring on the finger may signal an engagement or has importance as a wedding ring. Herbert Lorenz has suggested that the sets of rings incorporated in the costume may mark certain stages in women's lives, such as married women, those who had children or maybe those who were widowed. In the late Hallstatt and early La Tène periods,

[850] Bujna 2005, *e.g.* fig. 3, German summary 173–194.

[851] Lorenz 1978.

small buttons or club-shaped pendants with eyelets are occasionally found in the foot area of men's and women's graves[852]. They may be associated with shoes (Fig. 227).

That a high value was placed on personal hygiene and a neat appearance is attested by various toiletry articles. In the graves

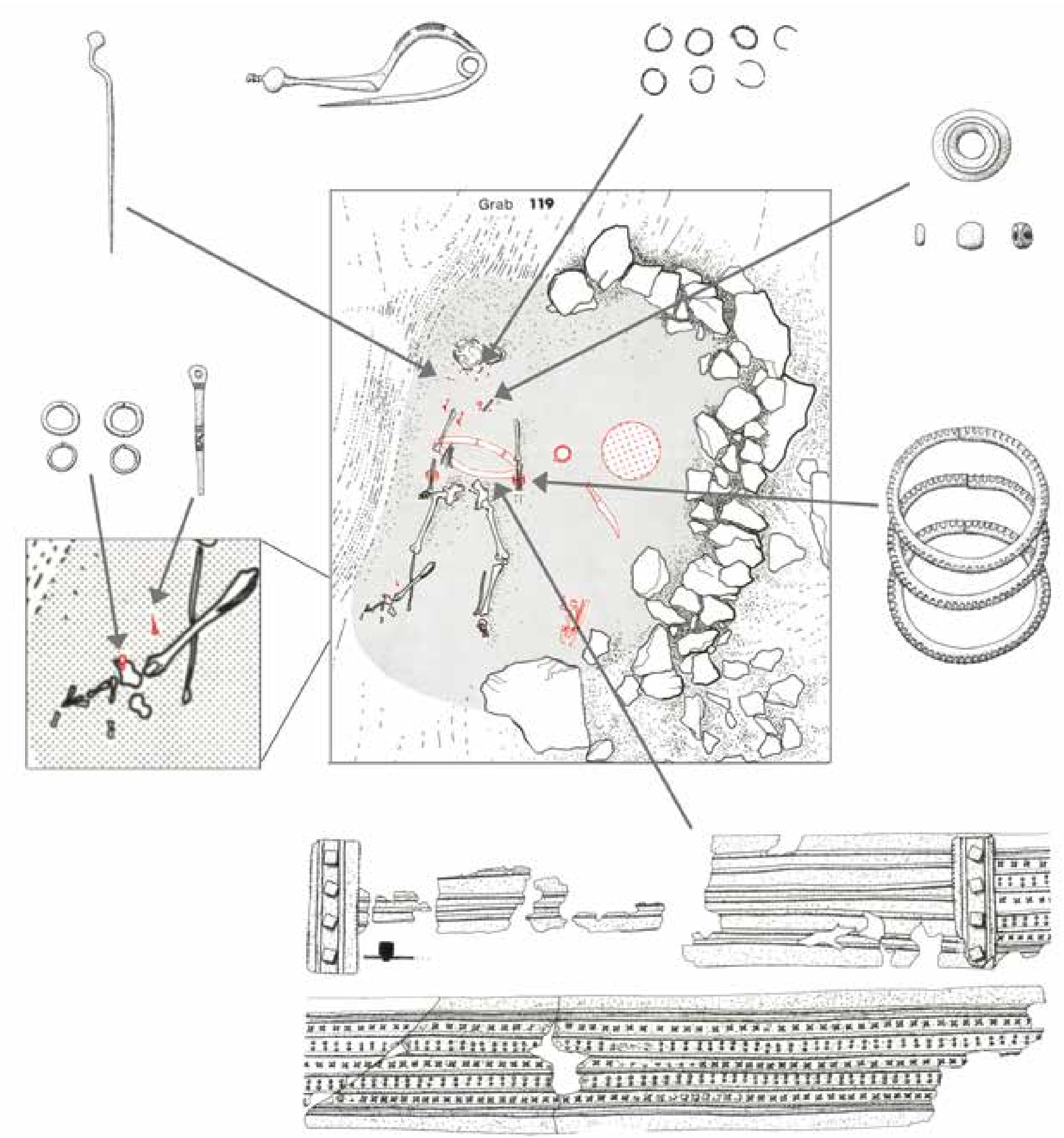


Fig. 227. Grave 119 from Dürrnberg-Eislfeld, Austria: Late Early Iron Age woman's grave with costume components (selection).

[852] Schönfelder 1999, 537–552.

of the Dürrnberg, for example, tweezers, scrapers, razors, grinding stones for sharpening the razors, and various tools for the care of fingernails are repeatedly found in male graves. Grave 44, for example, contained a two-piece toiletry set made of bronze, consisting of tweezers and a scraper, which is decorated with the head of a bearded man only a few millimetres high[853]. Evidence for late La Tène costume is sparse, because cremation prevailed at the time.

Fig. 228. Statuette of Idrija pri Bači in Slovenia. A man wearing a tunic, 5th century AD.

The observations presented here on La Tène grave inventories summarise basic tendencies that can be broken down in many ways – regionally, chronologically and in terms of different social levels. This, however, is the subject of many archaeological treatises[854] and would go beyond the framework of this book.

Pictorial sources for clothing

Late Hallstatt and early La Tène images of women's and men's clothing are mainly found on the numerous works of situla art mentioned above. A scene echoing the situla style that was incised on a scabbard from grave 994 in Hallstatt also was discussed before. In this section we will focus on other Iron Age human representations of the 5th–1st centuries BC.

Small bronze figurines[855] such as those found in Idrija pri Bači, Slovenia (Fig. 228) or on the Partinspitze near Imst in Tyrol (Fig. 229.1) complement the picture. Both examples date to the 5th century BC and show men dressed in late Hallstatt style short-sleeved, knee-length tunics. Early La Tène figurative depictions[856] are otherwise found almost exclusively on objects of arts and crafts, as ornamentation of vessels or integrated into bracelets, belt hooks or fibulae. Most of them only show the human head; the previously described early La Tène fibula from Dürrnberg is particularly rich in detail. The gold neck rings from

853 Penninger 1972, 78, pl. 42 A/3.

854 *E.g.* Bujna 2005. – Maute 1994. – Müller *et al.* 1994. – Ramsl 2002; 2011.

855 Idrija pri Bači: Gustin 1980. – Imst: Exhibition Catalogue 1997. Cover photo.

856 For general points on La Tène figurative representations, see Bagley 2014, 277–282. – Frey 1993, 153–168.

the treasure of Erstfeld in Switzerland[857] depict human figures alongside human-animal hybrids. As far as clothing can be discerned, they wear patterned trousers.

Early La Tène representations appear extraordinarily varied. No piece is like the other, as these are usually individual creations cast in the lost-wax technique. Celtic craftspeople modelled the objects in wax first, then covered them with clay and fired the mould. Upon firing, the liquid wax vanished and left a cavity, which was then filled with molten metal. Once the metal cooled and hardened, the mould was broken to remove the object.

At the end of the early La Tène period Celtic craftspeople discovered new forms of expression by fusing faces and ornaments into expressive symbols. These are usually very abstract and therefore not readily usable as sources for the reconstruction of La Tène garments.

The middle La Tène period representation of a man from Leipzig-Connewitz[858] appears on a belt hook; it shows a man standing with legs apart and leg wraps. The intersecting lines on the legs to the thighs indicate the way the binding was wrapped. Although the image was found in Germanic territory, its style reflects Celtic influences.

Numerous figurative works of bronze were found in the middle to late La Tène period *oppida*, town-like settlements north of the Alps. The pommels of sword handles are frequently designed in human form; linchpins on chariots and wagons are sometimes adorned with human heads.

The images of gods on the famous Gundestrup cauldron found in Denmark[859] occupy a special place amongst Iron Age representations. The cauldron was most likely manufactured in the centuries around the birth of Christ, but its origin is still unclear. The combination of Celtic and Thracian image elements possibly points to the Lower Danube region (present-day Bulgaria

857 Wyss 1975.

858 Frey 1993.

859 Nielsen 2005. – Taylor 1992.

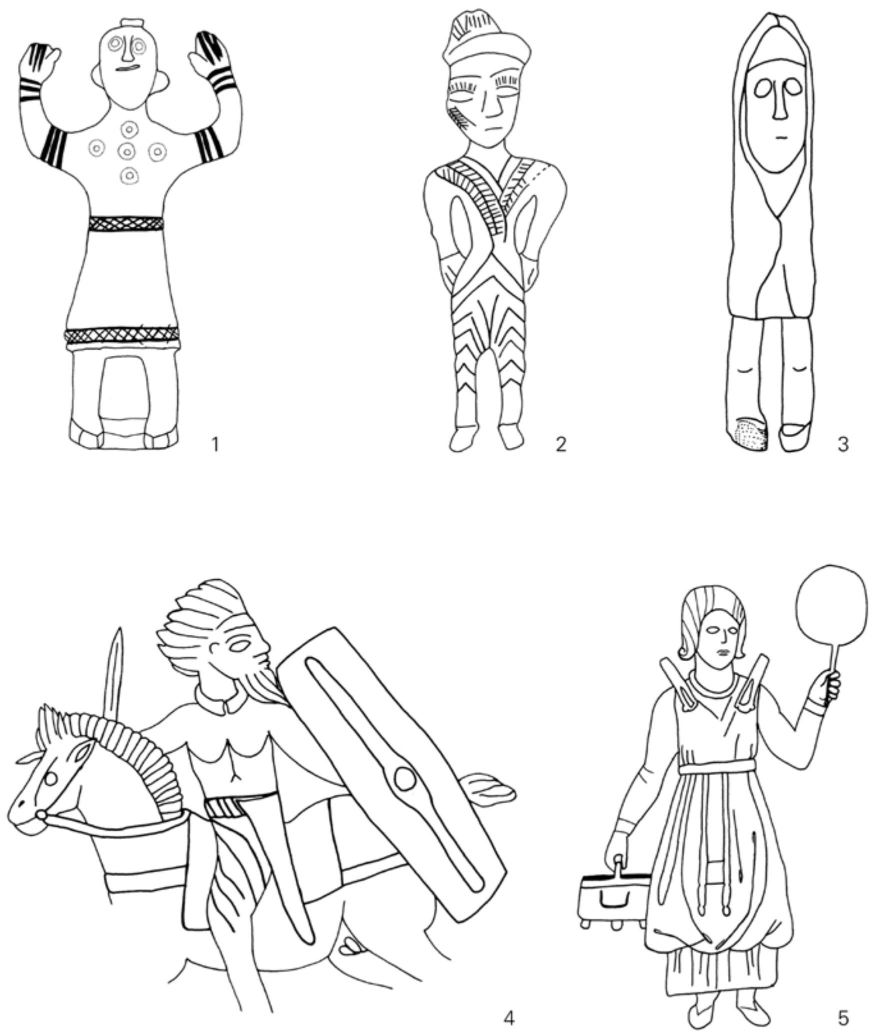


Fig. 229. Selection of human images from the 5th century BC to the 1st century AD: votive figure from Imst, Austria, 5th century BC (1), Early La Tène fibula from Dürrnberg/Hallein, Austria (2), Gallo-Roman votive offering from the sources of the Seine, Saint-Germain-Source-Seine, France, 1st century BC (3), Late Iron Age horseman from Magdalensberg, Austria (4), girl in Noric costume, tomb stone from Klagenfurt, Austria, 1st century AD (5). Different scales.

and Romania). The most striking garments represented are tight trousers; binding methods such as pointed twill are probably shown by the patterns.

Images of trousers[860] are known from a bronze figurine from Neuvy-en-Sullias in France, showing a dancer with checked trousers, and the representation of a horseman from the Magdalensberg in Austria (Fig. 229.4). This Celt with sword and shield is shown with naked torso, wearing wide trousers and a torque.

[860] Cunliffe 1979, 26–27, 100–101.

Both depictions date to the beginning of the Common Era, the end of the La Tène period and the beginning of Roman times.

During this time, large statues of wood and stone were created, which can be interpreted as gods. Examples include the stone reliefs from Entremont, France, the stone relief showing the goddess Epona from the Rhineland and wooden Gallo-Roman votive offerings, especially from France. These representations were, however, already created under Roman influence. A hooded cloak can be seen on a wooden figure from the headwaters of the Seine River in France (Fig. 229.3).

Even Roman period grave monuments from the provinces along the Danube and Rhine rivers sometimes provide insights into the forms of clothing that clearly have their roots in the Iron Age. First and second century AD tombstones show old, pre-Roman elements, particularly the custom of wearing a pair of fibulae on the shoulders[861]. Examples include the grave stones of Blussus and Menimane from Mainz, Germany, and the 'Norican girl' on the famous grave stone from Klagenfurt, Austria (Fig. 229.5).

Written sources

From the 2nd century BC onwards written sources contribute to our knowledge of Celtic clothing. This 'outsider's' view on the clothing of the Celtic and Germanic tribes (the terms are sometimes equated or used interchangeably), given by Greek as well as Roman authors[862], are valuable sources, even if they sometimes just repeat platitudes or deliver ideologically biased statements. As to the appearance, body size and the light skin and fair hair are often emphasised, for example by the Roman historian Tacitus (Tac., *Germ*. 4), who writes: '*…hence their body features are all alike… reddish hair eyes cruel and blue, large strong bodies good only to strike...*'. The ferocity of the Celts is also expressed

861 Böhme-Schönberger 1997, Blussus and Menimane, fig. 18. – Noric-Pannonian costume: Garbsch 1965. – Rothe 2012. – Rhine-Mosel area: Rothe 2009.

862 Translations after http://penelope.uchicago.edu *and* http://www.crtpesaro.it (last accessed 30th Nov. 2014).

in the description of Celts as barely clothed. Sallust, the Roman historian and contemporary of Caesar, thus writes (Sall., *Hist*. 3, 104-105): '… *the Germans* [= Celts] *cover their unclothed bodies with skins*.'

Diodorus Siculus, a Greek historian of the 1st century BC, wrote a universal history in 40 books from various viewpoints, in which he wanted to both teach and entertain. He also mentioned the wild nakedness of the Celts, particularly during fighting (Diod., *Hist.* 5, 29.2): '*Certain of them despise death to such a degree that they enter the perils of battle without protective armour and with no more than a girdle about their loins.*' Polybius, however, writes in his 2nd century BC *Histories* (2, 28.7-8): '*The Insubres and Boii wore their trousers and light cloaks, but the Gaesatae had discarded these garments owing to their proud confidence in themselves, and stood naked…*' The Celtic tribes of the Insubres and Boii settled in the eastern Alps, and from the 2nd century BC onwards also in northern Italy.

Diodorus Siculus also delivered more precise descriptions of typical tribal clothes. About the Celts (Gauls), he writes the following (Diod., *Hist*. 5, 30.1): '*The clothing they wear is striking – shirts which have been dyed and embroidered in varied colours, and trousers, which they call in their tongue bracae* [βϱάκαι]*; and they wear striped cloaks* [σάγος, sagum], *fastened by a brooch on the shoulder, heavy for winter wear and light for summer, in which are set checks, close together and of varied hues…some of them gather up their shirts with belts plated with gold or silver*.'

The historian and geographer Strabo, who worked around the beginning of the Common Era, in a time of intense contacts between the Romans, Celtic and Germanic tribes, reports similarly on the Belgae – the bravest among the Celts, as he emphasises (Strab., *Geog*. 4, 4.3): '*The Gallic people wear cloaks* [i.e. the sagum], *let their hair grow long and wear tight trousers; instead of tunics they wear slit shirts that have sleeves and reach as far as their private parts and the buttocks. The wool of their sheep, from which they weave the coarse cloaks they call* laenae *is not only rough, but also flocky on the surface.*' On the elite we read later on (Strab., *Geog*. 4, 4.5): '*In addition to their trait of simplicity and high-spiritedness, that of witlessness and boastfulness is much in evidence, and also that of fondness* *for ornaments; for they not only wear golden ornaments – both chains round their necks and bracelets round their arms and wrists – but their dignitaries wear garments that are dyed in colours and sprinkled with gold.'*

This small selection of ancient texts show a clear picture: they describe, for the most part, elements of clothing that emphasise the 'otherness' of northern barbarians in contrast to the civilized (= Roman) world. The most prominent garments for which the name is thus known are the trousers called '*bracae*' and the cloak held by a fibula called a '*sagum*'. Both were later incorporated into the attire of Romans, especially in the military, as the expansion of the Roman Empire to the north demanded suitable clothing for the local climate[863].

5.5 Iron Age head coverings and shoes

Head coverings

Anthropomorphic figures on pottery do not add a lot to our knowledge about head coverings, because they are very schematic. Especially differentiated is the headgear as shown on the works of situla art[864] (Fig. 221 and 230), if people are not shown bare-headed and/or bald. Women are usually depicted with veils of different lengths. Warriors – men armed with swords and shields wear helmets of types known from contemporary finds in the same area. *E.g.* it is possible to compare helmets from Magdalenska Gora or Brezje in Slovenia (type '*Doppelkammhelm*' and Negau, 6th century BC) with depictions on the belt sheet from Vače[865]. Non-armed persons usually have hats of various kinds. The situla from Kuffarn shows a flat, wide-brimmed hat for a socially high-ranking person. The majority of the men on the situla art, however, are depicted with a hemispheric cap or a beret. Phrygian caps, soft conical caps with the top pulled forward, are also common in the eastern Alpine region.

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863 For men's clothing, see Croom 2002, 31–59; – Speidel 2012.

864 Lucke and Frey 1962. – Turk 2005.

865 Kern *et al.* 2009b, 13 and 21.

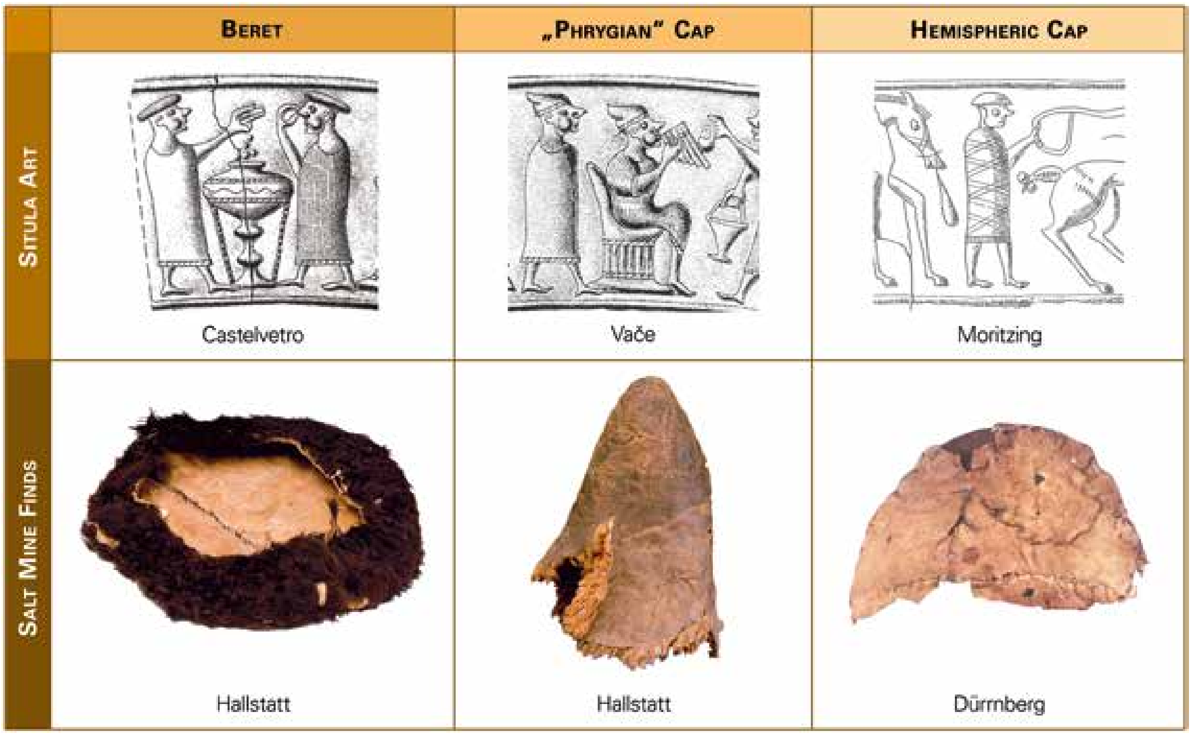


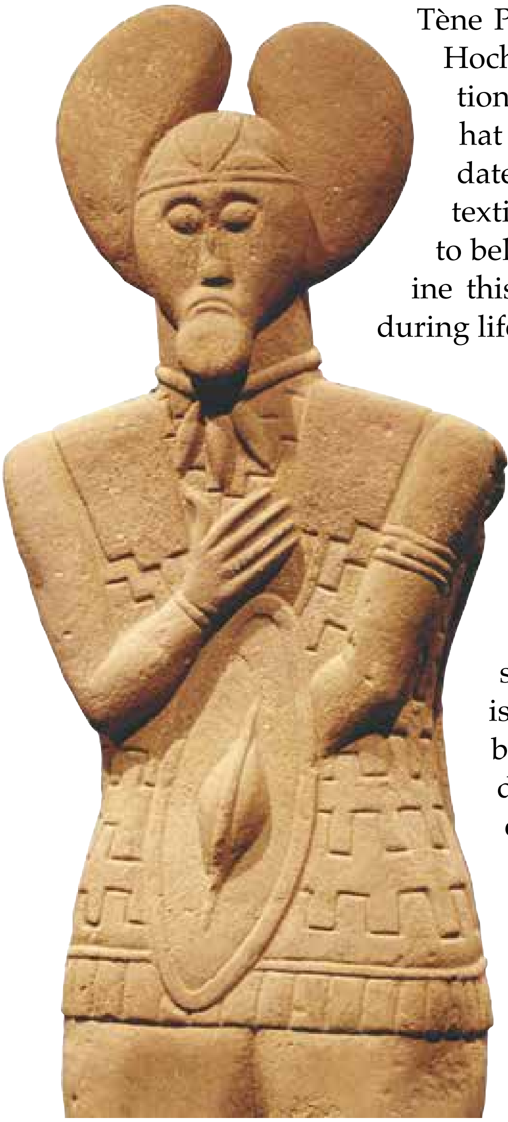
Fig. 230. Headgear from the Iron Age salt mines of Hallstatt and Dürrnberg in comparison with depictions on situlae, Iron Age.

It is very interesting that we have contemporary finds from the salt mines in Austria (Fig. 230), especially of the headgear, which are all made of leather or fur[866]. So far, the flat cap, the beret and the Phrygian cap have been found in Hallstatt, the hemispherical (globular) cap in Dürrnberg. The Phrygian cap made of fur was worn with the hair side inwards. The beret-like caps were made of sheepskin, by gathering a circular piece with a leather strap. In this case, the hair side was worn towards the outside. All of those items belonged to the workwear of the miners from the salt mines as functional and protective head coverings. As we can compare them with the contemporary depictions, they were worn by men. There is one example among the berets found in Hallstatt that belonged to a small child – as can be seen in the size of the item[867]. Scarce depictions of children (situla of Kuffarn) also point to the beret type of head gear for them.

Grave finds of headgear of high-ranked male persons are known in the princely tombs of the late Hallstatt and early La

[866] Popa 2009, 105. – Stöllner 2002, colour pl. 10.

[867] Pany-Kucera *et al.* 2010, fig. 8.



Tène Period in Southern Germany[868]. From Eberdingen-Hochdorf a pointed birch hat was found. More attention has to be drawn to the big leaf-shaped crown or hat (Fig. 231) depicted on the statue from Glauberg, dated around 400 BC. Metal wires, wood, leather and textile remains found in grave 1 could be reconstructed to belong to such a leaf-shaped crown. So we can imagine this depiction to have had a real counterpart worn during lifetime as well.

Hallstatt period inhumation graves contain a lot of bodily adornment. Typical metal objects around the head of female individuals are bronze rings and bronze pins[869], *e.g.* at Hallstatt or Gießübel, Tum. 18, grave 6. The position of the bronze pins suggests their use as hair-pins, or as part of some otherwise perishable head-gear such as a veil or bonnet. Grave 464 from Hallstatt is remarkable because there are hundreds of amber beads around the head (Fig. 232), which may have decorated a bonnet. The Early La Tène period cemetery of Dürrnberg is representative concerning inhumation graves in this region. Metal objects as remains of headgear are very scarce, sometimes in women's graves pins and bronze rings appear (Fig. 227). In one case a very rich adorned woman wore a bronze ring around her head, together with a torques around her neck, beads of a necklace, fibulae and rings around her arms and ankles[870].

Fig. 231. Glauberg, Germany, statue with leaf-shaped crown, *c.* 400 BC.

Like other elements of dress – the most famous being the use of paired fibulae on the shoulders and belts with metal fittings – the use of different hats, caps, veils and bonnets were developed

[868] Glauberg: Bagley 2014, 415, Kat. Nr. 118. – Bartel 2002, 163–167. – Frölich 2006. – Hochdorf: Biel 1985.

[869] Gießübel: Banck-Burgess 2012b, 41. – Hallstatt: Grömer and Kania 2006; – Kromer 1959.

[870] Moosleitner *et al.* 1974, pl. 189.

as a habit of the local people of the Alpine region until the Roman period (province Noricum and Pannonia)[871].

Shoes

Shoes complete the attire. Many different shapes of shoes are known from the Central European Iron Age. In the framework of this book, a detailed overview of Iron Age shoes[872] cannot be provided, so only the most important observations are included here.

Fig. 232. Hallstatt, Grave 464. Watercolour painting from Johann Georg Ramsauer's documentation of the cemetery excavations, detail.

In addition to the well-known finds of shoes from the bogs of northern Europe, various shoes have also been obtained from the salt mines of Hallstatt and Dürrnberg[873]. Fritz-Eckart Barth was able to distinguish three different types (Fig. 233). The shoes are normally a type of one-piece shoe where the sole and upper leather are made from a single piece of leather, one of open-work type. Those shoes are made of raw leather, barely tanned or not at all, with cut out opening and perforated edge. The shoes have a seam on the heel and the shape of the shoe is effected by binding straps or cords. This very basic type of shoe was named *carbatina*[874] by the Romans. In addition, a different type of shoe with a folded leather tongue was found in the Hallstatt Kilbwerk mine (9th to 4th centuries BC). These shoes are only sewn on the heel and otherwise consist of flaps, which are just folded over.

The leather shoe with a seam around the sole from the Pletznerwerk in Hallstatt[875] (Fig. 233 right), a salt mine complex dating to around the beginning of the Common Era, is a singular find. It is the front part of a right shoe made of cattle leather, the upper

871 Garbsch 1965. – Rothe 2012.

872 For a general overview, see Groenman-van Waateringe 1974, 111–120.

873 Barth 1992.

874 *Cf.* Knötzele 2007, 61–64, fig. 58–59.

875 Barth 1992.

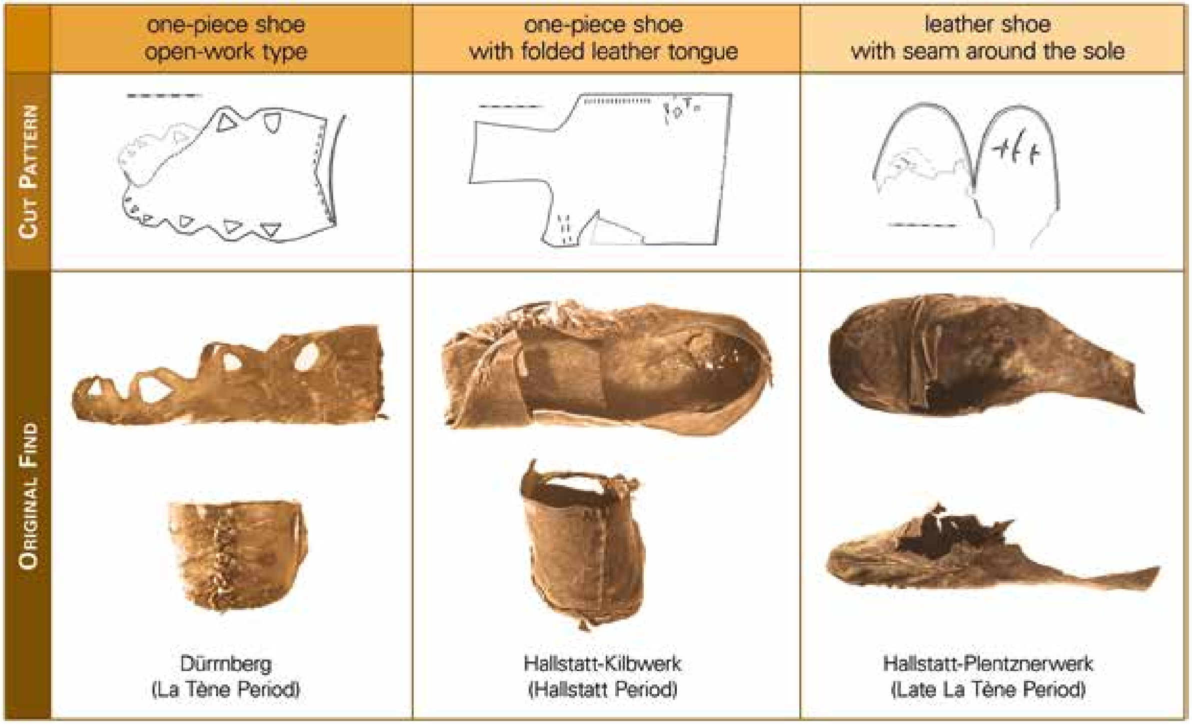


Fig. 233. Finds of Iron Age shoes from Austrian salt mines.

part and sole are interconnected by a seam that can be turned. Both the cut and the use of the closed seam with grain stitching characterise this shoe as a product of a professional shoemaker.

These three shoe types were found in the salt mines, so we may interpret them as common types of working shoes for the everyday Iron Age life. Interestingly, some very small shoes have been found in the salt mines, with today's European shoe sizes 31 to 35 (UK children's size 12 to women's size 2 ½, US children's size 13 to women's size 4 ½), which likely belonged to children and women.

Another type of shoe is represented by shoe-shaped pottery. This is probably a local shoe shape with sloping instep and flat tapered point. According to research by Ludwig Pauli[876], this type of shoe, a pointed shoe (*Schnabelschuh)* was especially fashionable in the early La Tène Culture, as evidenced by representations on shoe fibulae (Fig. 234) or ceramic pots in shoe shape. In the images of situla art we encounter *Schnabelschuhe* on the feet

[876] Pauli 1978, shoes: 217, fig. 11. Representations of shoes: list 3, 630–631, fig. 52.

of a socially superior group of people. The golden shoe fittings from the princely grave at Hochdorf also indicate this shape of shoe, just as the various shoe fibulae, of which famous examples were found at the Dürrnberg and Vienna-Leopoldau. The 'shoe vessel' from grave 4 from Mannersdorf[877] in Lower Austria (Fig. 235), the grave of a child, shows the *Schnabelschuh* of a child with laces at the instep.

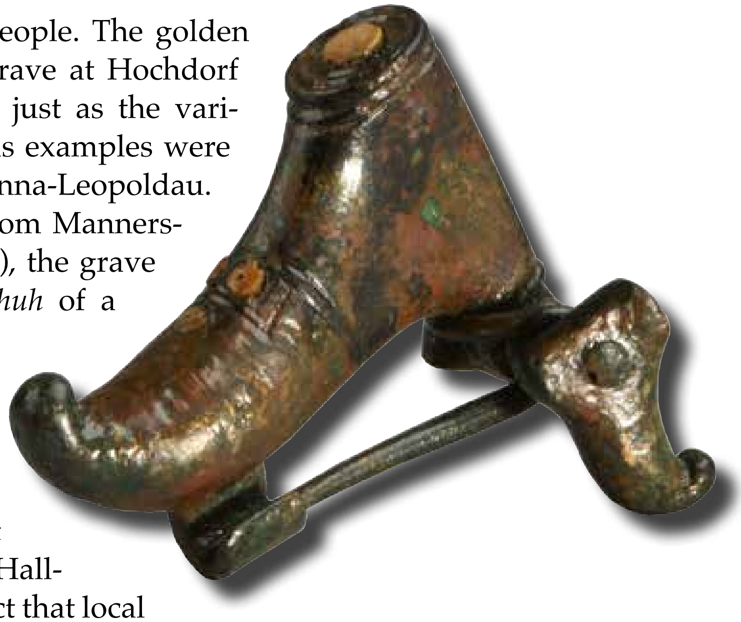


Fig. 234. Shoe fibula from Leopoldau, Austria, Late Iron Age.

Pointed shoes are generally considered a product of Etruscan influence, which was absorbed during the late Hallstatt period in the entire area of the Hallstatt and La Tène Cultures. The fact that local leather craftspeople possessed the skill to produce *Schnabelschuhe* is evidenced by the finds of craft tools. Ceramic shoe lasts, for example, have been found in Sommerein in Lower Austria[878] (Fig. 236). They roughly correspond to today's European shoe size 37 (UK size 5, US women's size 7).

Iron Age graves sometimes also include metal components from footwear: metal rivets or small rings in the area of foot bones[879]. Grave 119 from Dürrnberg-Eislfeld[880] (Fig. 227), for example, is the burial of a rich woman of the late Hallstatt period, who died at the age of *c.* 60 years. A rod-shaped pendant was found close to her lower right leg; at each foot, one larger and one smaller ring were found. The exact appearance of the

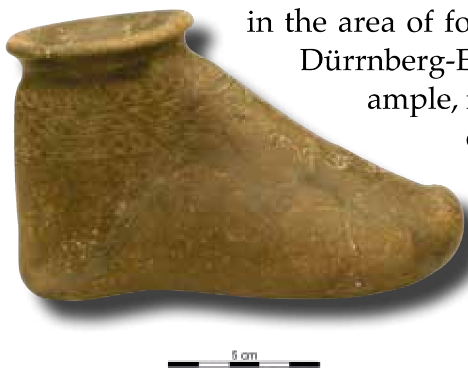


Fig. 235. Shoe vessel from Mannersdorf, Austria, Late Iron Age.

[877] Ramsl 2011.

[878] Neugebauer 1980.

[879] Schönfelder 1999, with finds catalogue.

[880] Pauli 1978, 532–533.

shoes cannot be reconstructed with certainty. It can be said, however, that rivets and little rings near the feet area of the skeleton were part of shoes that were closed (buttoned) over the instep. Especially on shoe fibulae, such as the one from Vienna-Leopoldau (Fig. 234), decorative and functional elements in round shape are shown.

5.6 Interpretation of Iron Age sources in terms of costume history

Fig. 236. Late Iron Age shoe lasts from Sommerein in the Museum Mannersdorf, Austria.

The image we create of costume during the Iron Age, based on an overview of grave finds, representations, written sources and original finds, clearly does not fully mirror the abundance and complexity of Iron Age clothing in Central Europe. In general, the clothes were very colourful, as evidenced on the one hand by original finds and on the other hand by ancient historians.

Men's costume

The images of men's clothing dating to the late Hallstatt and La Tène periods are sometimes very detailed and can be compared with original finds of garments. The upper body was covered by a long or short-sleeved shirt or tunic. These garments sometimes reached the knees and were occasionally belted, as on the figurines from Idrija pri Bači or Imst and based on finds of belts in graves. The belts are important accessory items, since their use optically divides the body clearly into an upper and lower body and thus strongly influences the silhouette of the person.

Jacket-like garments, *i.e.* open in front, are worn on early La Tène representations such as the scabbard of Hallstatt and the fibula from Dürrnberg. Men with long garments, without belts, can be found on the works of situla art. Different forms of cloaks worn over other garments were very popular. The written tradition names these garments *saga*. Roman representations and original finds from the bogs of northern Europe indicate they were rectangular pieces of cloth held together on the shoulders by fibulae. In men's graves, a single larger fibula on the right shoulder suggests that it probably served to hold together a coarse mantle (maybe a *sagum*). The *sagum* was later adopted as a military cloak by the Romans. Hooded capes (e.g. the *cucullus* or the *caracalla*[881]), closed at the front, were also in use; one of them is represented on the late La Tène wooden figure from the headwaters of the Seine. These hooded capes were worn well into Roman times and displayed as native costume on grave stones, for instance on the famous relief of the ship's captain (*nauta*) Blussus and his wife Menimane from Mainz-Weisenau in Germany[882], the man is wearing a *caracalla*.

The earliest evidence of trousers (or leggings) in Central Europe comes from the early Hallstatt period belt plate of Molník in Slovenia and the conical necked vessel from Sopron-Várhely, Tumulus 127 (Fig. 221). Narrow, long and patterned trousers are shown on the 'wheel-bearers' on the scabbard of Hallstatt, whereas the hunter on the belt plate of Molník wears baggy trousers. The leg wear of the figure on the Dürrnberg fibula has generous creases, just like the trousers of the mounted Celt from Magdalensberg – a much later image around the beginning of Common Era.

The representations also show that the trousers were often attached to the lower legs with bindings. Bronze pendants as we know them from the leg area in early La Tène burials may have hung on these bands. Tight Hallstatt leggings were found together with socks on the Vedrette di Ries glacier in South Tyrol. Original finds of trousers and leg wraps come from the Nordic bogs (Thorsberg, Damendorf, Søgårds Mose). They are usually dated to the Roman Iron Age, *i.e.* after the birth of Christ.

881 The *cucullus* is a hood with only a short extension covering just the shoulders; the *caracalla* is the long version of the same hooded cape. Friendly comment by John-Peter Wild, Manchester, Jan. 2015. See also Cleland, Davies and Llewellyn-Jones 2007, 30, 44.

882 Böhme-Schönberger 1997, fig. 18.

The name of certain types of garments is known through written sources: to Diodorus Siculus we owe the name *bracae*. The trousers are so clearly recognized as foreign in the Greek and Roman written sources that they almost became a symbol of barbaric northern peoples.

Nevertheless, the origin of this garment is not yet fully understood. Trousers, composed of two leg warmers stitched together in the middle, were probably developed at several different locations at the same time[883]. The earliest trousers known so far, radiocarbon dated between the 13th and 10th century BC, have been found in Turfan in China. Their age corresponds to the spread of mobile pastoralism in eastern Central Asia and predates the widely known Scythian finds. The trousers were made of three independently woven pieces of fabric, they were shaped in the correct size to fit a specific person and then sewn together[884]. Ancient horsemen, especially the Cimmerians and Scythians, already had trousers, as evidenced by trimmings of precious metals found in kurgans of the 4th century BC. This garment provides ideal protection of the inside and outside of the legs, particularly when riding, and can be considered as a well thought-out functional gear. Herodotus mentions in the 5th century that Medes, Persians, Scythians and Saci all had trousers (Hdt. 7, 61–64). In Greek art, trousers appear primarily to identify Scythians[885].

In Roman pictorial sources such as on Marcus Aurelius' or Trajan's Column, barbarians are repeatedly shown in trousers. The toga-wearing Roman *gens togata* was thus visually distinguished from the trouser-wearing *gens bracata*. Although Romans considered trousers the essence barbarity, they were eventually adopted as a practical piece of clothing in the military. Leather knee-length trousers (*feminalia*) can be, for example, found in the Roman cavalry from the late 1st century AD[886].

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[883] Von Kurzynski 1996, 131–139, with further sources and references.

[884] Beck *et al.* 2014, fig. 2 and 5.

[885] Gleba 2008b, 13–28.

[886] Böhme-Schönberger 1997, 26. – Croom 2002, 55–57. – Speidel 2012.

Women's costume

The costume of Iron Age women is more elusive on the situla art, women are always depicted with a long robe, combined with a veil and sometimes worn belted. The body silhouette of women is not revealing; straight, austere shapes of the robed figures emphasise the vertical. It is definitely not close to the images of the draped wealth of folds, as they are known from *peplos*-wearing women on Greek representations. Representing body shapes and movement was obviously not a concern with the female characters of situla art – the figures appear static, despite scenes with motion sequences. Apart from the images on situlae, there are very few La Tène period representations of women, except for the late La Tène representations of the goddess Epona, who mostly wears a knee-length robe.

We encounter the Iron Age woman in graves as follows: Smaller fibulae in the chest area probably served to fasten the neck opening of an (under?) garment. The fibulae placed symmetrically on both shoulders are usually associated with a specific overdress, the *peplos* (see below). The fibulae may, however, just as well fasten a cloak, similar to the fibulae found individually or closely adjacent on one shoulder (see Fig. 237).

The custom of wearing upper arm rings is interesting in terms of costume history, as it may indicate that short-sleeved dresses were worn and the upper arms were bare. Conversely, they may also indicate tight, long sleeves over which the rings could have been worn. The leg rings worn over ankles may also suggest that clothing was not floor length, so that the jewellery pieces could be seen.

Skirts, shoulder capes made of fur and various sprang nets for the hair are known from the Iron Age of northern Europe. Particularly well known is a tubular garment found from the bog of Huldremose, which has been interpreted as a *peplos* by the Danish textile researcher Margarethe Hald based on the Greek garment of that name[887]. This *peplos* and the way it was worn will be discussed below, as it has always been considered as a

[887] Hald 1980, 358–365.

Fig. 237. Variants of costumes with fibulae and garments of the Iron Age: Free reconstructions from Grave 119 from Dürrnberg (above) and Grave 1003 from Pottenbrunn (below). Tube dress *peplos* made of checked wool fabric, green cloak with decorative stitching and tablet woven belt: fabrics and patterns according to finds from Hallstatt. Simple linen dress with embroidery from the finds from Nové Zamky. Model: Anna Palme.

characteristic Iron Age woman's garment in the relevant research and popular literature. It is a piece of clothing made of textile which was either woven tubular or square, with the cloth sewn together. It is draped around the body and folded horizontally, so that a folded flap appears. At this line, the garment is fastened with a fibula or pin at each shoulder (Fig. 238). A belt, which may, depending on the length of the flap, be placed above or below, gives the *peplos* additional support. In Greek clothing[888] different variants of the *peplos* are distinguished, for instance depending on whether the side is sewn up (Doric *peplos*) or open (Ionic or Laconian *peplos*).

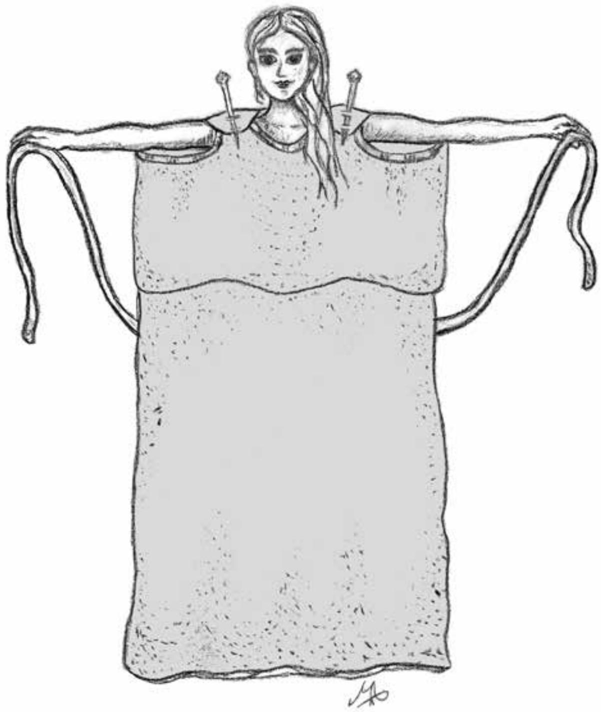

Fig. 238. Draping a Doric *peplos*.

The textile researcher Inga Hägg has dealt intensively with the question of where the *peplos* comes from and where it spread[889]. According to ancient tradition, the custom of the *peplos* was introduced into Greece with the arrival of the Dorians around 1,200 – 1,000 BC from the north. Immigration is indeed traceable through the dissemination of the Doric language groups. The *peplos* is first tangible in the archaeological record from the late Helladic III B – C (*c.* 1,200 BC) by large-sized pairs of pins found paired on the shoulders of the dead for the first time. It can later be seen on Greek works of art.

In Central Europe, women's costume with paired metal fasteners at the shoulders appears again and again from the Early Bronze Age (from *c.* 2,200 BC) to the Hallstatt and La Tène periods. Merely the types and shapes of the fasteners change, from variously designed pins in the Bronze Age to various forms of fibulae in the Iron Age. Metal belt elements are also frequently present, whether as a belt plates, belt hooks or belt chains. Thus we can ask whether it is possible that the *peplos* originated in

888 Pekridou-Gorecki 1989, 77–82.

889 Hägg 1996, 136–142.

Central Europe and spread to Greece in the 2nd millennium BC and reached northern Europe in the Iron Age.

This question provokes another one: is this garment known from the graves in Central Europe, closed at the shoulders and belted, really a long *peplos* folded at the upper side and pinned with fibulae through the fold[890], or may other forms of clothing result in the same archaeological pattern[891] (Fig. 237)? Interestingly, neither the few Bronze Age nor the slightly more numerous Iron Age representations of female figures show a folded *peplos*. This type of garment with its characteristic fold and fastening at the shoulders would result in a rather unique silhouette. In the works of situla art, for example, rather plain dresses, with or without belt and combined with long and short veils and cloaks are shown. The draped fabric of a *peplos* is nowhere to be seen.

Only the representations of ancient Germans, such as the ones from Trajan's or Marcus Aurelius' Column in Rome dating to the 2nd century represent Germanic women in a creased, *peplos*-like garment[892], but without a fold. The same can be said for tombstones from the Danubian *limes*, the Roman provinces of Noricum and Pannonia. There the tube-dress without fold is combined with local forms of large, winged fibulae at the shoulders, various hats and veils. In particular, the paired fibulae on the shoulders are unusual for the Romans and indicate a pre-Roman tradition in this costume.

The question of when and where the rectangular pieces of fabric or fabric tubes were turned into garments such as the *peplos* is also a matter of textile technology. In Northern Europe the situation is quite clear due to the good preservation of complete

[890] Antoinette Rast-Eicher's (2008) latest research doubts that the folded *Doric peplos* with flap was used in the Swiss textile material of the Iron Age. She rejects the idea based on the detection of weaving edges at the shoulder fibulae. *E.g.* Bern-Enge, Grave 15 and 39; fig. 41. – A tube-dress which was pinned directly at the borders to create the neck and arm opening was found in a woman's grave at Hamerum, Denmark, 1st century AD. This dress was 95 cm long and 146 cm in circumference and may have reached the knees of the woman. Mannering and Ræder Knudsen 2013.

[891] For different forms of clothing resulting in the same archaeological pattern see also Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013.

[892] Böhme-Schönberger 1997, 45. – Garbsch 1965. – Rothe 2012.

garments[893]. Garments of the Bronze Age include blouses and skirts for women and men's wrap-arounds, all of which are characterised by the fact that they were tailored. This means that the woven fabrics were cut and hemmed to prevent fraying of the edges with many different types of stitch and finally sewn into the desired garment. This approach is clearly derived from the technique of sewing leather especially for blouses, as Margarethe Hald has impressively demonstrated. The Iron Age garments of Northern Europe, in contrast, follow different design principles. The rectangular cloth derived from weaving on the warp-weighted loom is now incorporated. This was done mostly without further cuts; cuts across the fabric surfaces in particular are now avoided. These rectangles could be seamlessly wrapped as square upper garments, scarves, veils, headscarves or leg wraps, solely secured by the drapery or with accessories such as belts, pins or fibulae. Sewn together, the rectangular cloth elements result in different coats, tunics or the sewn *peplos*. All of these forms are also typical of Greek and Roman clothing. Only the design of trousers required a more complicated cutting and tailoring technique.

Comparing the textiles from Central Europe of the Bronze and Iron Age with these findings, no such clear picture emerges. Both on the Bronze and Iron Age textile remnants from Hallstatt many tailored elements[894] can be found. Curvy edges were often cut and seamed with buttonhole stitches; fabrics were cut transversely into trapezoidal shapes and assembled into a garment. The leggings and socks from the Vedrette di Ries glacier[895] were stitched together from several cut pieces, building the socks in a three-dimensional structure. There is clear evidence for sophisticated tailoring techniques, which are in the Nordic area interpreted as reminiscence of older furriery techniques which are superseded by the use of rectangular panels in the Iron Age.

In the Iron Age in Central Europe, we are clearly dealing with a variety of different shapes and designs for clothing, with different technological approaches.

893 Hald 1980. – Mannering *et al.* 2012.

894 Rösel-Mautendorfer 2013.

895 Bazzanella *et al.* 2005, fig. 9–12.

6 The meaning of clothes and jewellery

Some general thoughts on clothing will first be presented here, since clothes serve and served different purposes during history (Fig. 239)[896]. One basic function is certainly the protection against environmental elements such as rain, cold or heat. Utility, however, is not the only purpose for clothing. Decoration for the wearer and the representation of status are also significant aspects of clothing. Climate, level of craftsmanship, custom and tradition resulted in different forms of dress. Clothing is also an important means of communicating statements about identity, age, gender, group membership (including ethnicity, religion), and social status (*e.g.* work clothing, clothing with regard to marital status)[897]. The garments including dress accessories and jewellery further create identity for the individual, but also the community. Through clothing materialise aspects of a person, whether these are aesthetic, economic, and moral values or aspects such as charisma and power. Costume also sheds light on how much public and private space existed in a community and how gender relations were organised. Visually identical garments for men and women, for instance, express different social relations than do a strong emphasis on gender differences enhanced by various items of clothing.

Clothing may also be used to alter the body and its silhouette as well as reshape its surface. Likewise, garments influence body language and options of movement[898]. To put it boldly: the Roman toga allows for more thoughtful and slow movements because of its wealth of fabric and draping, giving the wearer a different body feeling to wearing than the late La Tène Celt's combination of trousers and cloak, which allowed considerably more freedom of movement.

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[896] *Cf.* Bender Jørgensen 2007. – Eicher and Evenson 2015. – Lurie 1981. – Schierer 1996, 10–29, 42. – Schneider and Weiner 1989. – Wincott Heckett 2007.

[897] The research project 'DressID – Clothing and Identity' under the direction of the Curt-Engelhorn Foundation Mannheim 2007–2012 had examined the function of clothing in terms of creating identity. Cultural identities and their reflection in textiles and costumes were explored starting from the Roman Empire with its archaeological, art and literary sources. http://www.dressid.com, last accessed 30th Sept. 2014. – See also Calefato 2004. – Roach-Higgins and Eicher 1995. – Sommer 2010; 2012.

[898] *Cf.* Grömer, Rösel-Mautendorfer and Mückler 2012, 152–153. – See also Koda 2001.

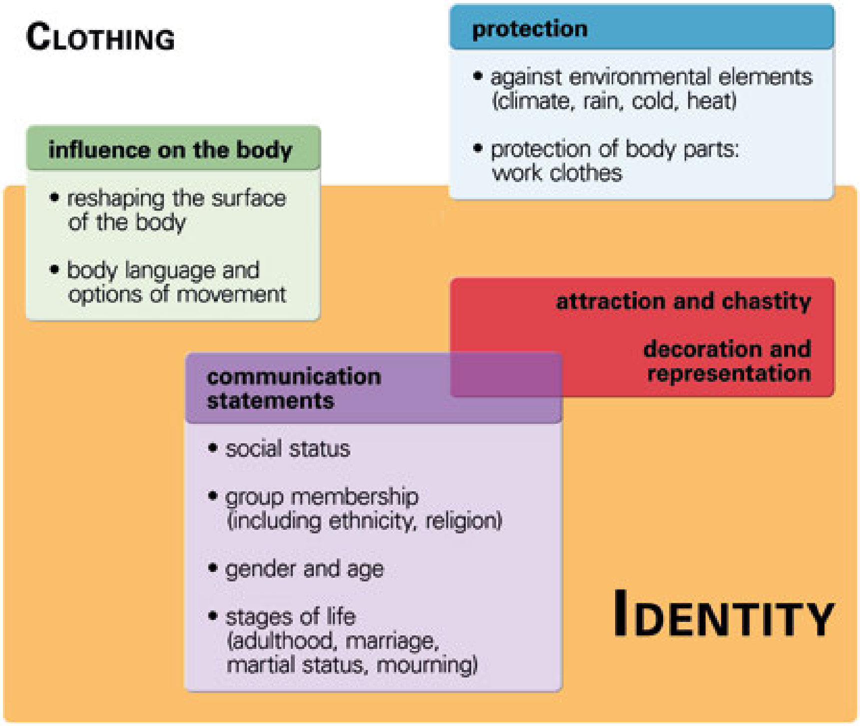

Fig. 239. Function of clothes.

6.1 Attraction and chastity

Early on, people started to ponder about the reasons for dressing. According to early moralists, clothing was invented to cover intimate parts of the body. The Bible's Old Testament story of the Original Sin (Genesis 3.7) will be familiar to many: '*Then the eyes of both of them were opened and they perceived that they were naked; and they sewed together fig leaves and made themselves loincloths*.' The texts of the Book of Moses were recorded from different traditions around *c*. 1,000 BC and give us an insight into the perception of morality in the Near East at that time. Nevertheless, these moral values shaped the Christian West until well into the 20th century.

The sense of shame, chastity and modesty[899], particularly as represented by moralists of the 19th and early 20th century, advocates that clothing developed because people were ashamed of their nakedness. This applies, however, only to those human communities for which clothing is common. If nudity is commonplace,

899 Hirning 1973. – Schierer 1996, 10–29.

shame is expressed in a different way. Drawing on colonial ideas of dress, undress, and nakedness, Adeline Masquelier[900] discusses the cultural specifity of appropriate body covering and its interpretation as moral or immoral. In the eyes of colonialists and ethnographers of the early 20th century, bodies without sufficient clothing were considered naked, hence immoral and primitive. These Westerners failed to recognise that small items of clothing such as a waist cord were sufficient dress to those who knew how to read them.

Chastity, modesty and shame are thus cultural products and depend on relative standards. Which parts of the body may be visible and which should be covered is constantly changing and not least inspired by erotic imagination. It is thus clear that during the course of human evolution, clothing was not invented out of a feeling of chastity. Chastity and its reversal – erotic appeal – are, however, essential factors in the expression of certain clothing customs. Research on this topic is particularly insightful for the Roman period, as it can include the rich written tradition[901]. Moralizing words about how to dress can be read in treatise on dress codes and satires.

Little is deducible on the question of shame and attraction for prehistory, even when written sources are available at the end of the Iron Age. Julius Caesar writes in his commentaries on the Gallic Wars about the Suevi (Caesar, *B.G.* 4, 1.10):[902] '*And to such a habit have they brought themselves, that even in the coldest parts they wear no clothing whatever except skins, by reason of the scantiness of which, a great portion of their body is bare, and besides they bathe in open rivers*.' Describing people like that was intended to mark them as primitive. It does not say anything about what the Suevi might have felt about nakedness and modesty.

Only few examples from modern research on prehistoric clothing may be considered to elucidate the oppositional pair of chastity and attraction. The function of the famous string skirt of the Bronze Age 'Egtved Girl', for example, is interpreted by

900 Masquelier 2005, 7–10.

901 *E.g.* Métraux 2008, 271–293.

902 http://classics.mit.edu/Caesar/gallic.4.4.html.

Elizabeth Wayland Barber[903] in terms of symbolising eroticism. To argue for this interpretation, she draws on a text from ancient Greece, a passage from the 14th book of Homer's *Iliad*, in which Aphrodite receives '*a girdle crafted with a hundred tassels*' (Homer, *Il*. 14.181) from Hera to seduce Zeus. '*… and there in it have been crafted all bewitchments – love, and sexual desire, and intimate persuasion, which has stolen away the mind of even those who think carefully*.' (Homer, *Il*. 14.214–217). According to Barber the decorative apron of Homer's time (8th century BC) represents an artefact from the 'legendary Bronze Age' with symbolic and ritual, but also erotic significance. An erotic component is inherent when the conspicuously veiled and wrapped references the hidden and invisible and thus creates a stimulating effect.

6.2 Protection of the body

In his theory of climate the Greek writer Plutarch emphasises the importance of clothing as protection of the body: '*The same garment warms in the winter cold, but cools in the sun... Germanic peoples thus use clothing only as protection against the cold, the Ethiopians* [i.e. Africans] *as protection from the heat, but we use it as protection against both.*' (Plut., *Mor*. 691d). In this context, mentioning clothing serves to legitimise the claim to power of the Romans because they live in the most balanced part of the world.

The function of clothing as a protective **cover against the weather** is still a topic of concern[904], whether one protects the body against heat loss in colder regions or from overheating in extremely hot regions. There are, however, extreme cases where people only wear little clothing despite inhospitable climate. The well-known British naturalist Charles Darwin, the founder of evolutionary theory, for instance reports that the residents of the southern tip of South America wear only body paint and a few scraps of fur in the tundra-steppe of the southern Polar Regions[905]. Humans can become acclimatized to cold, but only down to a critical level,

[903] Barber 1991, 256–257.

[904] Compare Eicher and Evenson 2015, 158–162. – Gilligan 2007. – Parsons 2003.

[905] Darwin 1839.

below which hypothermia begins within hours and can lead rapidly to death, literally overnight.

Clothing is essential as thermal insulation by trapping air close to the skin surface, reducing the thermal gradient between the body and external environment. After Ian Gilligan[906], two aspects largely determine the thermal effectiveness of clothing: first, whether a garment is properly fitted, *i.e.* shaped to fit closely to the body, including the limbs, as opposed to being loosely draped over the body. The second aspect is the number of layers, with multiple layers requiring that at least the inner layer(s) are fitted. Draped, single-layer clothing can provide only limited thermal protection, whereas fitted, multi-layered clothing assemblages are even sufficient in very cold environments. Also specific properties of raw material can be exploited for that reason. Wool, for example, when spun into loose yarns and woven into thick weave structures, can keep the body warmer than can flax fibres, because wool fibres are scaled and somewhat curly and can be made into a cloth that holds insulating pockets of air around the body. In contrast, flax will absorb body moisture and then release it at the touch of a breeze, so it can be woven into thin, light fabrics that cool the body.

In Central Europe, the change of seasons exposes the body to rapid temperature changes, which could be compensated for with appropriate clothing in prehistoric times[907]. It is, however, difficult to pinpoint specific summer and winter clothes in the archaeological record. Particularly striking examples are the Iron Age leggings from the Vedrette di Ries glacier, but especially the Stone Age 'alpine mountaineering equipment' of the Iceman, a fitted, multi-layered clothing assemblage as described above. These may well be interpreted as warm functional clothing. An ancient text of the late Iron Age by Diodorus refers to the fact that the Gauls used seasonally different garments: '*… they wear striped heavy cloaks, fastened with a brooch at the shoulder, heavy for winter wear and light for summer …*' (Diod., *Hist.* 5.30.1).

[906] Gilligan 2007, 501–503.

[907] *Cf.* Harris 2012, 82–84. – Wininger 1995, 121–131.

Another aspect of clothing components is their function to protect certain body parts during manual activities – **work clothes** in the broadest sense. These would include, for instance, aprons worn by a blacksmith (*faber ferrarius*) as shown in Roman representations[908].

Head coverings and shoes discovered in the Iron Age salt mines of Hallstatt and Dürrnberg in Austria clearly belong to the work clothes of underground miners due to the context of their discovery. Did these items differ from everyday garments at all? Was there a distinction between everyday and specialized work clothes in the Iron Age? We just do not know. It seems plausible that there was a special festive costume, particularly for the wealthy strata of the population. Studies conducted by the physical anthropologist Doris Pany[909] on skeletal remains from the cemetery of Hallstatt revealed interesting details: The buried community in the salt valley appears very rich, as they are equipped with numerous bronze vessels, exotic imports and a wealth of jewellery. The general population spent their life there and worked in the mines; the skeletons of the dead show that even this wealth was earned by hard physical labour. The Iron Age people of Hallstatt were generally built very strong, and traces of heavy workload can be seen on the bones. Muscle marks suggest that children, young people, women and men were all involved in the salt mining process. A specific division of labour could even be determined, which could be demonstrated by the fact that men and women primarily used different muscle groups. Men were responsible for the salt mining (striking movement with bronze picks), women for transport (lifting, pulling and carrying movements). Even people buried with very rich grave goods have such changes in the skeleton.

Back to the clothes: It seems unlikely that the pins, spectacle fibulae, sheet bronze rattling pendants and sheet metal belts found in the graves were worn while working in the mine. This is underlined by the fact that (except one pin) no such items were found in the salt mines themselves. They would not only be a hindrance, but could also be easily soiled or be damaged. Was

[908] Zimmer 1982, *e.g.* no. 117, grave monument from Ostia, blacksmith with tunic and apron.

[909] Pany 2009, 136–141.

there a difference between functional, hard-wearing clothing for work in the mountain (possibly with a different cut?) and clothes from fine fabrics complimented by rich jewellery? Or was the jewellery simply attached to the (cleaned) everyday clothes on festive days? In the absence of appropriate pictorial and written sources, these questions must remain open.

6.3 Psychological effects of clothing

Every object that human beings produce or select for their personal sphere can be considered as objectification and expression of their identity. Joanna Sofaer[910] writes: '*… as archaeologists we are familiar with the idea that objects are created by people…. we are perhaps less routinely aware of the ways that people are literally created by objects and the material world, although the implications of this are profound*.' Clothing takes on special significance, since of all personal items it is literally and figuratively the thing closest to us. After the mother's skin, fabric is the first substance a person comes into contact with after birth. The first sensory experiences take place and the senses awaken. Among all materials, textiles are obviously those with which people have the most intensive direct contact and which are most intensively used[911]. They are the ones in which we immerse ourselves at night and in which we walk around during the day; we will be even buried in textiles. Textiles are so elementary, because they are the first and last material with which one comes in contact. Clothing can be understood as a second skin and as kind of personal space[912]. With dress we transform our biological body into a socially meaningful manifestation. People are three-dimensional beings, all of whose utterances – the acoustic, tactile, olfactory and even optical – are spatially defined; clothing provides a protective shell and supports the personal space. The shell of the clothing, however, does not create the space alone – without the person, the shell collapses, it is hollow. People and clothing together are a system of mutual interdependence.

910 Sofaer 2006b, 84.

911 See also Bender Jørgensen 2007. – Sommer 2012, 257.

912 Antons 1999, 74–78. – Lurie 1981.

Clothing is an important means of body production and personal expression. Key priorities are the structural properties such as texture, colour and other material properties (*e.g.* transparent, rough, smooth, soft, hard, shiny, dull), but also the weight distribution on the body as well as the division of individual clothing items and clothing accessories (straight, round, square, closed, symmetric, *etc.*). Through these properties, the expressivity of clothing is defined, which is encoded in the value and symbolic system of a particular society (*e.g.* as solemnly, friendly, proud, dark, peaceful, hostile)[913].

The expressivity inherent in the clothing was most likely also perceived by prehistoric people and attached with values. As Susanna Harris[914] emphasised by taking the 14th century BC Bronze Age as a case study, different parts of Europe had different prehistoric 'cloth cultures', which probably also influenced the self-understanding of human psychology. According to Harris, all societies use cloth-type materials, *i.e.* flexible, thin sheets of skin, various types of plant fibres, bark or textiles that can be wrapped, folded, shaped and used for clothing and other purposes. For the Bronze Age, Harris distinguishes between cloth cultures of Scandinavia, Central Europe, the Aegean and Pharaonic Egypt. Materials are specific to each culture and thus contribute to express cultural identity.

6.4 Gendered design

Well into the 20th century in Europe it was considered as 'self-evident' that men and women could be identified on the basis of their different clothing[915]. The style of clothes alone determined gender so much that women dressed as men could live as men unrecognised for many years. In the 18th century, for example, it is reported about a woman in South Holland: *'… on February 23, 1769, the court of Gouda sentenced a woman because of "very gross and serious misconduct" and "ridiculing divine and human laws".*

913 Antons 1999, 78–79. – Eicher and Evenson 2015.

914 Harris 2012.

915 *Cf.* Barnes and Eicher 1991. – Calefato 2004. – Lurie 1981. – Reich 2005, 42–43. – Roach-Higgins and Eicher 1995, 7–18.

The crime had occurred eight years earlier, when she started to wear men's clothes, accepted a man's name and became a soldier …'[916]

The theme of changing gender to the opposite sex by dressing in men's and women's clothes is taken up again and again in fiction and film. The film Yentl with Barbra Streisand, for example, tells the story of a Jewish girl in 1904, who only succeeds in studying at a yeshiva in an Eastern European village by dressing as a man[917]. Since the Second World War, in Europe the strict visual gender assignment by clothing has been softened more and more in the Western world[918]. Nevertheless, even enlightened people of the 21st century stereotypically assign attributes like skirts and dresses to women and suits and ties to man.

Did a system like this also apply to prehistoric times? Was gender visible and articulated through clothes in the times of the early farmers or the pre-Roman Celts? For the Neolithic, the sources are few and far between. The complete garments of the Nordic Bronze Age clearly have different shapes, designs and cuts for men and women[919]. The silhouettes of men differ from those of women. The legs of men wearing wrap-arounds and loincloth are visible, whilst women normally wear long skirts. Their upper bodies and waists are accentuated with close fitting blouses and girdles, while on the other hand the cloak worn by men covers the upper body, making it shapeless and more massive.

Even in the Bronze Age in Central Europe, jewellery and clothing accessories for men and women are usually different in form and shape or in their number and the way they are placed in the

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916 After Dekker and van de Pol 1990, 11. *'… am 23. Februar 1769 verurteilte das Gericht von Gouda eine Frau wegen „sehr grober und schwerwiegender Verfehlungen" und „Verspottens der göttlichen und menschlichen Gesetze". Ihr Verbrechen bestand darin, dass sie acht Jahre zuvor Männerkleidung angezogen hatte, einen Männernamen angenommen hatte und Soldat geworden war …'*

917 Yentl, movie USA 1983. Directed and produced by Barbra Streisand.

918 In America, this process began in the 1930s, when women at universities such as Vassar, Bryn Mawr, Barnard and other 'preppy' schools began wearing the same clothes as young men were wearing at Harvard, Yale and Princeton. Rebecca C. Tuite 2014, Seven Sisters Style.

919 Bergerbrant 2007, 50–59. – Broholm and Hald 1940, 146–156.

graves. Most likely, these metal objects in the graves point to different forms of garments.

Images of narrative scenes on works of Iron Age situla art can be best used to contrast the differences in the representation of women's and men's clothes, as both genders are shown together on one medium and very clearly. Primarily people shown in these images are of the elite classes, engaged in festive and possibly ritual or symbolic activities. At first glance the two genders are quite similar in the silhouette and basic form of the garments, except perhaps for the warriors. The most common piece of clothing is the long tunic or dress, worn with or without a belt. A cloak is often combined with this garment. The most obvious difference between man and woman is articulated through the headdress and not – as might be expected – through an emphasis on secondary sexual characteristics such as women's breasts or men's beards.

Women cover their heads with a headscarf or veil, which can extend over the shoulders and buttocks to the ankles. Men are always beardless and wear various shapes of hats – if they are not represented totally bald. Some carry different helmets, (leather?) armour and weapons, which characterise the warrior. In addition to the garments of civilians that conceal the body shape, there are also those that remodel the body. If men wear the combination of trousers and tunic, *e.g.* on the Hallstatt scabbard or the Dürrnberg fibula, then the body is clearly divided into head, upper and lower body. This creates a completely different body silhouette than the one we encounter with the long, flowing robes shown on situla art.

Garments for women and men are also distinguishable in the finds from Iron Age bogs of northern Europe, although they were not always found with a body: there are trousers, tunics and cloaks for men; skirts, capes or *peploi* for women. The difference between men and women can clearly be recognized – the visibility of legs versus their almost complete concealment. It cannot be determined whether this has something to do with enabling and restricting movement, or with a taboo associated with certain body regions for women.

It can be generally assumed that different clothing for men and women existed in prehistoric times, in particular in the Bronze and Iron Ages. Did these gendered ways of dressing and their visual effect define gender roles so much that they created a boundary that could not be transgressed? For times without written history, this can ultimately not be decided. Dress codes were in use in the Roman period, as appropriate clothing was seen as an important key to social order[920]. For example, wearing a toga, the sign of citizenship and honour, was unthinkable for a respectable woman. She wears a *stola* in public, without which she did not leave the house.

6.5 Social function – vestimentary codes

Social categories such as ethnicity, religion, gender, character need to be manifested in visible expressions. Dress as identity medium plays an important role here. Costume helps people to express and represent themselves; it shows a person's dignity to others. This is necessary to orient and position themselves in the social world. Costume history is thus always a reflection of social history[921]. From the Roman period at the latest, even more so in the Middle Ages and in modern times, the social status and rank of the wearers can be read with reference to the cut, material, embellishment and colour of their clothing. Together with language, gestures and facial expressions, clothing is a powerful means of identity formation and self-expression. In Roman times and the Middle Ages, the social order is also reflected by clothes. Not least this is reflected by the various dress codes and laws[922].

Until the 19th century, public communication was choreographed and determined by information from clothes. Garments protected wearers from inappropriate communication through its function as marker of social class. The visual appearance of the textiles is most obvious to the human eye – their patterns, colouring, texture and draping – and acted as a medium

920 *Cf.* Böhme-Schönberger 1997. – Edmontson 2008.

921 Entwistle 2000. – Roach-Higgins and Eicher 1995. – Sørensen 1997; 2010.

922 Middle Ages: Reich 2005. – Late Antiquity to early Middle Ages: Schierer 1996.

of communication[923]. There are vestimentary codes[924], which are regularly used and interpreted in a largely consensual way. The signal range of this code is comprised of variations of material, colour (hue, intensity, and value), and cut. The respective meanings of such combinations are the result of a socio-cultural agreement. Due to a lack of literary sources in European prehistory, we do not have direct access to the symbolic meaning of jewellery, individual garments, materials, colours, *etc.* A look into history, for instance in the Middle Ages[925], tells us that certain colours were reserved for certain sectors of society. Expensive colours, such as purple red, for example, was the colour of aristocratic people.

Models from ethnology[926] are also helpful. An important indicator for the differentiation of social ranks can be different fabric types and qualities as well as the amount of material used, even if the cut of the garments within a culture remains the same in broad terms. In India for instance, only the high castes and the nobles were allowed silk fabrics, whilst the lower classes were only allowed cotton and wool. Even the colour of clothing is usually not random in pre-industrial societies, but can be used to distinguish between age groups, genders, social status or professions. Similarly, emotions and feelings – for example, mourning or joy – are expressed by the colour of clothing and certain accessories and thus communicated. In ethnology, jewellery is integral to the clothing and used as a sign of group membership, status and prestige. Jewellery also serves as a sign of political and economic relations. The different stages of life (birth, adulthood, marriage, marital status, mourning *etc.*) are accompanied by special clothes and special jewellery that thus acquires a high degree of magical and symbolic meaning. In addition to the norms of a society, clothing and jewellery is always also an expression of individual preferences and creativity.

923 See Sommer 2012, 257–259.

924 Eicher and Evenson 2015, 270–286.

925 See Reich 2005.

926 *Cf.* Cordwell and Schwartz 1979. – Feest and Janata 1989, 161–163, 225–226. – See also Leventon 2008, 184–223; 256–275.

Can we – with due caution – apply such considerations on costumes from historic periods and ethnology to prehistoric times? To what extent did garments refer to the social position of a person in prehistoric times?

Using the ethnological analogies above, we can assume that elaborate textiles were reserved for the richer sectors of society in the Iron Age. In addition to dyed textiles, these are labour intensive and time consuming textiles with high thread counts and complex weaves with special decorative patterns. Textiles made with 'expensive' materials such as imported dyes or gold threads in particular are probably attributable to the elite. Examples were found in the Iron Age princely tombs of Hochdorf and Hohmichele[927].

Assigning certain colour shades to social functions is more than difficult for prehistory. Most Iron Age illustrations do not contain any colour information. Even if textiles are available from graves, they are only preserved by metal mineralization and usually do not retain the original colour. In rare cases such as the elite graves from Hochdorf and Verucchio it could be ascertained that the textiles used as grave goods were primarily dyed in blue and red. Especially the red dye is very expensive in some cases, particularly if it is derived from insect dyes and had to be obtained through expensive imports. It does, however, fit the luxury good atmosphere of elite funerals. Was the use of this red colour or its imitation with the more easily available native plants such as madder a prerogative of the upper classes or available to the general population? Without written sources such as legal texts or decrees these questions ultimately cannot be answered. Information of this kind is only available from the Roman period, when purple is clearly reserved for the rulers[928].

Jewellery and dress accessories were used to visualise wealth and prosperity from the beginning of the Bronze Age at the latest. The archaeological investigation of grave good patterns in cemeteries using inhumation or cremation is one of the basic and frequently applied methods to gain insights into the hierar-

927 Banck-Burgess 1999, with reference to further finds. – Hundt 1962.

928 Edmontson 2008, 26–29, 32–36.

chy and structure of prehistoric societies. Dress accessories and jewellery not only communicate information about the financial situation and the social position of the owner by their number, but also by their material value (bronze, iron, silver or gold)[929].

Wearing jewellery, the shine of metal contrasting with the naturally coloured or dyed fabrics, is a matter of social representation and self-representation. Even the sounds that people make when moving and the way clothing feels varies according to the number of metal elements used[930], *e.g.* when the soft, warm, resilient wool fabric is contrasted with hard, shiny, cold metal. In the Bronze and Iron Ages in Central Europe, women generally have more metal objects (jewellery and clothing accessories) in their graves than do men, and wealthier people have more than poor people. The individual wealth thus has direct repercussions for the physical experience of touch – at least when one appears in full costume like in the graves.

Sounds also play a role in encounters between people, and the effect is partly dependent on the metal objects a person carries. A particularly striking example is the fibula with sheet metal rattling pendants (Fig. 240) found in rich women's graves of the Hallstatt period. Examples include the two crescent bronze fibulae with ornate rattling plates and representations of animals from Grave 551[931] from the cemetery of Hallstatt in Upper Austria. It is certain that the appearance of the person should be striking not only visually, but also acoustically.

Behind some artefacts lies another interesting message, which was understood within the community jointly with the body language. Rich women of the Austrian and Bavarian Middle Bronze Age[932] for example sometimes have very long pins and spiked disk pendants placed on their chest (Fig. 241), whereas 'poorer' women only adorn their upper bodies with shorter pins and simple bronze spirals. Wearing spiked disk pendants does not only symbolise prosperity due to the ornamentation and

929 Sørensen 2010, 54–58.

930 Bergerbrant 2007, 62–65, 139–140.

931 Kromer 1959, 124, pl. 105/5. – Kern, Lammerhuber and Schwab 2010.

932 Grömer, Rösel-Mautendorfer and Bender Jørgensen 2013. – Wels-Weyrauch 1978.

Fig. 240. Sheet metal rattling pendants on an Early Iron Age fibula from the cemetery of Hallstatt in Austria, Grave 551. Model: Angelika Rudelics.

amount of metal used, but can clearly be understood as an obstacle to physical contact – a demarcation to a member of the elite.

In how far the garments themselves indicated membership in a particular social group in addition to the tangible evidence of jewellery and dress accessories from graves is not easily ascertained due to the low numbers of available textile material. In the Early and Middle Bronze Age[933], for example, people were regularly buried with dress pins. If we assume that at least the wealthy women, those who were buried with a garment that was fastened with two pins in the shoulder region, had at least one set of clothing, what did the women wear that were not buried with metal items? Were the metal clothing accessories merely replaced by organic materials such as two wooden thorns or by cords which could fasten the clothes in a similar fashion? Or was the clothing of the 'poorer' sectors of society cut differently, for example as a simple dress, which required no further fixing by the help of metal accessories?

[933] *E.g.* Wiegel 1994, 173–177. – Sørensen 1997, 95–102; 2010.

Only from the Iron Age onwards we find more answers to these specific questions about memberships to particular social groups. In the works of situla art it can be noted that different groups of males wear different clothes. The warriors on the situla from Certosa in Italy, for example, or on the scabbard of Hallstatt all wear short tunics, the 'civilians' on the situla from Certosa, however, wear a long garment reaching the calves concealing the body silhouette. People engaged in 'serving' activities, such as the 'waiter' on the situla from Kuffarn in Austria, are dressed in shorter tunics or just wear a loincloth. Even the hunter on the situla from Welzelach in Austria is dressed in such a way. One can therefore see a social differentiation in the clothing. Fist fighters only wear a narrow belt, but even this may be missing – they fight naked. On the situla housed in the Museum of Art in Providence, Rhode Island, USA, the folded clothes can be seen placed next to the naked fighters[934]. It is unclear, however, whether the stories shown in the pictures reflect the reality of the general population in the Hallstatt period (in the Eastern Alps).

Fig. 241. Middle Bronze Age Grave 2 from the cemetery of Pitten in Austria: spiked disks positioned on the chest and two long pins on the arms.

6.6 The value of clothing

Colour, texture, pattern, decoration and qualities such as fineness and coarseness demonstrate the visual judgements and cultural choices inherent in technological styles[935]. The manufac-

934 Rebay-Salisbury 2012a, 189–201.

935 See Harris 2012, 84–86.

ture of textiles is very labour intensive and time consuming[936]. The more complex the textile and the technique used, and the finer the quality of the fabric, the more time that is needed for its production. The question of the value of the clothes brings us to consider the value of work hours and human labour – dependent on the people who actually manufactured the textiles. For the Iron Age it is likely that mostly women were engaged in household production or responsible for spinning and weaving as specialists or in workshop production (see pages 247–261). Without written sources, the value of their work is simply not obtainable. From the Roman period, however, prices and wages become available through price edicts, ordinances or labels such as lead tags[937]. For the Central European Iron Age it can only be noted that some very valuable materials were used, be it imported dyes (Hallstatt, Hochdorf) or even gold threads (Hohmichele).

Furthermore it can be emphasised that garments, and textiles in general, were handled with care. We know of fabrics from the salt mines of Hallstatt that were carefully darned and mended with patches[938]. In addition, clothing was reworked and used for secondary purposes, for instance ripped into strips as binding material. All this proves that the 'resource textile', which neccesated so much labour and time, was valuable.

The value of clothing is well known from the ancient cultures of Greece and Rome, which have left many written sources[939]. In the Homeric epics, the Iliad and Odyssey, textiles represent a significant part of the total household assets. Gowns for wedding and death, family clothes and linen were part of the domestic wealth that women had to manage. Garments served both for representation in the wealthy households and as valuable gifts or votive offerings to the gods. The possession of clothes is – like jewellery – an investment, not an expendable item that was replaced after a short time. In Roman period, clothing forms an

936 Andersson Strand 2010a and b.

937 Lead tags: Martijnse 1993. Radman-Livaja 2013. – Papyri: Droß-Krüpe 2011. – Diocletian's Edict on Maximum Prices: Lauffer 1971.

938 Rösel-Mautendorfer 2013, 113–115. – Grömer, Rösel-Mautendorfer and Reschreiter 2013, 130–134.

939 Droß-Krüpe and Wager 2014. – Wagner-Hasel 2000; 2006. – Yiftach-Firanko 2003.

important part of dowries. Even in the Middle Ages[940] garments are mentioned in wills and inventories as durable valuables, which were often handed down through generations.

Is there any evidence how many pieces of clothing people would have possessed in prehistoric times? Answering this question is difficult, because we do not even know if there were special summer or winter clothes[941], although this is likely. Likewise, the question arises of in how far garments could be selected at will. Indirect evidence for the number of garments owned by an individual person comes again from graves, especially of the rich strata of the population. Women's graves of the Iron Age, particularly from the La Tène period, often contain very large numbers of fibulae. Many more pieces than would be necessary for fasting under and over garments in the shoulder and chest area were placed in the grave. Some burials were found with ten to sixteen fibulae in the chest area[942]. In some cases, they are placed so close to one another that a deposition in a pouch or purse seems likely.

The 'record holder' for most fibulae in one burial is a woman from the cemetery of Münsingen in Switzerland, who had 26 fibulae in her grave (Fig. 242), along with a bronze belt chain and gold and silver finger rings. Whether one can deduct from the number of fibulae how many pieces of clothing the woman 'owned' is questionable but not impossible. Assuming that two fibulae are needed to close a garment like a *peplos*, the women in grave 184 from Münsingen might have possessed at least 13 *peploi*. Such a wealth of clothes was certainly dedicated to her representational function.

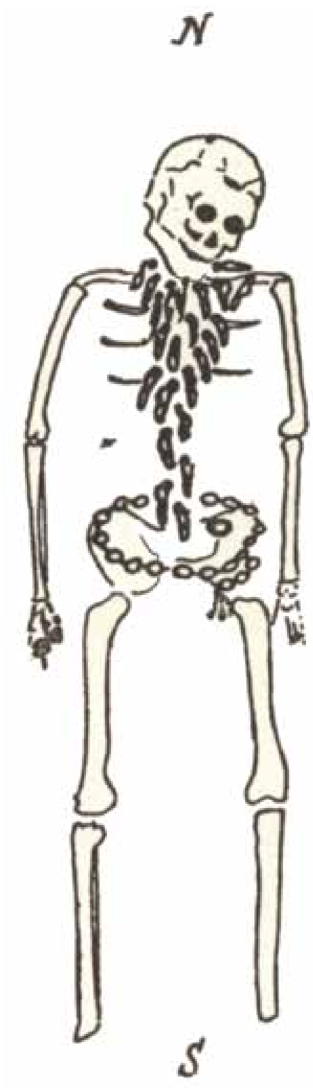

Fig. 242. Late Iron Age woman's Grave 184 from Münsingen in Switzerland with 26 fibulae.

7 Pre-Roman clothing history: conclusions

Wild, shaggy hair, primitive garments of coarsely materials, a fur coat slung over the shoulder – these are often the first im-

940 Reich 2005, 51–55, 182.

941 For general thoughts on Bronze Age cloth cultures see Harris 2012, 82–84.

942 Müller and Lüscher 2004, 108–109. – Münsingen: Wiedmer-Stern 1908 and Hodson 1968, 63.

ages that come to mind when one raises the question of how prehistoric people were clothed. This contrasts with the image of the noble, white-robed figures of Greek and Roman antiquity, wrapped in finely draped garments. The clothing of European prehistory, however, was colourful and varied, which this book aimed to demonstrate. A large number of different items of clothing can be identified. Some of these differences are due to the climates in which they have been used and found millennia later by archaeologists. Other changes in clothing are tied to the technical possibilities of the individual prehistoric periods. Particularly striking are the jewellery and the (metal) clothing accessories, which testify various fashions and fads. Clothing and costume are further the material expression of the social status of a person and their place in society.

It should be noted that there is not a continuous development from simple to complicate in the over 5,500 years spanning Central European clothing history from the Neolithic to the end of the Iron Age. It can be expected that clothing in prehistory was adapted to the situation – for summer and winter as well as for different climatic environments. A variety of materials played a role in the clothing of the people – leather, fur, various plant materials and finally woven textiles. Josef Wininger correctly states that '*textile garments could only replace those made of animal skins due to a more efficient textile production and such could only be achieved mechanically through the invention of weaving on a loom during the Neolithic.*' [943]

Developments in the textile crafts play a major role for woven clothes in particular. Changes, influences and innovations such as weaving and patterning technologies directly influence the design of clothing and are easy to trace and observe from the Neolithic to the Roman period. Furriery techniques, however, remain significant for the design of textile clothing to at least the Bronze Age, as evidenced by the cuts of Bronze Age blouses. Tailored garments also seemed to have been popular in the Central European Iron Age, as many scraps of sewn fabrics from Hallstatt demonstrate. In contemporary artistic representations, such as the ones on situlae, no draped garments like those worn

[943] Wininger 1995, 121.

in contemporaneous ancient Greece can be found. Clothes tailored and fitted to the body shape protected better from the cold than the draped and wrapped robes of the Mediterranean south. Cutting and sewing played an important role in Central and Northern Europe. The colder climate also makes a greater number and variety of clothing necessary.

Nevertheless, beside fitted garments like trousers, more and more the principles of clothing design based on the rectangular panel seem to prevail from the Iron Age onwards. This shapes the way they were put on and worn and has repercussions for the appearance and shape of individual pieces of clothing as well as the overall appearance of the person, including the body silhouette. Cloaks, scarves, throws or leg wraps consisted only of rectangular pieces of fabric, taken directly from the loom without further cutting or sewing.

Fig. 243. Figurine of a *togatus* from Carnuntum in Austria, Roman period.

Clothing draped around the body was taken to the extreme by the people of Mediterranean civilizations. The most striking example is the toga (Fig. 243), the robe of state and honour of the Roman citizen. In his book *De Pallio*, Tertullian describes the toga and its drapery around 200 AD:

'First, as to the simple putting on of the pallium, it is absolutely not bothersome. Indeed, there is no need of a specialist, who, the day before use, forms the plies at the beginning and leads them in pleats, assigning the whole formation of the contracted umbo to the custody of the pincers; who, at daybreak, having first shortened the tunic (which had better been woven at a moderate length!) with a belt, checks the umbo again and if anything has gone out of line, rearranges it, lets a part of the garment hang down on the left, draws back from the shoulders the surrounding part (from which stem the folds), with its folds now ending, and leaving free the right shoulder piles it on the left shoulder yet again, with another mass of folds destined for the back, thereby imposing a burden upon the man. Now I will interrogate

your conscience: how do you feel in a toga: dressed or oppressed? Is it like wearing clothes or bearing them? If you deny, I will follow you home, and I will see what you hasten to do right after the threshold. No other garment is taken off with such relief as the toga!' (Tert. *De Pallio* 5.1.3, 5.2.1).

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8.2. Visuality – Movement – Performance. The costume of a rich woman from Franzhausen in Austria, c. 2000 BC

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Visuality – Movement – Performance. The costume of a rich woman from Franzhausen in Austria, c. 2000 BC

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Introduction

Visual appearance is of tantamount importance for how a person is perceived by others. Body size, shape and colouring can be enhanced and manipulated by dress, make-up, jewellery and other props. This is something people have been aware of since the dawn of humankind, as evidenced by the finds of beads and ocher processing more than 70,000 years old.[2] The appearance of textile and metallurgical technologies added new possibilities, soon to be exploited by the emerging elites, e.g. in the early civilizations of Mesopotamia and Egypt.[3] Iconography, textual evidence and archaeological artefacts supply numerous examples of how dress was used to indicate superiority.

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[3] R. Hall, *Egyptian Textiles,* Aylesbury 1986, 63; J.N. Postgate, *Early Mesopotamia. Society and Economy at the dawn of history*, London and New York 1996, 261.

A rich female burial from Early Bronze Age Austria demonstrates that the prehistoric peoples of Europe also understood how to employ dress to impress.

Appearance and Performance, Movement and Body Language

Recent scholarship in psychology and sociology has investigated how visual appearance, movements and body language are perceived, and how this is processed by the brain.[4] Clothing conveys information about the identity of the person wearing it, and about social relations. Most studies have been conducted on modern western clothing styles, but recent research has also encompassed studies on clothing in prehistoric Europe and the ancient world.[5] In a series of studies, Marie Louise Stig Sørensen has called attention to the impact of clothing in Bronze Age Europe, discussing how it may have been used as a means for communicating identity and identifying social conventions.[6] In order to do that, she has created a series of analytical tools. One is the distinction between *cloth*, i.e. the textile itself; *clothing* designating the items of clothing made from the cloth, and *costume* of the total assemblage including dress fittings and ornaments.[7] Another distinction is between *attached objects,* i.e items that have become a permanent part of the body, such as finger-rings and ear-rings, but also neck-, arm- or anklerings that had been put on at an early age and no longer could be removed; *associated objects* that are removable adornments such as neck rings, ornamental buckles and larger arm- and leg rings and spirals; *additive objects* that either were sewn on and thus had become a permanent part of the clothing, or attached to the clothing such as buttons or pins; and *extensions,* objects that served as extensions of the body such as swords. In the Early Bronze Age, attached and additive objects were common while associated objects and extensions became common with the Middle Bronze Age.[8] Based on the work of Wels-Weyrauch,[9] Sørensen suggests that female costume can be divided into chest-costumes, where elaborate neck rings call attention to the upper part of the torso, and waist-costumes where jewellery and dress fittings draw the eye to the lower torso.[10] Throughout the Bronze Age, the head and hair area appears to have been regarded as a special zone.[11]

Archaeologist Peter S. Wells has used studies by neuroscientists and psychologists to explore how the human eye perceives dress and costume accessories found in prehistoric graves.[12]

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[4] E.g. F. Kiener, *Kleidung – Mode – Mensch. Versuch einer psychologischen Deutung,* München-Basel 1956; R. König, *Menschheit auf dem Laufsteg. Die Mode im Zivilisationsprozess,* Opladen 1999; A. Lurie, *The Language of Clothes,* New York 1981; C. M. Sommer, Dress and Identity – A Social Psychologist's Perspective. In: S. Schrenk; K. Vössing; M. Tellenbach (eds.), *Kleidung und Identität in religiösen Kontexten der römischen Kaiserzeit.* Publikationen der Reiss-Engelhorn-Museen Mannheim Bd. 47, Regensburg 2012, 257–263.

[5] S. Bergerbrant, *Bronze Age Identities: Costume, Conflict and Contact in Northern Europa 1600–1300 BC*. Stockholm Studies in Archaeology no. 43, Stockholm 2007; K. Grömer; H. Rösel-Mautendorfer; L. Bender Jørgensen, Visions of Dress. Recreating Bronze Age Clothing from the Danube Region. In: *Textile Journal of Cloth and Culture* Vol. 11/3, 218–241. DOI: 10.2752/175183513x1379321037403; M. Harlow; C. Michel; M.L.B. Nosch, *Prehistoric, Ancient Near Eastern and Aegean Textiles and Dress. An interdisciplinary antology,* Oxford and Oakville 2014, Dress in antiquity: DressID – dress and identity in the Roman Enpire www.dressid.eu (last accessed 1.10.2014).

[6] M.L.S. Sørensen, Identity, Gender, and Dress in the European Bronze Age. In H. Fokkens; A. Harding (eds), *The Oxford Handbook of the European Bronze Age,* Oxford 2013, 223.

[7] M.L.S. Sørensen, Reading Dress: the Construction of Social Categories and Identities in Bronze Age Europe. *Journal of European Archaeology* 5/1, 1997, 96, Fig. 2.

[8] M.L.S. Sørensen, Bronze Age bodiness – maps and coordinates. In K. Rebay-Salisbury; M.L.S. Sørensen; J. Hughes (eds), *Body Parts and Bodies Whole: Changing Relations and Meanings*, Oxford 2010, 56-57.

[9] U. Wels-Weyrauch, Im Grab erhalten, im Leben getragen - Tracht und Schmuck der Frau. In: A. Jockenhövel und W. Kubach (Eds): *Bronzezeit in Deutschland*, Stuttgart 1994, 59-64.

[10] Sørensen, *Reading Dress*, fig. 3.

[11] Sørensen, *Reading Dress*, 104-106.

[12] P.S. Wells, *Image and Response in Early Europe,* London 2008, 30-34.

Experiments show that attention focuses on certain aspects when looking at a person or object. The eyes first scan the surface, looking for landmarks such as edges and points that attract attention. Complex objects with highly decorated and possibly shiny surfaces require more viewing time and attention than simple unadorned objects. Surfaces, edges, structures, shapes, ornaments and colours thus play an important role in how an object, a costume ensemble, and thus in how a person is perceived. Lighting is an essential element of perception as well - a fact commonly forgotten in the modern world full of artificial lighting. In prehistoric times light sources merely included sunlight and fire, the latter in the form of a hearth, torches or oil lamps. In a case study Wells uses an Iron Age burial to discuss the visibility of different elements in daylight compared with the light of fire at night, concluding that the reflection of shiny surfaces makes metal objects stand out as glittering.[13]

Performance studies[14] mainly focused on theatrical and musical performances attempt to verbalise intangible phenomena such as rituals and acting. Rituals are described as collective memories encoded into actions that lead people into a 'second reality', separate from ordinary life, and thereby transforming them temporarily or permanently through rites of passage. Rituals may be sacred as well as secular; many rituals comprise both.[15] Textiles and clothing play important roles in rituals, often acting as symbols of transition. The lowering, wrapping, lifting or unwrapping of a piece of cloth, the wearing and/or exchanging certain garments serve to mark important stages in ceremonies such as initiations, weddings or funerals, and in a wide range of other performances.

Further recent scholarship has addressed relationships between clothing and body language,[16] mainly in works on modern business attire. Body language is a form of nonverbal commununication related to the movement of the body or any part of it – that comprises also facial expressions, eye movement, and – in relation with clothing – also body posture, gestures and use of space.

The connection between clothing and movement is also addressed in studies on 17th and 19th century female garments (crinoline, corset etc.), discussing how garments, their design and cut support or restrict specific movements.[17] In a new book on functional clothing design, Susan M. Watkins and Lucy E. Dunne[18] introduce new ways of looking at how clothing works, especially with movement, based on physics and physiology. They are analysing and describing sensory as well as mechanical aspects of body movements and try to identify what users of clothing need for movement. An aspect of their work is analysis of how volume and shape of clothing affect movement.[19] The latter is especially researched on modern sportswear, but the principles can also be applied to historic clothing. For prehistoric clothing, functional aspects of garments relating to movement have sometimes been discussed, e.g. in recent publications of the earliest trousers, excavated at Yanghai near the Turfan oasis in western China (date: 13th-10th century BC):[20] The authors argue that the

[13] Wells, *Image and Response...*, chapter 3, case study 68-69.

[14] H. Bial (ed), *The Performance Studies Reader,* London and New York 2010; R. Schechner, *Performance studies: An Introduction*. Third Edition. London and New York 2013.

[15] Schechner, *Performance studies...*, 52-53.

[16] S. Molcho, *Body speech,* New York 1985: St. Martins Press; B. Pease; A Pease, *The Definitive Book of Body Language,* New York 2006.

[17] K. Grömer; H. Rösel-Mautendorfer; H. Mückler, Immobilisierung durch Kleidung. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 142, 2012, 137–158; J. Laver, *Costume & Fashion. A concise history,* London 1996; Lurie, *The Language....*

[18] S. Watkins; L. Dunne, *Functional Clothing Design,* New York – London 2015, 31-88.

[19] Watkins; Dunne, *Functional Clothing...*, 53.

[20] U. Beck; M. Wagner; X. Li; D. Durkin-Meisterernst; P. E. Tarasov, The invention of trousers and its likely affiliation with horseback riding and mobility: A case study of late 2nd millennium BC finds from Turfan in eastern Central Asia. *Quarternary International* 348, 2014, 224–235.

trouser design with straight-fitting legs and wide crotch-piece which allows specific movements are part of a tool kit with which humans improve their physical qualities in an new epoch of horseback riding and greater mobility.

In the following, the thoughts of Sørensen, Wells and Watkins/Dunne will be applied in our investigation of a rich female burial from Franzhausen, dated to the Early Bronze Age.

ARCHAEOLOGICAL BACKGROUND: THE CEMETERY OF FRANZHAUSEN

The lower Traisen Valley in Lower Austria[21] was densely populated in the Early Bronze Age. Agriculture formed the livelihood of the population, while crafts and trade ensured a remarkable prosperity. Hilltop settlements, which were sometimes fortified, were centres of trade and metal working. Several small, rural settlements in the form of small hamlets were situated along a glacial ridge in the immediate vicinity of the Early Bronze Age cemetery at modern Franzhausen. One almost completely excavated settlement site revealed two longhouses of about 20 m length and several smaller additional buildings, interspersed with several storage and refuse pits.

The Franzhausen I cemetery[22] was excavated 1981-1983 and proved to comprise more than 1200 inhumation burials, dated within the time span of c. 2200-2000 BC. The graves were marked at the surface by mounds of different sizes, sometimes lined by stones, and by wooden posts. The dead were interred in crouched position, with more or less flexed legs. Imitating the natural sleeping position is thought to be at the root of this particular way of placing the dead. Although this mode of burial has been in use since the Palaeolithic, it was particularly widespread in the Early Bronze Age in Central Europe. Burials in supine position tend to be the exceptions. Cremations are very rare in the Early Bronze Age in Lower Austria.

Grave 110

Burial 110[23] contained the remains of a 25-30 year-old woman (Fig. 1). She was buried at a depth of 2.5 m, lying on her right side with the head to the south. Her grave was well furnished. Most notable is the bronze crest (a boomerang-shaped headdress), composed of small pieces of sheet bronze of 0.7 mm thickness. Within it, fragments of striped fabric were preserved. The headdress was placed obliquely along the cranium and it is decorated with lines in point and boss technique. The central, cross-like ornament may be perceived as a highly abstract anthropomorphic representation with outstretched arms.[24]

The woman from Grave 110 had a decorated sheet metal band around her head. Various rings and spirals of bronze wire were presumably braided into her hair. Her neck was adorned with an *Ösenhalsreif* neck ring; several heavy arm spirals were worn on the wrists and the hem of her dress was decorated with bronze plaques. The remains of food offerings, a ceramic bowl and the front leg of a sheep, as well as a drinking cup were found at her feet (Fig. 1). The grave structure as well as the rich grave goods suggests that the deceased had a high social status.

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[21] J.-W. NEUGEBAUER, *Archäologie in Niederösterreich. St. Pölten und das Traisental,* St. Pölten-Wien 1993, 59-69.

[22] C. NEUGEBAUER; J.-W. NEUGEBAUER, Franzhausen. Das frühbronzezeitliche Gräberfeld I, *Fundberichte Österreichs Materialhefte A 5,* Wien 1997.

[23] NEUGEBAUER; NEUGEBAUER, *Franzhausen...*, 116-117 and Taf. 41; 449-450.

[24] NEUGEBAUER, *Archäologie...*, 30.

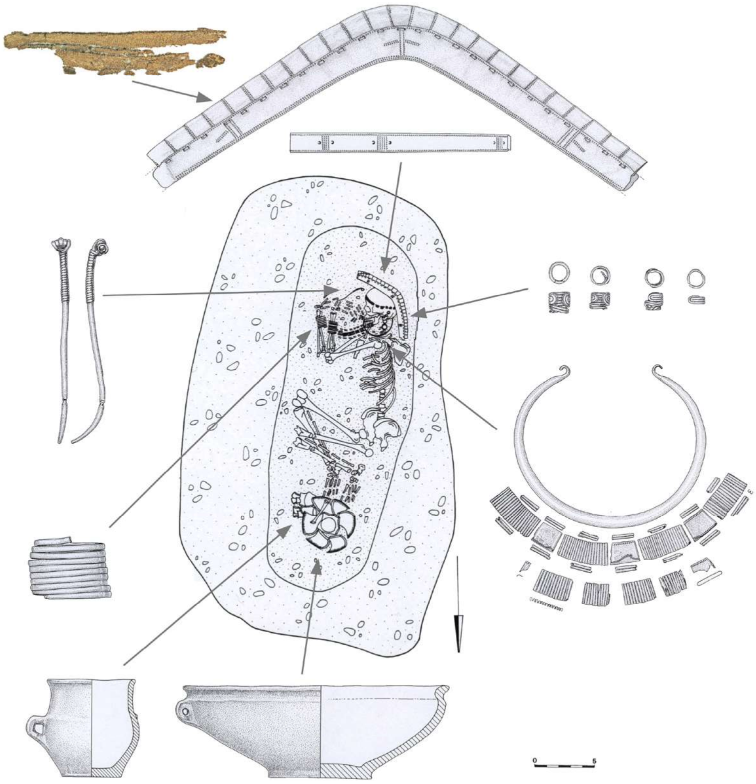

Fig. 1: Franzhausen I, Grave 110 (after Neugebauer and Neugebauer 1997, Taf. 41, 449-450).

Textiles Remains from Franzhausen and other Bronze Age sites

Textile remains were found in three graves at Franzhausen.[25] The fabric from the bronze crest of Grave 110 features quite prominently, as relatively large-scale organic remains are preserved. The fabric (Fig. 2) is a fine repp-like plain weave with 7/17 threads per cm. The S-twisted linen threads have a thread diameter of 0.3-0.4 mm like other fine Early Bronze Age textiles. The linen now appears in an olive hue due to the context with the bronze headdress. The striped design is outstanding. Two stripes of 6 dark brown threads are found on olive-coloured background, separated by one thin band of colour (8 threads) and another broader one (36 threads). The rest of the pattern cannot be ascertained. This fabric is the oldest textile with colour stripes from Central Europe. Unfortunately, it has not been possible to ascertain if the fibres of these darker threads also are linen, or perhaps a different fibre such as wool.

Other fabrics from Franzhausen such as an imprint on a bronze pin from Grave 392 resemble the coarser Bronze Age plain weaves.[26] It is a simple textile with 1 mm Z-twisted yarn and 5 threads per cm, which had corroded to a bronze pin in the chest area of a juvenile individual. Furthermore, from Grave 866 the remains of 1.5-2 mm S-plied yarn are visible on a bracelet.

A bronze sheet metal band around the head of a 20-30 year-old woman in Grave 234 is of

[25] K. Grömer, Textilien der Bronzezeit in Mitteleuropa. *Archaeologica Austriaca* 90, Vienna 2006, 58.
[26] See e.g. Hallstatt: K. Grömer, *The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe*, Veröffentlichungen der Prähistorischen Abteilung 5 (Vienna 2016), fig. 42 and 62.

interest here as well, because on the inner side organic remains are preserved. They are not analyzed so far, but at first sight they resemble leather/fur or felt.

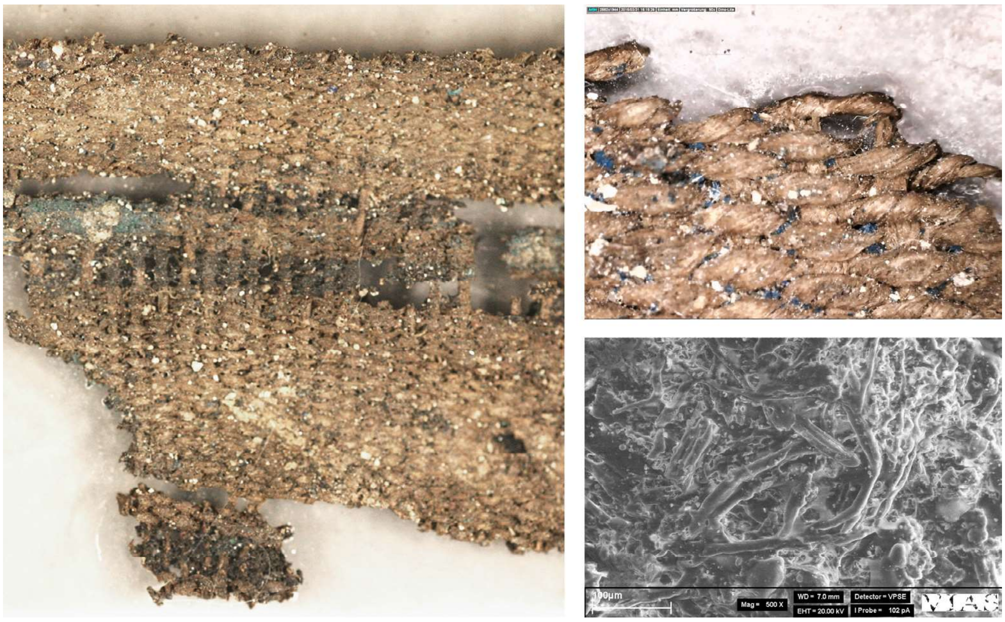

Fig. 2: Franzhausen I, Striped textile from Grave 110 (Photo: A. Schumacher and M. Mehofer).

In the last two decades, the textile culture of the Bronze Age in Central Europe has received special attention. Chronological as well as regional differences can be clearly determined. Early Bronze Age textiles from the countries around the Alps are still strongly rooted in the Neolithic tradition.[27] Plant raw materials are preferred. Fabrics are primarily made from flax yarn with average thread thickness of 0.5-0.7 mm. Patterns of Early Bronze Age textiles are often based on floating threads or inserted material that gives rise to structures, or sewn-on elements such as seeds.[28] Again, such techniques are rooted in older understandings of decoration. Unique in its complexity is the fabric from Pfäffikon-Irgenhausen in Switzerland[29] (date: 1700-1440 calBC), which is embroidered with checkerboard and triangular motifs.

In Central Europe, wool textiles tend to be common from the late Early Bronze Age/Middle Bronze Age onwards at sites like Mitterberg or Castione di Marchesi,[30] but these are made with thicker yarns (0.8-1.5 mm diameter). As in the Neolithic, the fabrics are only woven in plain weave. More complex types of weaves (twill) and specific weaving techniques such as tablet weaving have, according to current research, not been in use before the Middle Bronze Age. Well-known examples

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[27] Cf. A. Rast-Eicher, Bast before Wool: the first textiles. In P. Bichler; K. Grömer; R Hofmann-de Keijzer; A. Kern; H. Reschreiter (eds), *Hallstatt Textiles. Technical Analysis, Scientific Investigation and Experiment on Iron Age Textiles*. BAR International Series 1351, 2005, 117-31. Oxford, 124-129.

[28] E.g. from Molina di Ledro. M. Bazzanella; A. Mayr, *I reperti tessili, le fusaiole e i pesi da telaio dalla palafitta di Molina di Ledro,* Trento 2009.

[29] A. Rast-Eicher; A. Dietrich, *Neolithische und bronzezeitliche Gewebe und Geflechte. Die Funde aus den Seeufersiedlungen im Kanton Zürich,* Monographien der Kantonsarchäologie Zürich 46, Zürich and Egg 2015, 95-97, Fig. 267 and Taf. 42.

[30] Mitterberg: Grömer, *Textilien der Bronzezeit*..., 58-59; Castione di Marchesi: M. Bazzanella; A. Mayr; L. Moser; A. Rast-Eicher, *Textiles: intrecci e tessuti dalla preistoria europea*. Catalogo della mostra tenutasi a Riva del Garda dal 24 maggio al 19 ottobre 2003, Riva del Garda, Trento 2003, 200.

can be found in the salt mines of Hallstatt.[31] There are also finer fabric qualities and first spin direction patterns, the latter documented in finds from Hallstatt and Mitterberg.[32] Dyeing with plant dyes such as woad is also ascertained for the first time in the Middle Bronze Age in Central Europe.[33] At the same time, sheep with light wool[34] are bred, as wool from dark pigmented animals is not suitable for dyeing.

The reconstruction of the Franzhausen costume

In order to reconstruct the costume of the burial 110 from Franzhausen I, replicas were made of all bronze dress accessories and jewellery items present in the grave, as well as of the fabric from the headdress.[35] Additionally, our knowledge about contemporaneous textiles and pictorial sources were explored. As a basis for the shape reconstruction of the deseased's dress, the clothing of clay figurines from the Lower Danube was used. These are represented wearing long dresses with wide skirts[36] (Fig. 3).

Fig. 3 Clay figurine from the Lower Danube area, Middle Bronze Age, the National Museum Budapest (Photo: A. Krenn-Leeb).

[31] K. Grömer; A. Kern; H. Reschreiter; H. Rösel-Mautendorfer (eds.), *Textiles from Hallstatt. Weaving Culture in Bronze and Iron Age Salt Mines*, Archaeolingua 29, Budapest 2013, Bronze Age Catalogue, HallTex 211 and 288.

[32] Mitterberg: Grömer, *Textilien der Bronzezeit...*, Fig. 6.

[33] R. Hofmann-de Keijzer, Dyeing. In: K. Grömer, *The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe,* Veröffentlichungen der Prähistorischen Abteilung 5, Vienna 2016, 140-169, Fig. 84.

[34] Cf. A. Rast-Eicher; L. Bender Jørgensen, Sheep wool in Bronze and Iron Age Europe, *Journal of Archaeological Science* 40, 2013, 1234.

[35] Made by Stefan Jaroschinski, Pruttning, Dt. (Noricum-Replikate); https://de-de.facebook.com/pages/Noricum-Replikate-Shop/309064862518194 (last accessed 1.1.2016).

[36] T. Kovács, *A bronzkor magyarországon (Die Bronzezeit in Ungarn),* Budapest 1977, fig. 24; H. Müller-Karpe, *Handbuch der Vorgeschichte IV. Bronzezeit,* München 1980, pl. 326-327.

The dress

The linen fabric used for the dress reconstruction corresponds to the textile imprint from Franzhausen grave 392 in thread diameter and fabric density, as it was likely associated with a dress worn on the body. This linen quality is common in the Early Bronze Age.[37] The textile is an approximately 90-year-old 'peasant linen' from the Upper Austrian Mühlviertel region (Alberndorf), locally grown, hand spun and woven on a treadle loom.

A dress with the simplest possible cut was manufactured - two composite rectangles with neckline and holes for the arms. The length of the dress was arbitrarily chosen as ankle length - there is no evidence available in Grave 110 that would indicate a specific length. When girded, the dress presents a silhouette known from the Neolithic[38] and similar to the Danubian Bronze Age clay figurines.

The upper part of the reconstructed dress was embellished with replicas of the decorative elements known from the grave. These consisted of sheet bronze plaques with curled ends, which are easy to fasten. In the grave, these items are situated in a row on the neckline area (Fig. 4). As they were placed in a curved line, we arranged the neckline of the dress in a similar way.

On the lower part of the dress, some centimetres above the hem, shells were attached as ornaments, as known from the figurines as well. In the Franzhausen graves shells were sometimes found, but it is not sure if they corresponded to a dress.[39]

Fig. 4: Arrangement of the ornaments in the chest region in in the archaeological evidence (left) and reconstruction (right) (Photo: A. Schumacher, NHM; graph: after Neugebauer and Neugebauer 1997, Taf. 41).

[37] E.g. Bazzanella; Mayr, *I reperti...*, 129.
[38] Cf. Grömer, *The Art of...*, fig. 180, no. 14. Site Murr.
[39] See e.g. the shells in grave 258 (Neugebauer; Neugebauer, *Franzhausen...*, Taf. 481).

The headgear

For the reconstruction of the headgear, direct evidence from Grave 110 could be used: the bronze elements (boomerang-shaped crest and sheet metal band), as well as the preserved textile remains. Replicas of these were produced.

As the sheet metal band must have been attached to something, a cap was selected to be worn directly on the head, trimmed with sheet metal band. Leather as well as felt are possible materials for the cap (as we know from Grave 234). For our reconstruction brown felt was chosen.

The remains of striped fabric from the headdress were reconstructed by a hand weaver, and woven thread by thread exactly like the original.[40] The raw material for the ground weave was flax, but for the dark brown stripes "natural brown" wool was chosen, although this is a conjecture not backed by unequivocal fibre identification of the brown threads of the original textile. The striped fabric was interpreted as a veil, fastened to the bronze crest and hanging down from it. The length of the veil was freely chosen: a 120 cm long and 100 cm wide fabric that fully extends over the back when worn. How the striped fabric was attached to the headdress is unclear, as no holes or other mounting options were found at the edges, onto which a fabric could have been sewn and attached on permanently. A temporary solution to this problem was achieved by tucking the fabric firmly into the headdress (Fig. 5). Although this attachment is relatively simple, it holds surprisingly well. In the Bronze Age, a secure attachment was perhaps achieved by using resin or similar material.

Two pins were also found in Grave 110. It was not clear exactly what they were used for. From contemporaneous graves we often find two pins, worn on each shoulder[41]. In the case of Grave 110, we decided to fasten the veil with the pins.

Fig. 5: Reconstruction of the headgear, attaching the veil to the bronze crest (Photo: K. Grömer).

The reconstructed costume

Bringing all the evidence together, we were able to reconstruct a person wearing a long linen dress, richly decorated in the chest area with glittering bronze ornaments. That was topped

[40] Woven by Sirko Galz, Burglengenfeld, Dt. (Handweberei Galz); http://www.handweberei-galz.de/ (last accessed 1.1.2016). A treadle loom was used instead of the warp weighted loom common in the Bronze Age.
[41] Examples: e.g. Franzhausen I, Graves 118 and 747 (Neugebauer; Neugebauer, *Franzhausen*..., Taf. 46, 563-564.

by a marvellous headgear with a metal sheet trimmed cap and a bronze crest crowning a striped veil that is fastened to the dress by pins. All of these dress items together compose an impressive costume. Furthermore, to use Sørensens terms, the metal ornaments, bronze band and crest may be seen as additive objects, permanent parts of the clothing. In addition, the burial - and the costume – also contained several associated, removable objects. On both lower arms wide bronze-spiral armrings were worn. Smaller spirals in the ear-neck-region indicate some sort of braided hairstyle. An *Ösenhalsreifen* neck ring was worn around the neck.

Discussion

How the headdress was worn

The headdress of Grave 110 must have been conspicuous. In the grave, the bronze crest was situated above the head of the woman lying on her side in a crouched position (Fig. 6 left). This initially suggests hat the crest was worn sagitally, over the parting of the hair.

Against this may be argued that the crest had an obvious front and reverse side. The highly stylized antropomorphic figure is centrally located, but on one side only. The surface with the ornament makes more sense on the front. This implies that the headdress was worn across the head. Practical wearing experiments revealed that the headdress is very well balanced and holds up well when worn across the head. Worn over the hair parting like in the grave, in contrast, the centre of gravity is too far back and the object slides backwards off the head. Even fabric parts (veil) could not stabilize the heavy metal object. We therefore argue that the bronze crest was worn across the head rather than over the parting of the hair, and that the placement in the grave is the result of burying the woman on the side in crouched position, which tilted the headdress (Fig. 6, right).

Fig. 6: Franzhausen I, Grave 110: a. archaeological evidence and b. reconstruction of the costume in the burial (after Neugebauer 1993, p. 66; Photo: ©A. Schumacher).

Movement and body language

Compared to other female costumes from Central European Early Bronze Age, the headdress is especially noticeable. Other rich female graves also display pins on the shoulders,[42] as well as sheet metal bands on the forehead suggesting caps (e.g. Franzhausen I, grave 747).[43] Looking at these rich costumes in terms of possibilities of movement and body language, however, various further issues arise. It is assumed here that the costume from Grave 110 was worn during the woman's lifetime and does not merely represent a burial costume.

In principle, it can be assumed that wearing such a headdress requires practice as well as assistance. The bronze crest is heavy[44] and not permanently fixed on the cap. It has to be balanced on the head, and the veil draped correctly. In advance, the hair has to be arranged in a suitable coiffure and the bronze rings and spirals attached to it. This is best done by one or more assistants. Carrying the headdress requires a strictly upright posture. More or less slow, controlled movements are required to hold the headgear in place. Bending down or lowering the head should be avoided, otherwise the headgear falls off the head. The volume and shape of the veil also affect movements.[45] Mechanisms like that are known from various draped garments such as the Roman toga[46] which also requires specific postures and gestures to hold in place. Garment, body stance and movements are all part of a performance, communicating a message. The Roman toga was a formal garment, demonstrating a specific status. This is also the case with conspicuous and heavy headwear: crowns of royalty throughout the ages are examples in point.

Thus, such garments do have specific significance for a certain body language. In the case of the Franzhausen costume, the upright position, occupation of more space especially around the face (indicated by the wide flaring veil and headgear, sticking out over the shoulders) – will have created an imposing kind of body posture. Widening one`s personal space[47] through open and expansive posturing suggests a dominant status (in contrast to submissive postures which display avoidance tendencies)[48]. This will have been further emphasized by slow, controlled movements, creating tension and a feeling of expectance.

Such observations regarding movement, body language and performance also lead to suggestions about the occasions when this type of garment was worn. Was it a representative garment of a high-ranking person, was it reserved for ritual use, or both? The practical experiments with this kind of costume tell us clearly that the movability was restricted. The need for assistance to put it on, for keeping head and upper body upright and move in a controlled way suggests that it was hardly used for ordinary, daily wear.

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[42] U. Seidel, *Bronzezeit; Sammlungen des Württembergischen Landesmuseums Stuttgart* Bd. 2, Stuttgart 1995: Württembergisches Landesmuseum; Sørensen, *Reading Dress...*. Also Gemeinlebarn or Franzhausen II: Neugebauer, *Archäologie...*, 65.

[43] Neugebauer; Neugebauer, *Franzhausen...*, Taf. 563-565.

[44] Weight bronze crest: c. 500 g; veil c. 900 g.

[45] Compare Watkins; Dunne, *Functional Clothing...*, 80-81.

[46] J. Edmontson, Public Dress and Social Control in Late Republican and Early Imperial Rome. In: J. Edmontson; A. Keith (eds.), *Roman Dress and the Fabrics of Roman Culture,* Toronto 2008, 35.

[47] Pease; Pease, *The Definitive Book...*, 192-208.

[48] Molcho, *Body speech...*, 205-210.

Appearances - visual impact

The overall silhouette of the reconstructed garment ensemble from Franzhausen Grave 110 is strongly characterised by the bronze headdress and the drooping veil (Fig. 7). They conceal the shape of the person but empasize the face and give it an imposing frame. This effect is emphasised by the *Ösenhalsreif* neck ring, the pins and metal dress fittings at the chest. The striped fabric guides the gaze along the stripes and encourages the viewer to focus on the edges and the face again and again. This is further highlighted by the bronze rings and spirals decorating the hair. Through the stately headdress, the woman appears taller and larger. The dress itself - as reconstructed - has a monochrome surface offering few highlights to hold the eye, apart from the metal fittings on the upper body.

Altogether, the Franzhausen costume focuses attention on the head and upper torso. The effect is mainly due to the metal artefacts, in particular the bronze headdress, but the striped veil also contributes. The stripes make it stand out compared to all other known textiles from the Early Bronze Age. It is a rare case where Sørensen's concept of *cloth* is a distinctive feature in Bronze Age dress. If the dark stripes of the original fabric were wool, a novelty at the time, this will have added to how the garment was perceived. This is further emphasized by Peter Wells' argument that highly structured and decorated surfaces and shiny surfaces are crucial for the visual impression. The focus of this outfit is primarily on the head and upper body area. Seen from the back (Fig. 7 right), the person appears dressed in two layers of textiles and crowned by the curved headdress.

Fig. 7: Reconstruction of the costume from Franzhausen I, Grave 110 (Model: G. Lekaj; Photo: A. Schumacher, NHM).

The spiral armrings serve to round off the eye-catching part of the costume, placing it as an example of what Sørensen terms chest-costume with particular emphasis on the head. None of the bronze objects appear to have been permanently attached to the woman's body, but fall into Sørensen's categories of associated and additive objects. This suggests that it was a costume to be worn on special occasions, in particular the heavy headdress with the bronze crest.

Some thoughts on lighting as a factor may be added, based on the methodology presented by Peter Wells[49]. The effect of the clothing ensemble differs immensely whether it is seen in daylight, in full sunlight or at night with the light of fire. Further, the different effects of direct light (sun or fire) and indirect ambient lighting have to be considered. In the latter, the metal surfaces reflect light and add more diffuse shimmering highlights, which vary greatly in motion.

Figure 8 gives an idea of how the Franzhausen lady may have appeared to spectators processing towards a lit fire. Her bronze crest shines like the crescent of the new moon, or perhaps the rising sun. It is easy to imagine that her arrival will have produced a strong effect. As noted by Schechner, rituals frequently contain sacred as well as secular aspects.[50] The effect of the Franzhausen dress will have served excellently in purely religious performances, as well as legitimising the status of a ruling elite through spiritual connotations.

Fig. 8: The Franzhausen dress in the dark (Photo: K. Kracher, NHM).

Conclusion

The Franzhausen costume must have appeared extraordinarily impressive to contemporaneous viewers, due to the sheer amount of glittering bronze, and its very special form, as well as the way it made the woman's shape more imposing and conspicuous. The whole outfit expresses the high status of the wearer, and also demonstrates the Bronze Age people's skill of consciously combining different components and effects such as ornamented bronzes, textile textures and glossy surfaces to achieve an impressive ensemble and to convey non-verbal messages.

Acknowledgements

Thanks to Gloria Lekaj who acted as model and to Alice Schumacher for the photographs.

[49] Wells, *Image and Response...*, 46-47.
[50] Schechner, *Performance studies...*, 53.

8.3. Gedanken zur Kinderkleidung durch die Jahrtausende mit Schwerpunkt auf das römische Österreich

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Gedanken zur Kinderkleidung durch die Jahrtausende mit Schwerpunkt auf das römische Österreich

Von

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Zusammenfassung

Kinderkleidung als eigenes Modephänomen existierte weder in der mitteleuropäischen Eisenzeit noch in der römischen Kaiserzeit oder Spätantike. Die wenigen bildlichen Darstellungen der vorrömischen Epoche entsprechen den Hinweisen aus den Grabungsergebnissen. Nach der archäologischen Evidenz scheint es, dass Kinder als kleine Erwachsene gesehen wurden, die besonderen Schutz benötigten, der durch verschiedenste Amulette gewährleistet wurde. Prinzipiell sind auch in römischer Zeit die Kinder mit ähnlicher Trachtausstattung versehen wie die Erwachsenen, allerdings kommen charakteristische Elemente hinzu, während andere, einzig Erwachsenen vorbehaltene, die einen bestimmten Rechtsstatus anzeigen, fehlen. Zu beachten bleibt allerdings, dass sowohl schriftliche wie auch bildliche Quellen nicht alle Gesellschaftsschichten beschreiben, sondern es sich meist um frei geborene, sozial besser gestellte Kinder handelt. Die Grabbefunde aus Noricum verdeutlichen das aus den anderen Quellen vorliegende Bild für die breitere Bevölkerung in ländlichem Umfeld. Im Rahmen des Projektes DressID wurden auch Gewebereste aus diesen Bestattungen analysiert. Erste Ergebnisse zeigen, dass die Stoffe für Kinder und Erwachsene einander glichen, Unterschiede nur für Überkleidung (Mäntel?) beobachtet werden konnten.

Summary

Special clothes for children as an individual dress did not exist either during Iron Age or the Roman Period. The few existing effigies of the pre-Roman period match with our information from excavations. Children were considered to be small adults, who needed special protection, which was provided by various kinds of charms. This need for protection was also met during the Roman period. In general children wore similar dress than the adults. Characteristic elements were added while others being left to adults only with a certain legal status are missing. It is important to observe that written sources and effigies do not describe all social classes, but mostly refer to freeborn children of a higher social rank. Findings from the cemeteries of Noricum clarify the picture, which is shown in the other sources, for a larger population in a rural environment. The project DressID works on remains of fabric from those burials. First conclusions show, that the fabrics used for children's and adult's clothes were similar, differences can be found for cloaks.

1. Einleitung zum Begriff der Kindheit

Die Kinderkleidung ist ein Bereich, der in den meisten kostümkundlichen und modegeschichtlichen Abhandlungen eher spärlich erfasst ist – umso mehr, wenn es sich um die Urgeschichte handelt. Auch römische Kinderkleidung ist ein Forschungsdesiderat, sodass sich im EU-Projekt „*DressID – Kleidung und Identität*“[1] eine eigene Studiengruppe unter der Leitung von Cäcilia Fluck und Manel Garcia mit dem Thema „*Gender and Age*“ befasst[2], das Forschungen zur Repräsentation von Kindern im römischen Reich mit einschließt.

Allgemein ist die Geschichte der Kinderkleidung untrennbar mit Mentalitätsgeschichte verbunden – damit, wie eine Gesellschaft Kinder und „Kindheit“ wahrnimmt, vor allem, ab welchem Alter Kinder Aufgaben der Erwachsenenwelt übernehmen.

Allgemein umfasst die Kindheit den Zeitraum von der Geburt bis zur Geschlechtsreife. Nach heutigem, westlichem Konsens (Brockhaus 1990, Stichwort „Kind“) wird zwischen dem Babyalter (1. Lebensjahr), dem Kleinkindalter (2.–3. Lebensjahr), der frühen Kindheit (4.–6. Lebensjahr) und dem „Schulkind“ (7.–14. Lebensjahr) unterschieden, worauf das Jugendalter mit der Pubertät folgt.

Der Begriff Kindheit ist nicht nur ein biologischer, sondern er ist sehr stark vom Weltbild geprägt, was ihm einen kulturellen, soziologischen Aspekt verleiht (Stearns 2007). Die Idee der „Kindheit“ wie wir sie heute verstehen, als eine Zeit der Erwerbsfreiheit und des Lernens, in der die Kinder das Recht auf Schutz, Erziehung und Entfaltung ihrer Persönlichkeit haben, ist relativ jung (Postman 1987, 49 ff.; Stearns 2007, 88 ff.). Erst zwischen dem 16. und dem 18. Jh. entwickelte sich dieses Weltbild, das sich auch in einer sichtbaren Separierung der Kinder von den Erwachsenen niederschlägt. Dies äußert sich dann unter anderem in definitiver Kinderkleidung – auf die Spitze getrieben im 19. Jh. mit den „Matrosenanzügen“ und kurzen Hosen für Knaben und die Kleiderschürzen für Mädchen.

Geht man nun Jahrtausende zurück in die mitteleuropäische Eisenzeit, so sind wesentliche weltanschauliche und soziologische Fragen aufgrund der fehlenden Schriftlichkeit nicht zu beantworten: Wir wissen nicht mit Bestimmtheit, wie die Sichtweise zur Kindheit war, wann nach dem Säuglings- und Kleinkindalter der soziologische Statuswechsel vom Kind zum Erwachsenen erfolgte, ab wann Kinder in die Arbeitswelt der Erwachsenen integriert wurden (vgl. Stearns 2007, 19–33). Der soziale Status des Kindes und seiner Familie dürften vor allem bei letzterem Kriterium eine Rolle gespielt haben.

In römischer Zeit sind wir zur Kindheit besser unterrichtet (Eyben 1986; Veyne 1989, 23–44): Der junge Römer (teils auch Mädchen) wurde zwischen seinem 7. und 11. Lebensjahr in der Schule bzw. von einem Hauslehrer unterrichtet. Jungen aus der Oberschicht im Alter von 12 bis 16 Jahren besuchten die Grammatik- und Rhetorikschulen. Nach Römischem Recht lag das Mindestalter für die Eheschließung bei 12 Jahren für Mädchen und 14 Jahren für Knaben, wenn auch meist später geheiratet wurde. Ein Altersunterschied von ca. 10 Jahren zwischen Braut und Bräutigam wurde für sinnvoll erachtet, sodass junge Männer meist zwischen 20 und 30 Jahren heirateten. Für Mädchen markierte die Ehe den Statusübergang vom Kind zur Erwachsenen, zur verheirateten Frau.

Der junge, frei geborene Römer legte hingegen mit ca. 14–16 Jahren die Kinderkleidung ab und hatte nun das Recht, Männerkleidung zu tragen. Nun folgte bis zur Eheschließung eine Phase der Jugendjahre, teilweise wurden von einem Spross einer angesehenen Familie auch schon vor seinem 20. Lebensjahr Ämter bekleidet.

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[1]) Das Naturhistorische Museum Wien nimmt 2007-2012 am internationalen Forschungsprojekt „*DressID – Clothing and Identities. New Perspectives on Textiles in the Roman Empire*“ teil, das unter der Leitung der Curt-Engelhorn-Stiftung für die Reiss-Engelhorn-Museen Mannheim aus den Mitteln des EU „Culture“ Programmes finanziert wird. Projektpartner sind neben dem NHMW das Centre for Textile Research in Dänemark, das Institut KIK IRPA Brüssel in Belgien, das Department für Archäologie der Universität von Kreta, Rethymnon in Griechenland, das Departamento de Historia der Universidad Valencia in Spanien sowie das Department of Archaeology der Universität Sheffield in Großbritannien. Homepage: http://www.dressid.eu.

[2]) http://www.dressid.eu/study-groups/c-gender-and-age (Abruf 17.2.2010).


Abb. 1. Frühlatènezeitliche Situla von Kuffarn, Niederösterreich, Detail des Frieses mit Trinkszene (© Naturhistorisches Museum Wien).

Abb. 2. Rekonstruktion des Kindergewandes von Sieglinde Obermüller im Museum Hallstatt (Foto: K. Grömer).

Die Lebensalter der Kinder römischer Bürger sind also einer gewissen Abfolge des Lernens und der Entfaltung unterworfen. Sind jedoch diese Kriterien auch auf Kinder der Unterschicht, der einheimischen Bevölkerung in den Provinzen und der Sklaven anwendbar – oder wurden diese so früh es nur irgend ging, zur Subsistenzsicherung in Arbeitsprozesse der Erwachsenen mit eingebunden (vgl. STEARNS 2007, 45–50)? Eventuell erfolgte dies bereits schrittweise vor und vor allem in der frühen Kindheitsphase mit 4–6 Jahren. Nach entwicklungspsychologischen Erkenntnissen (verkürzt in BROCKHAUS 1990, Stichwort „Kind") ist ein Kind mit 4–6 Jahren körperlich und geistig bereits so weit entwickelt, dass der Spracherwerb im Wesentlichen abgeschlossen ist und es grundlegende Handgriffe des täglichen Lebens bewältigen kann.

Überlegungen zu einer frühen Sozialisation in die Welt der Erwachsenen wurden erstmals vom französischen Historiker Philippe Ariès angedacht. Manche der bei ARIÈS (1978, 46 f. und bes. 69–220) vorgebrachten Thesen sind heute umstritten bzw. widerlegt (siehe etwa STEARNS 2007, 71–87), die hier verwendete grundsätzliche Aussage im Spannungsfeld von Arbeit und visueller Repräsentation von Kindern ist jedoch nach wie vor relevant. Ariès stellte in seiner „Geschichte der Kindheit" die Theorie auf, dass es in Frühgeschichte und Mittelalter die Abgrenzung zwischen Kindern und Erwachsenen, so wie wir sie kennen, nicht gegeben hat. Kinder lebten, sobald sie sich alleine fortbewegen und verständlich machen konnten, mit den Erwachsenen in einem informellen natürlichen „Lehrverhältnis", sie waren kleine Erwachsene. Die Kinder waren schon sehr früh in die Aufgabenbereiche der Erwachsenen integriert – sie verrichteten die gleiche Arbeit, sie spielten auch dieselben Spiele wie diese und waren auch ähnlich gekleidet.

Nach den Weistümern, den bäuerlichen Gewohnheitsrechten aus dem 14.–16. Jh., galten Jungen wie Mädchen ab dem 7. Lebensjahr als fähig, sich durch Arbeit selbst zu ernähren (REALLEXIKON 2000, bes. S. 529 „§4 Die rechtliche Stellung der Kinder").

Diese einführenden Worte sollten jenen Rahmenbegriff „Kindheit" etwas relativieren, der uns heutzutage in der westlichen Welt so selbstverständlich und festgeschrieben erscheint. Er variierte jedoch je nach Epoche, kulturellem Zusammenhang und innerhalb dieser auch nach Sozialstatus.

2. Eisenzeit

Beginnen wir unseren Streifzug durch die Kleidungsformen von Kindern im 1. vorchristlichen Jahrtausend. Die Kinderkleidung in der Eisenzeit erschließt sich uns vor allem durch direkte Zeugnisse, etwa in-situ-Lagen von Trachtbestandteilen und Schmuck in Gräbern, während Kinder in zeitgenössischen Darstellungen eher selten abgebildet wurden.

Am Ende der mitteleuropäischen Eisenzeit sind vereinzelt antike Schriftquellen greifbar, die auch Bemerkungen zur Kleidung der „barbarischen" Stämme nördlich der mediterranen Hochkulturen enthalten (Zusammenstellung etwa bei KURZYNSKI 1996, 68 ff.). Zu Kindern ist dabei die literarische Quellenlage äußerst spärlich. Die Hinweise sind nur marginal – so bemerkte etwa Aristoteles im 4. Jh. v. Chr., dass die Kelten Neugeborene nur wenig bekleideten (Aristoteles politika VII, 17, p.1336a 18 ff.: HERRMANN 1988–1992, 54 f.). Er führt das aber nicht aus dem Aspekt der Kinderkleidung an, sondern weil er festhalten wollte, dass die Kelten viel von Abhärtung gehalten hätten – der Topos des wilden Kriegers.

Es ist aus der Eisenzeit Mitteleuropas keine originale Kinderkleidung aus gewobenem Stoff erhalten – an Kleidungsbestandteilen kennen wir nur die Kinderschuhe aus den Bergwerken Hallstatt und Dürrnberg/Hallein. Es handelt sich bei diesen drei Exemplaren um verschiedene Bundschuhe in (heutigen) Schuhgrößen 31/32. Diese Schuhtypen gibt es von diesen Fundorten auch in „erwachsenen" Größen, etwa (heutiger) Schuhgröße 40/41 (BARTH 1992). Zur Rolle von Kindern im Bergwerk vergleiche den Beitrag von Doris PANY-KUCERA, Hans RESCHREITER und Anton KERN (in diesem Band).

Die Analyse von Trachtlagen – der Kleidungsbestandteile und Schmuckstücke in den Gräbern – zeigt an, welche Kleidung die entsprechende Person bei der Grablege trug bzw. was von den Angehörigen zur Sichtbarmachung des Status als wichtig erachtet wurde. Dies muss nicht unbedingt die (Alltags-)Kleidung zu Lebzeiten widerspiegeln. Dennoch sind derartige Untersuchungen von essentieller Bedeutung für die Kleiderforschung.

Die Trachtlagen in eisenzeitlichen Kindergräbern (ca. 6–14-jährige Individuen) Mitteleuropas (s. in diesem Band Anton KERN für Hallstatt, Peter RAMSL für Latènezeit) entsprechen zum Teil jenen der Erwachsenen und teilen auch deren soziale Abstufungen. So haben Mädchen wie Frauen einer bestimmten Sozialschicht Arm- und Halsringe, Schmuckketten und paarige Fibeln an den Schultern. Bei Knaben findet sich als Trachtbestandteil eine Fibel an der Schulter – was wiederum auch bei Männern zu beobachten ist. Zeigt dies nun an, dass Kinder dieser Altersgruppe auch dieselben Kleidungsstücke wie Erwachsene trugen? Zusätzlich werden Kindern häufig Amulette mitgegeben.

Die bildliche Kunst der Eisenzeit ist in Bezug auf Kinderkleidung eher spärlich (Situlendarstellungen: LUCKE – FREY 1962 oder TURK 2005). Eine eindeutige Kinderdarstellung (aufgrund der Körperproportion) gibt es auf der frühlatènezeitlichen Situla von Kuffarn in Niederösterreich (Abb. 1). Sie findet sich bei der Szene mit einem thronenden Erwachsenen mit langem, kariertem Gewand und großem Hut, dem von zwei Personen Wein gereicht wird. Diese „Diener“ tragen einen kürzeren (ärmellosen?) Kittel bzw. ein Lendentuch. Das Kind (Abb. 1–2), das hinter dem sitzenden Erwachsenen steht und zu diesem emporblickt, hat wie jener ein knöchellanges kariertes Gewand und eine Kopfbedeckung – eine barettartige Kappe. Das Gewand des Kindes verhüllt vollständig die Körpersilhouette – eine Kleidungsart bzw. Darstellungsweise, die auch bei den langen Gewändern stehender Erwachsener etwa auf den Situlen von Certosa oder Sanzeno sichtbar ist (LUCKE – FREY 1962). In diesem Fall gleicht also die Kinderkleidung jener der anderen nichtkriegerischen männlichen Erwachsenen in der Situlenkunst. Dabei ist zu beachten, dass sich auf der Situlenkunst die soziale Oberschicht repräsentiert.

Eine Kinderdarstellung einer im Donaugebiet heimischen Bevölkerung, die ebenfalls dieselbe Tendenz wiedergibt, datiert in römische Zeit. Sie findet sich auf der um 193 n. Chr. fertig gestellten Markussäule in Rom (WOLFF 2001; SCHLABOW 1976, 49) mit der Darstellung der Kriege des Kaisers Marcus Aurelius gegen die im Donaugebiet besiegten germanischen Völker (Markomannen, Quaden, Sarmaten ...). Bei der Szene, bei der römische Truppen in ein germanisches Dorf eindringen, ist neben Männern und einer Frau auch ein Kind zu sehen (Abb. 3). Dieses trägt wie die erwachsenen Männer lange Hosen und einen Kittel – Kleidungsformen, die wir auch für die Kelten in der Latènezeit annehmen.

3. Römerzeit

Für die römische Zeit sind die Quellen zur Kleidung von Kindern höchst vielfältig. Viele bildliche Darstellungen aus Rom und aus den Provinzen stehen zur Verfügung, Kinder und ihre Kleidung werden auch in Schriftquellen genannt. Vor allem aus Ägypten sind zahlreiche vollständige Originalfunde von Kindergewändern erhalten (s. Cäcilia FLUCK, in diesem Band).

Im vorliegenden Beitrag werden nur einige allgemeine grundlegende Bemerkungen zu römischer Kinderkleidung thematisiert, bevor wir uns mit Fallbeispielen der Provinz Noricum im Speziellen zuwenden.

In der Antike war es üblich, Neugeborene und Säuglinge in Tücher und Bänder einzuwickeln, sodass ihre Bewegungsfähigkeit eingeschränkt war. Der Arzt Soranus gibt in seiner Gynaecologia (2.14 [83]; zit. nach CROOM 2002, 119 ff.) im frühen 2. Jh. n. Chr. detaillierte Anweisungen, wie dabei vorzugehen und welche Stoffe zu verwenden seien. Er führt an, dass Kinder ca. 40–60 Tage vollständig gewickelt werden sollen.

Abb. 3. Markussäule in Rom, 193 n. Chr. Darstellung eines germanischen Kindes (nach SCHLABOW 1976, Abb. 62).

Diese Praxis des vollständigen Umwickelns von Säuglingen ist durch die Zeiten, auch noch in der mitteleuropäischen Volkskunde zu beobachten. Bei diesen Wickelkindern erübrigte sich bis auf allfällige Kopfbedeckungen jede weitere Kleidung. Im archäologischen Fundgut aus der griechischen und römischen Antike tauchen Votivstatuetten und auch Grabreliefs mit Darstellungen von Wickelkindern auf (CROOM 2002, Abb. 58; CLELAND et al. 2007, 184 „swaddling"). Die berühmteste literarische Schilderung eines antiken Wickelkindes ist die Beschreibung des neugeborenen Jesus im Neuen Testament (NT, Lukas 2, 6–7).

Für die Zeit nach dem Säuglingsalter vertreten die meisten Forscher die These, dass römische Kinder dieselben Kleidungstypen wie Erwachsene tragen (CLELAND et al. 2007, 32 „childrens clothing"; CROOM 2002, 120 ff.; differenziert bei OLSEN 2008). Es ist vor allem das Weglassen bzw. das Hinzufügen bestimmter Elemente, was dann die Kinderkleidung auszeichnet. Die grundlegenden Kleidungsstücke für Erwachsene wie auch für Kinder waren verschiedene Tuniken und Mäntel. Die Tuniken wurden – außer bei Kleinkindern – gegürtet getragen. Freigeborene Jungen und teils auch Mädchen durften sich bei formellen Anlässen mit der *Toga praetexta* kleiden, die Toga mit roter Borte. Diese rote Bordüre, die auch römische Beamte trugen, galt bei Kindern als Unheil abweisendes Symbol und als Zeichen der freien Geburt. Es gibt Darstellungen sehr kleiner Kinder der kaiserlichen Familie mit Toga, etwa auf der Ara Pacis in Rom (Abb. 4). Jungen hatten zusätzlich auch die Bulla (GOETTE 1986), ein unheilabwehrendes Amulett von hohler, runder Form, das ebenfalls nur von Freigeborenen getragen werden durfte. Diese wurde beim Erreichen des Erwachsenenalters den Hausgöttern, den Laren, geopfert, und die *Toga praetexta* wurde gegen die *Toga virilis* (vgl. die angegebenen Stichworte bei CLELAND et al. 2007), die weiße Toga, ausgetauscht.

Wenn auch die grundlegenden Kleidungstypen für römische Kinder und Erwachsene ähnlich sind, so werden sie in den literarischen Quellen mit unterschiedlichen Be-

Abb. 4. Ara Pacis in Rom, Detail des Südfrieses mit Darstellung von Kindern in Toga (nach OLSEN 2008, Abb. 6.2).

nennungen versehen (vgl. die angegebenen Stichworte bei CLELAND et al. 2007). Die Untertunika der verheirateten Römerin wird *indusium* genannt, die leinenen ärmellosen Untertuniken von Mädchen und Bräuten *supparum*. Als Attribute für Mädchen werden literarisch Haarbänder (*vittae*) genannt, die anstelle der Schleier (*velum*) oder des Übergewandes/Mantels (*palla*) erwachsener Frauen getragen wurden. Das Amulett junger Mädchen war die *lunula*, ein mondförmiger Anhänger. Lunulae sind durch Bodenfunde oft bezeugt (vgl. Kap. 3.2).

Aus Rom mit seiner reichen Evidenz richten wir nun mit Noricum das Augenmerk auf eine Provinz am Donaulimes, die 15 v. Chr. in das Römische Reich eingegliedert wurde und die auch großteils das Territorium der oben beschriebenen eisenzeitlichen Funde abdeckt.

3.1 Ikonografie zur sogenannten „Norischen Tracht“

In den römischen Donauprovinzen finden sich im 1. und 2. Jh. n. Chr. Grabstelen und Grabaltäre der einheimischen Bevölkerung, die zwar Produkte von Bildhauern in römischer Tradition sind, aber in Gewandtracht und Frisuren auf einheimische Motive zurückgreifen (BÖHME-SCHÖNBERGER 1997). Diese Bildzeugnisse zeigen oft weibliche Personen in lokaler Tracht, während meist der Mann (wenn auch mit einheimischem Namen), teils auch Knaben mit Toga dargestellt wurden, um den Status eines römischen Bürgers zu repräsentieren.

Die sogenannten „Norischen Mädchen- oder Dienerinnenreliefs“ aus dem 1. und 2. Jh. n. Chr. zeigen Mädchen in zwei unterschiedlichen Gewandtrachten (GARBSCH

1965; zuletzt: POCHMARSKI 2004). Die einen, mit dem berühmtesten Vertreter aus Klagenfurt (Abb. 5, 6A), haben ein knöchellanges Kleid und darüber ein an den Schultern gefibeltes Schlauchkleid, das kürzer ist als das Untergewand. Die Fibeln sind dabei ein Typicum, das auf eisenzeitliche Traditionen zurückgeht (s. Kap. 2). Sowohl bei den Darstellungen als auch bei zeitgleichen Bodenfunden der frühen Kaiserzeit handelt es sich um bis zu 20 cm lange Flügelfibeln. Dazu betonte ein metallverzierter Gürtel mit dreigeteiltem Riemenende die Taille. Andere Mädchen, etwa auf dem Grabstein von St. Peter in Holz (Abb. 6B), sind mit einem ebenfalls knöchellangen Untergewand und einem darüber getragenen Kleid mit angeschnittenen weiten Dreiviertelärmeln dargestellt. Bei diesen Abbildungen finden sich keine Fibeln an den Schultern, das Kleid wird lediglich mit einem schmalen Schnurgürtel zusammengehalten.

Die bildlichen Darstellungen (vgl. GARBSCH 1965) lassen klar den Unterschied zwischen der Mädchentracht und jener der verheirateten Frau erkennen: Die auf zeitgleichen Grabsteinen dargestellte Kleidung von Frauen hat ebenfalls jene Grundbestandteile, wird aber um einen offen getragenen Mantel und verschiedene Hut-, Hauben- und Schleierformen erweitert.

3.2 Trachtlagen in Gräbern der Provinz Noricum

Für Neugeborene und Säuglinge bestand eine gesetzliche Regelung, dass Kinder nur dann auf Gräberfeldern regulär bestattet werden durften, wenn ihre Zähne bereits durchgebrochen waren und sie als Mitglieder der Gemeinschaft zählten (Plin. Nat. hist. VII 15,72). An dieser Bestimmung wird üblicherweise abgelesen, dass Kinder im ersten Lebensjahr außerhalb der Norm zu betrachten sind. Die Ausstattung von Kleinkindern in norischen Gräberfeldern reduziert sich hauptsächlich auf wenige Beigaben wie Keramikbecher, verkleinerte Keramikformen (HÖLBLING 2008, 76–77), Glasgefäße, Saugfläschchen aus Ton oder Glas (Tulln Feuerwehrschule, unpubliziert, FN 5212, 5459) sowie Schmuckgegenstände und Trachtzubehör. Stoffreste selbst finden sich selten.

Römische Kaiserzeit (1.–3. Jh. n. Chr.)

In den Kinderbrandgräbern der römischen Kaiserzeit wird kaum Bekleidungszubehör gefunden, was auch der Ausstattung der Erwachsenengräber häufig entspricht, da die Toten nicht in voller Tracht verbrannt wurden. Kindern wurden bei der an die Verbrennung anschließenden Beisetzung in einem Brandgrab eher Gebrauchsgegenstände mitgegeben und auf Schmuck wurde meist wenig Wert gelegt. Ein Beispiel für aufwändige Schmuckbeigaben der Kaiserzeit ist das Grab des Mädchens Crepereia Tryphaena aus Rom, der eine Gliederpuppe aus Elfenbein, ein Holzkästchen und ein Ring mit geschnittenem Jaspis mitgegeben wurden (BÖHME-SCHÖNBERGER 1997, 61–62).

Mit so reicher Ausstattung ist in den kaiserzeitlichen Gräberfeldern Noricums nicht zu rechnen. Als großes Problem für die Analyse der früh- bis mittelkaiserzeitlichen Bestattungen erwies sich, dass bei Altgrabungen dem Leichenbrand kaum Beachtung geschenkt wurde und daher für die meisten der norisch-pannonischen Hügelgräber des 1. und 2. Jh. keine anthropologische Untersuchung durchgeführt wurde, die es nun ermöglichen würde, Kindergräber herauszufiltern[3]. Zudem kann zur Trachtlage aus den Befunden heraus nichts gesagt werden, da es sich für die Frühzeit zumeist um Brandgräber handelt. So bleibt die Analyse auf die Informationen aus der oben bereits vorgestellten Ikonographie beschränkt. Die von dort bekannten Trachtbestandteile sind durch zahlreiche Funde zwar bestätigt, können aufgrund der eben erläuterten Problematik allerdings keinen bestimmten Kinderbestattungen zugewiesen werden.

Als eines der wenigen Hügelgräberfelder, in denen Kindergräber identifizierbar sind, sei jenes von Kapfenstein angeführt. In vier Hügeln wurden Kinder einzeln bestattet (URBAN 1984). Die Beigaben entsprechen dem typischen keramischen Spektrum

[3]) Kontrolliert wurden stichprobenartig die Publikationen zu den Hügelgräbern von Rassach, Grünau, Tanzelsdorf, Leitersdorf, Flavia Solva und Katsch.

der norisch-pannonischen Hügelgräber mit Dreifußschüsseln, zugehörigen Deckeln, Schüsseln und Töpfchen. Nur in Hügel 22 wurde eine Doppelknopffibel im Leichenbrand gefunden. In der Nachbarprovinz Pannonien wurde in Hügel 4 von Katzelsdorf (URBAN 1985) Leichenbrand eines Kindes gefunden, ebenfalls mit der typischen Keramik. Riemenbeschläge, Hutnieten, Fibelreste, sowie bronzene Sieb- und Kannenfragmente zeigen die ungewöhnlich reich ausgestattete Bestattung eines sechs- bis zwölfjährigen Kindes. Vereinzelt wurden verschmolzene Glastropfen im Leichenbrand gefunden, die auch von Glasperlen stammen können, so etwa in den Gräberfeldern von Pottenbrunn (HÖLBLING 2008, 227) und Saladorf (Grab 1799).

Neonaten wurden fast immer ohne Beigaben oder Trachtbestandteile in einem Körpergrab bestattet und nur selten verbrannt. Beispiele für beide Sitten finden sich in ländlichen Gräberfeldern wie Pottenbrunn.

Ein Beispiel für eine vergleichsweise gut ausgestattete Kinderbestattung ist das Körpergrab eines Mädchens aus Wels, in dem einerseits Töpfchen und Teller, aber auch zwei Doppelknopffibeln an der Schulter gefunden wurden (MIGLBAUER 2007: Wels Bahnhofstrasse, Grab 36). In den Gräberfeldern Noricums wurden immer wieder Neonaten bzw. Kleinkinder gefunden, die neben der Urne der Mutter bzw. gemeinsam mit der Mutter bestattet wurden. Deren Ausstattung kann sowohl Mutter wie Kind gelten und ist daher von der Analyse ausgenommen.

Späte Kaiserzeit und Spätantike (4.–5. Jh. n. Chr.)

In den Kinderkörpergräbern der späteren Kaiserzeit und Spätantike fehlen Beigaben oder Trachtbestandteile ebenfalls häufig. An Schmuck werden Kleinkindern besonders Stücke mitgegeben, die dazu dienten, Unheil abwehren. Eine derartige apothropäische Wirkung wurde vor allem Melonenperlen (Abb. 7) in verschiedenen Schattierungen von blau bis türkis zugesprochen (KEMMINGER 1995, 99-100), aber auch sogenannte Augenperlen, bei denen färbig aufgelegte Glasfäden Kreisaugen auf größeren Glasperlen bilden, dienten einem ähnlichen Zweck (STEINKLAUBER 2002, 74, 139), wie generell Glasperlenketten (ERTEL u. a. 1999, 86; MACKENSEN 1978, 155). Im Gräberfeld von Pottenbrunn wurden diese Schutzelemente in einem Kindergrab (Grab 173, 2. Hälfte 4. Jh.) vereinigt, wo eine Kette aus zehn großen polychromen Perlen gefunden wurde, darunter eine Melonen- und eine Kreisaugenperle (Abb. 8). Am Frauenberg fanden sich ebenfalls große polychrome Perlen in Kindergräbern (STEINKLAUBER 2002, 74. Grab F154, F215, F136). Im bisher nur in Vorberichten publizierten Gräberfeld von Unterradlberg finden sich Kreisaugenperlen in drei Gräbern (Grab 3151, 3179, 3648) und eine Melonenperle in Grab 3598. Grab 64/1991 des Gräberfeldes Tulln-Bahnhofstrasse enthielt neben der Melonenperle eine größere Bernsteinperle (MAYR – WINKLER 1991, 33–45).

Auch bei Lunula-Anhängern (Abb. 9), die die Mondsichel symbolisieren, handelt es sich um Unheil abwehrende Symbole, die besonders Kinder zum täglichen Schutz trugen und die ihnen auch ins Grab mitgegeben wurden (KEMMINGER 1995, 99). Sie kommen ebenfalls häufig in verschiedener Form in norischen Gräberfeldern vor, wobei sie sich besonders bei Mädchen und jungen Frauen finden. Aus Pottenbrunn (Grab 197) stammt ein solcher Anhänger aus einer reich ausgestatteten Bestattung einer jungen Frau, weitere Lunulae aus Bronze und Silber sind aus Kindergräbern vom Frauenberg (Grab F31, F245) bekannt. In einem Grab aus Unterradlberg wurden Perlen, eine Lunula, eine Bronzescheibe, eine gelochte Münze und ein Bronzering als Halskettenbestandteile gefunden (Grab 3549).

Halskettchen aus bunten Glasperlen in verschiedenen Größen, für Knaben *bullae* aus Bronze oder Silber, und geschnitzte Beinanhänger sind Hauptbestandteil der Schmuckausstattung für Kinder jeden Alters. Dabei wurde – abgesehen von den *bullae* – in der Verwendung der Schmuckstücke nicht im Geschlecht unterschieden. Wie bei dem oben schon erwähnten Kindergrab aus Pottenbrunn finden sich auch metallene Kettchenglieder, die an den Perlenketten befestigt waren und ein rasselndes Geräusch machten. In einem Säuglingsgrab in Linz wurde beispielsweise dem bestatteten Mäd-

Abb. 5. Rekonstruktion der Tracht des norischen Mädchens von Klagenfurt. Rekonstruktion: Karina Grömer und Sabine Kastlunger. Model: Sigrid Kastlunger, 10 Jahre alt (Foto: K. Grömer).

Abb. 6. „Norische Mädchentracht" des 1. und 2. Jh. n. Chr. A Klagenfurt, B St. Peter in Holz (Umzeichnung K. Grömer nach GARBSCH 1965 und POCHMARSKI 2004).

Abb. 7. Saladorf Grab 2126: Glasperlen. (© Bundesdenkmalamt).

Abb. 9. Tulln Feuerwehrschule: Lunula aus einem Grab (© Bundesdenkmalamt).

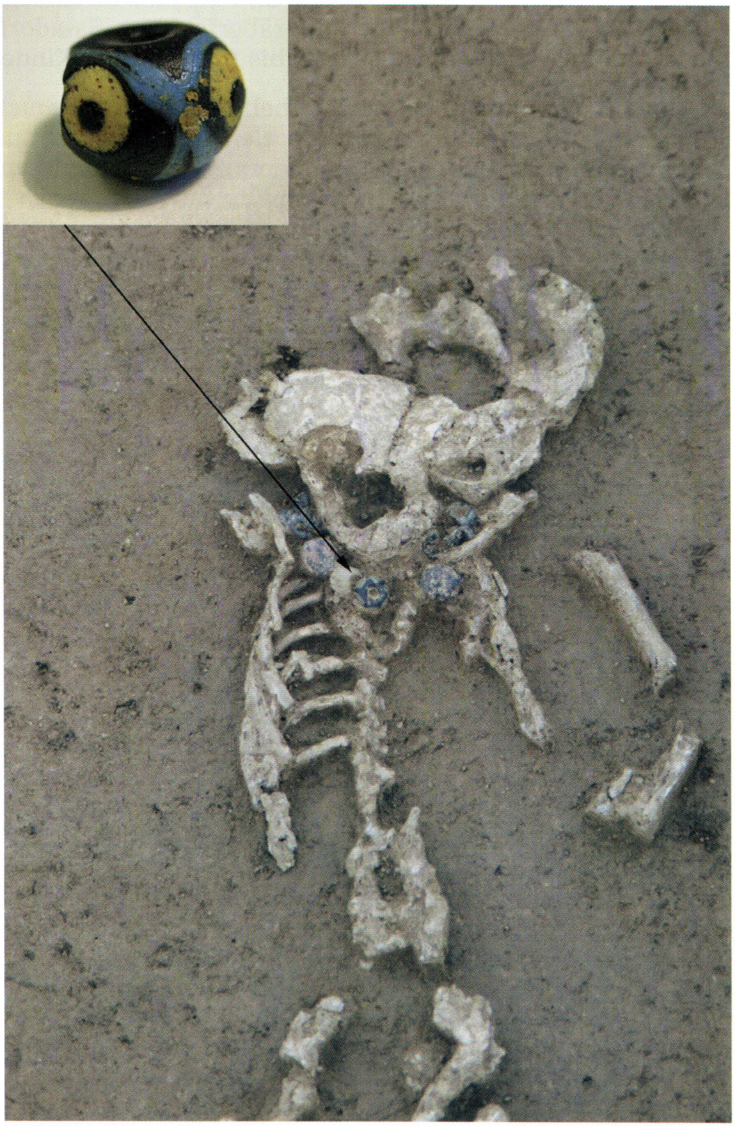

Abb. 8: Pottenbrunn Grab 173: Grab eines Säuglings mit Glasperlen, Detail Perle nach der Restaurierung (© Bundesdenkmalamt).

chen auch ein Armreif mitgegeben, an dem ein Glöckchen hing (RUPRECHTSBERGER 1996). Eine Amulettkapsel war gemeinsam mit großen bunten Glasperlen einem Kind am Frauenberg beigegeben worden (Grab F245).

Zu Ketten und Amuletten kommen bei Kleinkindern beiderlei Geschlechts und älteren Mädchen Armreifen aus verschiedenen Materialien wie hauptsächlich Bein und Bronze hinzu, die die Formen der Erwachsenen imitieren, hingegen sind Fingerringe kaum zu finden. Eine Tradition, die vor allem in der Provinz Pannonia festgestellt wurde, sich aber auch entlang des Donaulimes und seines Hinterlandes in Noricum feststellen lässt, ist, dass Frauen fast immer mehrere Armreifen tragen. Bevorzugt wurde dabei der linke Arm. Im Gräberfeld von Pottenbrunn konnten in allen Frauenbestattungen, die Armreifen enthielten, mehrere Exemplare gefunden werden, auch bei dem Grab eines 13–14-jährigen Mädchens (Grab 200). Ebenfalls mehrere Armreifen tragen etwa gleichaltrige Mädchen in Unterradlberg (Grab 2480, 2483, 3179, 3314, 3326, 4041). Trägt ein Mädchen mehr als einen Armreifen, wird sie in der Forschung als verheiratet angesehen (KEMMINGER 1995,12.), hier wäre dann schon der soziale Übergang zur erwachsenen Frau festzustellen. Dieser bisher in der Literatur vertretenen Annahme widersprechen verschiedene Befunde aus Noricum: In Unterradlberg wurden in drei Gräbern mit Kleinkindern (Infans Ia) ebenfalls mehrfach Armreifen gefunden (Grab 2484, 3139, 4021), ebenso wie im Gräberfeld von Saladorf in einem sehr reich ausgestatteten Grab (Grab 1816) eines drei- bis fünfjährigen Kindes.

Gelegentlich vervollständigen verkleinerte Fibelformen die Schmuckensembles bei Kindern ab sechs Jahren (Abb. 10), die schon wie kleine Erwachsene ausgestattet wurden. Häufiger kommt es vor, dass Fibeln – besonders Zwiebelknopf- und Ringfibeln – die eindeutig in Gebrauch standen, in ihrer Normalform in Gräbern von Kindern gefunden wurden. Dabei handelt es sich aber nicht notwendigerweise nur um Bestandteile ihrer Tracht, sondern möglicherweise auch um Erinnerungsstücke ihrer Eltern, die dennoch in der originalen Trachtlage beigegeben wurden (Bóna in: VÁGO – BÓNA 1976, 167; KUHNEN 1988, 104 ff., 121). Beispiele für diese Sitten stammen etwa aus Unterradlberg, wo Zwiebelknopffibeln in Trachtlage in Grab 3178 und Grab 3648 gefunden wurden, vom Frauenberg (Grab F1, F50, F84, F213, F227, F316, F336, F337) und aus dem Gräberfeld Tulln Bahnhofstraße (Grab 105/1992).

Ebenfalls am Frauenberg wurden in einem Kindergrab (F50) zwei spätlatènezeitliche Fibeln in einem Lederbeutel gefunden, die eindeutig nicht als Trachtbestandteil zu werten sind, da das Grab anhand weiterer Funde in das 3. Viertel des 4. Jh. zu datieren ist (STEINKLAUBER 2002, 150). Eher werden sie als Fundstücke und Spielzeug, als „Schatz" eines Kindes zu verstehen sein, der seinen Weg mit in das Grab gefunden hat. Ringfibeln als weit verbreitete Form im 4. Jh. fanden sich bei sechs Kinderbestattungen in Unterradlberg (Grab 2493, 3193, 3456, 3881, 3958, 4035), eine Kniefibel in Grab 2123 von Saladorf.

Heiratsfähige Mädchen wurden bisweilen auch mit reicher Schmuck- und Trachtausstattung beigesetzt, welche den Ensembles erwachsener Frauen entspricht. Neben dieser Tracht enthalten die Gräber auch Gefäße aus Glas oder Keramik als Beigaben. Dies wird dahingehend interpretiert, dass sie, weil sie noch unverheiratet verstorben sind, mit ihrer Aussteuer begraben wurden (STEINKLAUBER 2002, 74; HÖLBLING 2008, 223, 227). In Pottenbrunn ist das Grab 200 eines 13- bis 14-jährigen Mädchens ein gutes Beispiel für diese Sitte, ebenso wie vier Gräber auf dem Frauenberg (Grab F109, F162, F208, F251) und sechs Gräber in Unterradlberg (Grab 2480, 2484, 3314, 4006, 4018, 4041). Etwas aus dem Rahmen fällt in diesem Zusammenhang ein gleichfalls für die Provinz sehr reich ausgestattetes oben schon erwähntes Kindergrab aus Saladorf (Abb. 11), das neben Perlenkette und Armreifen auch einen Krug, einen Glasbecher, zwei gläserne Balsamarien, ein gläsernes Unguentarium, einen vollständigen Bleirahmenspiegel, sowie ein Messer enthalten hat. Es ist in seiner Ausstattung mit dem ebenfalls oben erwähnten Säuglingsgrab aus Linz zu vergleichen. Bei heiratsfähigen Mädchen können auch Beinkämme zur Ausstattung hinzukommen (Linz – Tiefer Graben: RUPRECHTSBERGER 1999, 102, 114–115, Grab 15, 33, 35).

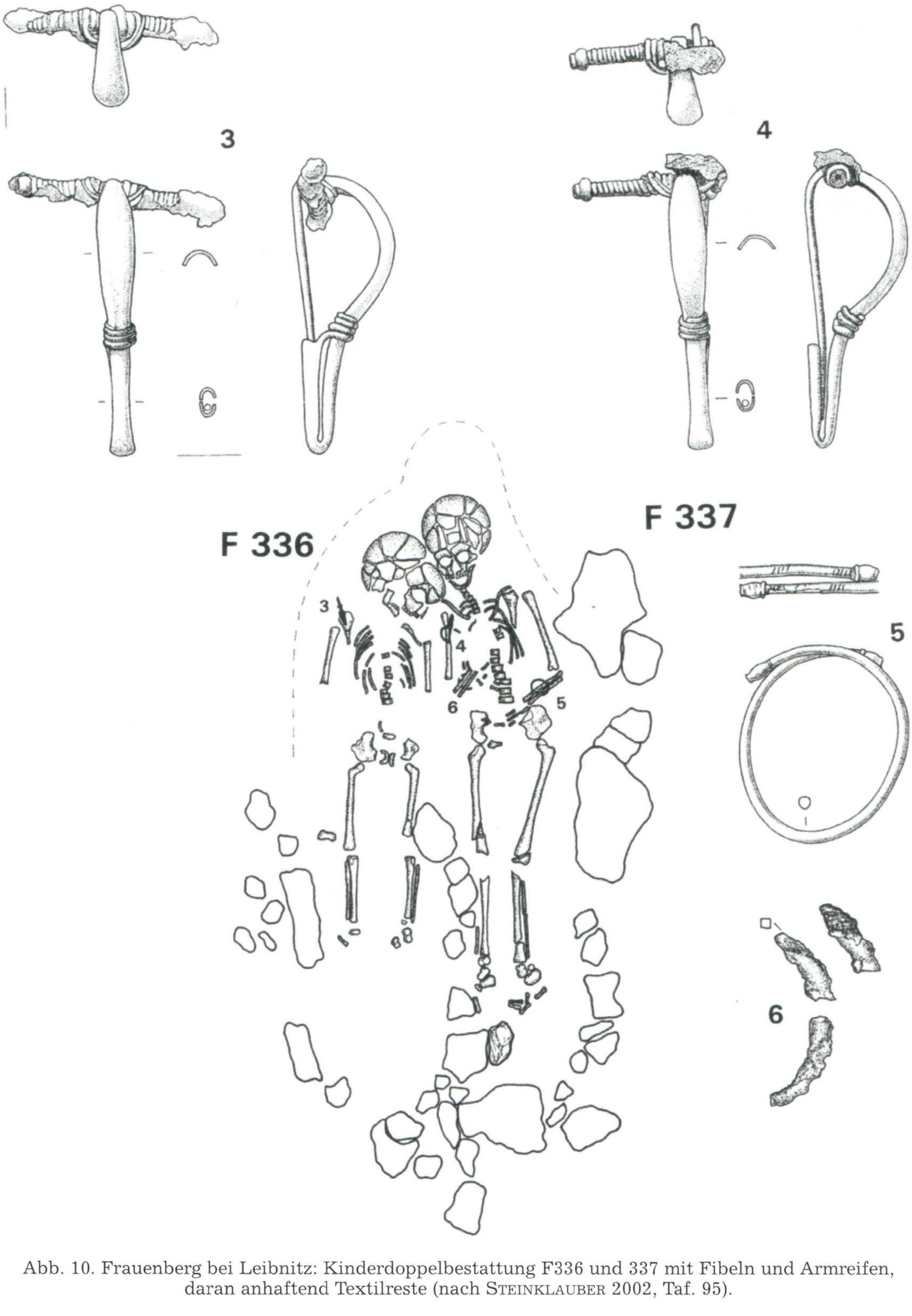

Abb. 10. Frauenberg bei Leibnitz: Kinderdoppelbestattung F336 und 337 mit Fibeln und Armreifen, daran anhaftend Textilreste (nach STEINKLAUBER 2002, Taf. 95).

Abb. 11. Saladorf Grab 1816: Auswahl der Ausstattung (© Bundesdenkmalamt, Foto: A. Schumacher).

Bei Jungen zeigt sich das fortschreitende Lebensalter eher in einem Weniger-werden von Schmuck, so fallen Glasperlen und *bulla* weg, stattdessen ergänzen Messer und Gürtelschnallen die Ensembles. Gürtelschnallen finden sich meist ebenso in Trachtlage wie die Fibeln, und wie dort stimmen Formen und Größen mit denen von Erwachsenen überein, wobei sie – sofern bestimmbar – Knaben mitgegeben wurden. Vollständige Gürtelgarnituren, wie sie erwachsene Männer trugen, sind für Kinder bisher kaum festgestellt worden, das einzige publizierte Grab stammt aus Linz (Ebd., 103–106, Grab 18). Beispiele für Schnallen und Riemenzungen gibt es etwa am Frauenberg (Grab F50, F84, F93, F213, F252), in Unterradlberg (Grab 3193, 3524, 3617, 3648, 3956, 3958, 4016, 4022, 4035) und Saladorf (Grab 2114, 2123, 2126, Brandgrab 1790). Messer wurden in vier Kindergräbern am Frauenberg (Grab F50, F194, F252, F283) und bei einer Bestattung in Unterradlberg (Grab 3193) gefunden. In Saladorf kamen Messer in drei Körpergräbern von Kindern (Grab 1816, 1993, 2114) und einem spätantiken Brandgrab (Grab 1799) vor. In der kleinen ländlichen Nekropole von Brunn am Gebirge wurden in allen vier ergrabenen Kinderbestattungen Messer gefunden. Allerdings weicht dieses Gräberfeld auch in der Beigabe von Tellern und Bechern in allen vier Gräbern von der sonst in Noricum bisher dargestellten Beigabensitte ab (FARKA 1976, 41–80).

Beobachtungen

Prinzipiell kann man feststellen, dass sich in den norischen Gräberfeldern der Spätantike die Trachtbestandteile von Kinder- und Erwachsenengräbern nur darin unterscheiden, dass Kindergräber ein kleineres Repertoire aufweisen. Die Formen der Gegenstände gleichen aber durchaus jenen der Erwachsenen; diese sind dann entweder in verkleinerter Form wiedergeben oder bei den etwas älteren Kindern auch in üblicher Größe. Das Repertoire erstreckt sich im Allgemeinen selbst bei Kleinkindern von verschiedenstem Halsschmuck mit besonderer Betonung auf Schutz- und Amulettwirkung über Armreifen bis zu Fibeln und Gürtelschnallen. Vereinzelt finden sich auch andere Schmuck- und Trachtbestandteile, wie Ohr- oder Fingerringe. Größere Mädchen wurden dabei wie erwachsene Frauen mit Schmuck und Trinkbechern bedacht, bei Jungen wird das Repertoire auf Schnallen und Messer reduziert. Insgesamt werden Kinder weniger reich ausgestattet, die einzige Ausnahme bilden gelegentlich Mädchen in heiratsfähigem Alter.

3.3 Textilien in den Kindergräbern der Provinz Noricum

Im Rahmen des Projektes DressID werden auch Originalfunde von Textilien analysiert, wie sie etwa in spätantiken Körpergräbern auf dem Gebiet des heutigen Österreich zu finden sind[4]. Diese blieben durch Korrosionsprodukte an Metallen als klein-

[4]) Im ca. 420 Gräber umfassenden Gräberfeld Mautern-Burggartengasse, das mit über 50 textilführenden Gräbern ein wichtiger Teil des Projektes DressID ist, konnten lediglich in zwei Kindergräbern Textilreste entdeckt werden. Diese sind jedoch zu schlecht erhalten, um konkretere Aussagen machen zu können, weshalb Mautern hier ausgespart bleibt (KG Mautern, SG Mautern an der Donau, VB Krems, Niederösterreich. Vorberichte: zuletzt WEWERKA 2004. Textilanalyse im Rahmen Projekt DressID: Karina Grömer).


Abb. 12. Furth bei Göttweig: Armreif aus dem 1888 entdeckten Grab mit Detail Textilanhaftung (© Naturhistorisches Museum Wien, Fotos: A. Schumacher).

stückige Ausschnitte der in den Gräbern verwendeten Gewebe erhalten. Diese Textilien gehörten einst zu Kleidungsstücken, aber auch zu Verhüllungen einzelner Gegenstände, sowie auch zur „technischen" Ausstattung einzelner Artefakte (z.B: Messer mit noch erhaltener textilgefütterter hölzerner Messerscheide aus Mautern-Burggartengasse, Gr. 83). Jene Gewebereste, die sich bei Körpergräbern an Trachtbestandteilen wie etwa Fibeln, Gürtelschnallen oder Armreifen befinden, können als Reste der Kleidung angesehen werden, welche die verstorbene Person bei der Grablege am Leib trug.

In diesem Rahmen können erste Fallbeispiele von Kinderbestattungen mit Textilresten aus Gräberfeldern des 4. und 5. Jh. n. Chr. präsentiert werden: das im Rahmen des Projektes untersuchte Kindergrab von Furth bei Göttweig und die Gräberfelder in Tulln (Feuerwehrschule und Bahnhofstrasse) in Niederösterreich, sowie das bereits publizierte Gräberfeld Frauenberg bei Leibnitz in der Steiermark, dessen Textilreste von Eva Grollegger beschrieben wurden.

Es werden bei nachfolgender Aufstellung exemplarisch den Geweben aus Kindergräbern jeweils Textilien an entsprechenden Trachtbestandteilen aus Erwachsenengräbern gegenübergestellt – dabei handelt es sich nicht um einen vollständigen Katalog aller Textilfunde des jeweiligen Gräberfeldes.

Furth bei Göttweig

Im Jahre 1888 wurde am Fischeracker auf der Strasse zwischen Göttweig und Paudorf ein römisches Grab aus dem 4. Jh. n. Chr. entdeckt (Abb. 12), das zu der bei Zabhelicky (1976, 35–36) unter Furth genannten Gräbergruppe gehört. Aus dem Grab wurden menschliche Zähne, ein Tongefäß mit Henkel und verschiedene Tracht- und Schmuckelemente (Bronzefibel, Bronzekette mit grünen Perlen, Eisenarmringbruchstücke, Beinarmring und ein Bronzering mit Gewebespuren) geborgen. Ein Gläschen mit sorgsam verwahrten Geweberesten enthielt den Hinweis, dass diese vom Bronzearmring einer Kinderleiche stammten. Die Funde gelangten in die Sammlung des Abtes des Stiftes Göttweig, Adalbert Dungl, die dieser im Jahre 1920 dem Naturhistorischen Museum schenkte.

Sowohl der Eisen- als auch der Bronzearmring trugen teils mehrlagige Textilreste eines sehr dichten feinen Leinens (je 0,2–0,3 mm z-Garne, Gewebedichten 18–20 Fäden pro cm), das vor allem den Bronzearmreif außen großflächig bedeckte. Dieser Stoff gehörte möglicherweise zum Ärmel eines Gewandes.

Frauenberg bei Leibnitz

Flavia Solva als wichtige Stadt in Binnennoricum wurde in der Spätantike verlassen, und der Frauenberg gilt als die Rückzugssiedlung der romanischen Bevölkerung. Das heißt, der Ort an den Durchzugsstrassen wurde zugunsten einer geschützten Lage aufgegeben. Das Gräberfeld auf dem Frauenberg (STEINKLAUBER 2002) liegt in unmittelbarer Nachbarschaft zur Siedlung auf einem Höhenzug des Seggauberges. 472 Körpergräber wurden ergraben und die Belegung für die 2. Hälfte des 4. Jh. bis Mitte 5. Jh. festgestellt.

In Bezug auf Textilreste (GROLLEGGER 2002) ist das Doppelgrab F336 und F337 aufschlussreich (Abb. 10). Bei Bestattung F336 handelt es sich um die Niederlegung eines Kleinkindes (Infans I, 3–5 J.) mit einer Fibel auf rechter Schulter, die Textilreste aufwies. Zu seiner Linken lag das größere Kind Bestattung F337 (Infans II, 7–8 J.). Dieses hatte um den linken Unterarm eine Armspange aus Bronze, um den rechten Arm einen aus Eisen mit nicht näher identifizierten Textilresten. An der rechten Schulter lag eine Bronzefibel mit Textilresten wie bei Grab F336. Bei beiden Kindern fanden sich je an der Außenseite der Fibelspirale Reste eines feinen leinwandbindigen Textiles (je 0,1 mm z-Garn, Gewebedichte: 12–14 Fäden pro cm), wahrscheinlich aus Flachs. Womöglich handelt es sich hier um einen leichten Mantelstoff, der an der Schulter gefibelt wurde.

Am Frauenberg sind lediglich zwei Erwachsene mit Textilresten an einer Fibel erfasst. Bei der Körperbestattung F275 eines spätmaturen/frühsenilen Mannes (55–65 J.) fand sich auf der rechten Brustseite eine fragmentierte eiserne Fibel, am linken Oberschenkel ein Messer und eine Schnalle. Der leinwandbindige Textilrest auf dem Bügel der Eisenfibel ist sehr grob mit 0,8 mm z-Garnen (8–10 F/cm) in einem Fadensystem und 0,4–0,6 mm z-Garnen (12–14 F/cm) im anderen. Das Gewebe hat eine Oberflächenstrukturierung, wobei einander in einem Fadensystem Gruppen mit einfachem Garn sowie Doppelfäden abwechseln.

In Grab F353 einer spätadulten/frühmaturen Frau (35–45 J.) fand sich in der Gegend der rechten Schulter eine Zwiebelknopffibel, die zwei verschiedene Gewebereste aufwies. Beim schwer zu identifizierenden Klumpen an der Nadel der Fibel dürfte es sich um einen stark zusammengedrückten Wollköper handeln, der mit z-Garnen gewoben wurde. Außen auf dem Nadelhalter ist ein feines dichtes Gewebe in Leinwandbindung (0,2 mm z-Garne, Gewebedichte 16–18 Fäden pro cm, Flachs) erhalten. Der Köperstoff dürfte einen dickeren Mantel darstellen, der feine Stoff eventuell ein Leichentuch oder einen Schleier.

Tulln

Comagenis war bis in die Spätantike Standort eines Auxiliarlagers mit Reitertruppe und in der Spätantike auch Flottenstützpunkt am Donaulimes. Westlich und südlich des Lagers erstreckte sich ein ausgedehnter Vicus, den Handwerker, Angehörige der Auxiliarsoldaten und Händler bewohnten. Die unmittelbare Nähe zum Truppenstandort und zur Limesstrasse, die Fernverbindungen ermöglichte, zeigt sich auch in der Ausstattung der Gräber, die verschiedenste Importwaren beinhalten. Zu diesem Vicus gehörten bisher drei nachgewiesene Gräberfelder, die an den Ausfallstrassen angelegt waren und zu verschiedenen Zeiten in Verwendung standen. Zwei dieser Gräberfelder, in großen Teilbereichen vom Bundesdenkmalamt 2006–2008 ergraben, sollen hier betrachtet werden. Das Gräberfeld Nordwest (Tulln Alte Feuerwehrschule) wurde in der mittleren Kaiserzeit belegt, während das Gräberfeld Süd (Tulln-Bahnhofstrasse) erst in der Spätantike in Verwendung stand. Das Gräberfeld Süd wird in das 4. und die 1. Hälfte des 5. Jh. datiert und von unteren und mittleren sozialen Schichten angelegt (WEWERKA 1992; HÜBL 2004). Das Gräberfeld Nordwest hat eine frühe Belegungsphase mit Brandbestattungen (spätes 1.–3. Jh.), und eine späte Belegungsphase mit Körperbestattungen (ab spätes 3.–4. Jh. n. Chr.). Bei den laufenden Grabungen wurden immer wieder Textilreste aufge-

Abb. 13. Tulln-Bahnhofstrasse: Kinderarmreife mit Textilresten aus Grab Verf. 335 (© Bundesdenkmalamt, Foto: K. Grömer).

deckt, die im Rahmen des Projektes für eine Untersuchung zur Verfügung gestellt wurden. Auch ein Kindergrab barg aussagekräftige Gewebereste.

Das in das 2.–3. Drittel des 4. Jh. n. Chr. datierende Körpergrab eines kleinen Mädchens[5], Sign. 335, von Tulln-Bahnhofstrasse enthielt zusammenkorrodierte Bronze- und Beinarmreife (Abb. 13). Auf diesen fanden sich sowohl an der Außen- als auch an der Innenseite mehrlagige Reste eines sehr feinen leinwandbindigen Textiles (je 0,2 mm z-Garne, 16–18 Fäden pro cm). Dabei handelte es sich wohl um den Ärmel eines langärmeligen Gewandes (*tunica manicata Typ?*), dessen Stofffülle im Bereich des Armreifes faltenreich zum Liegen kam.

Eine ähnliche Fundlage und Stoffqualität wurden im zeitgleichen Frauengrab Grab 463 des Fundplatzes Tulln-Alte Feuerwehrschule entdeckt. Bei dieser Frauenbestattung fanden sich drei zusammenkorrodierte Armreifen mit interessanten organischen Auflagerungen (Abb. 14). An der Innenseite der Reifen sind noch Hautreste der Trägerin erhalten. An der Außenseite der Reifen findet sich direkt anliegend mehrlagig (bis zu 4-lagig) ein sehr feines leinwandbindiges Textil (je 0,2 mm z-Garne, 14–16 Fäden pro cm). Mikrostratigrafisch darüber ist als oberste Lage an mindestens zwei Stellen ein etwas gröberer panamabindiger Rest dokumentierbar (Panama 2:1, Fadensystem 1: paariges 0,3 mm z-Garn, 10 x 2 Fäden pro cm; Fadensystem 2: 0,3 mm z-Garn, 9–10 Fäden pro cm).

Wiederum sind die inneren feinen Textillagen als wahrscheinliche Ärmel zu interpretieren. Der etwas gröbere Stoff in Panamabindung gehörte eventuell zu einem Übergewand.

Beobachtungen

Es kann vorerst festgehalten werden, dass in Göttweig und Tulln an den Armreifen sowohl bei Erwachsenen wie auch bei Kindern als innerste Lage jeweils ähnliche feine Stoffe zu finden sind. Diese haben eventuell zu Ärmeln eines langärmeligen Gewandes

[5]) Die anthropologische Altersbestimmung liegt noch nicht vor.

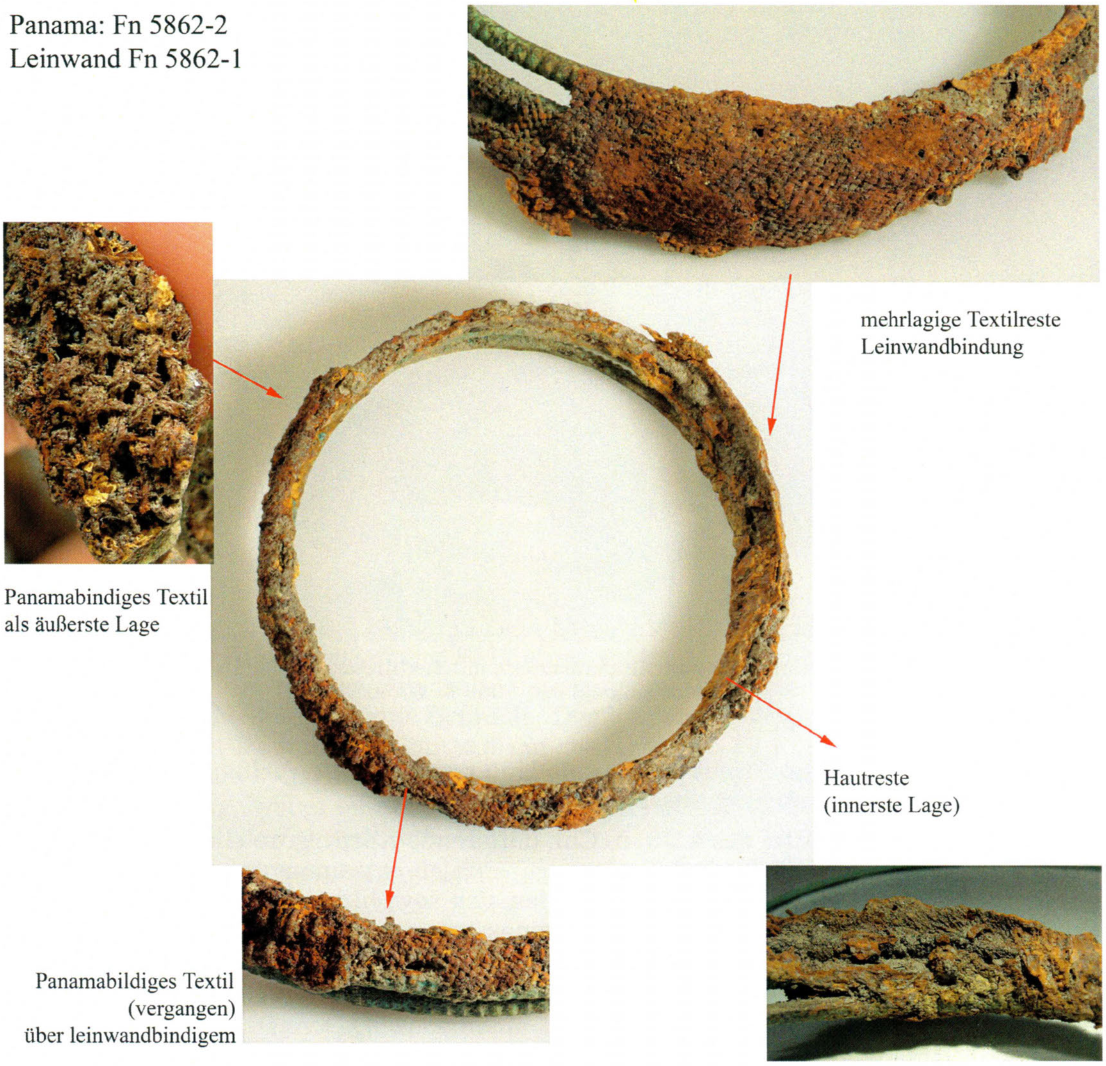

Abb. 14. Tulln-Feuerwehrschule: Frauengrab 463 mit organischen Resten auf einem Armreif (© Bundesdenkmalamt, Grafik: K. Grömer).

gehört – ein leinenes langärmeliges Gewand, das direkt am Körper getragen wurde. Im Falle des Frauenberges sind die Mantelstoffe der Erwachsenen dicker als jene der Kinder. Ob diese unterschiedlichen Stoffqualitäten für Mäntel als spezifisch für Kinder und Erwachsene gesehen werden können, ist fraglich. Möglicherweise spiegeln sie lediglich jahreszeitlich bedingte Präferenzen wider.

Diese Aussagen an Einzelbefunden sind natürlich nicht repräsentativ, geben aber einen ersten Einblick in Stoffqualitäten, die für die Kleidung von Kindern – und im Vergleich dazu Erwachsenen – verwendet wurden.

Da es aus dem 4. und 5. Jh. n. Chr. aus der Provinz Noricum keine Grabsteine mit Darstellungen der Kleidung gibt, können diese hier erfassten Charakteristika von „Kleidungsstück mit Ärmel“ und „Mantel“ nur mit Vorbehalt mit konkreten Gewandformen der kaiserzeitlichen Grabsteine Noricums oder mit in Schriftquellen genannten Kleidungsstücken in Verbindung gebracht werden.

3.4 Katalog der für die Auswertung der Trachtlagen und Textilfunde herangezogenen Gräberfelder

Frauenberg bei Leibnitz
KG und OG Seggauberg, VB Leibnitz, Steiermark
Analyse des Gräberfeldes: Steinklauber 2002.
Textilanalyse: Grollegger 2002.

Furth bei Göttweig, Straße von Göttweig nach Paudorf
MG Furth bei Göttweig; Fischeracker, VB Krems-Land, Niederösterreich
Funde im Naturhistorischen Museum Wien. Armreife mit Textil: Inv.Nr. 55138 und 22143.
Angaben zum Fundort: Nach den Unterlagen zur Dungl-Sammlung im Fundaktenarchiv der Prähistorischen Abteilung des Naturhistorischen Museums Wien Akt: „Vollständiges Verzeichnis der Dungl-Sammlung", S. 4.
Allgemeine Angaben zum Gräberfeld: Zabehlicky 1976, 35–36.
Textilanalyse im Rahmen Projekt DressID: Karina Grömer.
Faseranalyse: Sylvia Mitschke, Curt-Engelhorn-Zentrum für Archäometrie (CEZA) der Reiss-Engelhorn-Museen Mannheim.

Pottenbrunn
KG Pottenbrunn, SG St. Pölten, VB St. Pölten, Niederösterreich
Literatur zum Fundort: Hölbling 2008.
Kinderbrandgräber: Grab 19, 77, 78, 285. Kinderkörpergräber: Grab 77, 78, 182, 183, 202, 203.
Textilanalyse im Rahmen Projekt DressID: Karina Grömer.

Saladorf
KG Saladorf, MG Würmla, VB Tulln, Niederösterreich
Literatur zum Fundort: Blesl – Stöckl 2004, 38; Hermann 2005, 122–125; in Vorb.
Textilanalyse im Rahmen Projekt DressID: Karina Grömer.
Faseranalyse: Sylvia Mitschke, Curt-Engelhorn-Zentrum für Archäometrie (CEZA) der Reiss-Engelhorn-Museen Mannheim.

Tulln
KG Tulln, SG Tulln, VB Tulln, Niederösterreich
Allgemeines zu den Ausgrabungen des Bundesdenkmalamtes in Tulln: Scholz – Steinegger – Singer – Krenn 2007.
Literatur zum Fundort Bahnhofstrasse: Wewerka 1992; Mayr – Winkler 1991; Hübl 2004.
Textilanalyse im Rahmen Projekt DressID: Karina Grömer.
Faseranalyse: Sylvia Mitschke, Curt-Engelhorn-Zentrum für Archäometrie (CEZA) der Reiss-Engelhorn-Museen Mannheim.

Unterradlberg
KG und SG Unterradlberg, VB St. Pölten, Niederösterreich
Literatur zum Fundort: Blesl – Gattringer 2004, 29; Gattringer 2001, 33–35; Neugebauer – Gattringer – Blesl 1995, 28–29; Neugebauer – Blesl 1996, 34–35; Neugebauer – Gattringer – Blesl 1999, 33–34; Neugebauer – Gattringer 2000, 30–31; Preinfalk 2002, 31.
Befundaufnahme durch Eva Hölbling-Steigberger (in Arbeit).
Anthropologie: A. Merker, unpubl. Dipl. Universität Wien 2010.

Wels, Gräberfeld Ost
KG Wels, SG Wels, VB Wels, Oberösterreich
Literatur zum Fundort: Miglbauer 2007, 117–125.
Ausstellung zum Gräberfeld Ost in Wels, Sommer 2007.

4. Ausblick

Zur mitteleuropäischen Eisenzeit bleibt festzuhalten, dass die wenigen Quellen auf eine Kinderkleidung ähnlich jener der Erwachsenen hindeuten. Die bildlichen Darstellungen eines Kindes auf der Situla von Kuffarn spricht ebenso dafür wie die Trachtlagen in den eisenzeitlichen Gräbern. Dort sind Kinder meist als „kleine Erwachsene" repräsentiert – unter Beigabe zusätzlicher schutzbringender Amulette. Beide Quellengattungen beschreiben jedoch nicht Kinder aus allen Gesellschaftsschichten.

Zeigt diese Ähnlichkeit der Kleidung zwischen Kindern und Erwachsenen, die auch im Frühmittelalter (Müller 2003, 101–104) und Mittelalter zu beobachten ist, jenes in der Einleitung beschriebene Weltbild an, in dem Kinder soziologisch als „kleine Erwachsene" gesehen werden, mit einem entsprechenden Pflichtenkatalog (Arbeit oder

Repräsentation – je nach Status) noch vor Erreichen der Geschlechtsreife (ARIÈS 1978; STEARNS 2007)?

Für römische Zeit sehen wir ein differenzierteres Bild – wohl auch durch die reichen literarischen und bildlichen Quellen sowie durch Funde von Originalgewändern. Auch hier waren grundlegende Kleidungselemente von Erwachsenen und Kindern (vor allem nach dem Säuglings- und mit beginnendem Kleinkindalter) gleich. Das Spezielle an Kinderkleidung vor allem der frei geborenen Kinder römischer Bürger wurde durch besondere Attribute und Amulette bzw. durch das Fehlen von besonderen, Erwachsenen vorbehaltenen Kleidungsstücken (z. B. der Schleier der verheirateten Frau) offenbar.

Diese Dynamiken sind auch in der Provinz Noricum zu beobachten, sowohl in der ikonografischen Evidenz des „Norischen Mädchens“ und der „Norischen Frau“ der frühen Kaiserzeit, als auch in den Trachtlagen aus Körpergräbern der späten Kaiserzeit und Spätantike. Beim Projekt DressID konnten nun auch Gewebereste aus norischen Gräberfeldern bearbeitet werden, um so erste Einblicke in die verwendeten Stoffqualitäten zu erhalten. So wurden für Erwachsene wie Kinder ähnliche feine Leinenstoffe für langärmelige Gewänder verwendet, die sich an den Armreifen erhalten haben. Die Stoffqualitäten der gefibelten Mäntel sind hingegen unterschiedlich.

Danksagung

Ein herzlicher Dank gilt dem Bundesdenkmalamt für die Zurverfügungstellung unpublizierter Befunde und Funde sowie der Erlaubnis zu deren Analyse. Für die Bereitstellung der Materialien danken wir besonders Christoph Blesl und Martin Krenn.

Wir möchten uns auch bei Familie Kastlunger für die Hilfe bei der Rekonstruktion des Norischen Mädchens bedanken.

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8.4. Liturgical Vestments of the 16th to the 18th Century in Austria

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Liturgical Vestments of the 16th to the 18th Century in Austria

Introduction

In addition to architecture, sacred objects, paintings and statues, textiles play an important role in the sign system within rituals in the Catholic Church. They can be consecrated objects serving as official dress of the priests or covering and wrapping sacred objects. The vestments also carry messages that are reflected in specific colours and symbols. During the liturgical year, vestments in different colours have to be used, and they mark specific periods, *e.g.* the time before Christmas and Easter (Advent and Lent – violet), specific ceremonies (*e.g.* feast of Our Lord's Passion, feasts of martyred saints – red; Gaudete and Laetare – rose), high festivities of the liturgical year (*e.g.* Easter and Christmas – white) or mourning (black) (Braun 1907, 728-760; Legg 1882). Especially the design of historical, mainly baroque vestments is strongly orientated towards pictorial and symbolic connotation. The level of meaning distinguishes these special historical textiles from other fabrics of the time. Liturgical vestments in monasteries, churches and museum collections have been the subject of many different approaches. They are a valuable source for researchers with a focus on costume history, textile craft and art history (*e.g.* Fortescue 1934; Johnstone 2002; Stauffer 2001), but even if detailed descriptions of vestments are published, these descriptions differ from that needed for archaeological inquiry. Usually the cut of the garment, the patterns and iconography of the fabrics used and other details are emphasised, while there is rarely any detailed description of yarn qualities or thread counts. Such technical analysis is, on the other hand, more common when describing archaeological artefacts, but the ideal is of course to use both. The following article focuses on liturgical textiles in Austria of the 16th, 17th and 18th centuries.

Archaeological finds: graves of priests

For many centuries, Catholic priestly burials were equipped with liturgical vestments to emphasise the identity of the deceased. That was not only a common habit of specific parishes or for highly valued persons, but was prescribed in church laws from 1590 (although reaching back to the 9th century) and published by the Vatican as the *Rituale Romanum* in 1620. The formal objectives of the burial, the sequence of events and the gifts of a Catholic funeral are described in detail with a specification for the funeral clothing of a deceased priest:

> *sacerdos, aut cuiusvis ordinis clericus, defunctus, vestibus suis quotidianis communibus usque ad talarem estem inclusive, tum desuper sacro vestuitu sacerdotali, vel clericali, quem ordinis sui ratio deposcit, indui debet; acerdos quidem super talarem vestem amictu, alba, cingulo, manipulo, stola, et casula, seu planeta violacea sit indutus*
>
> A deceased priest or cleric of any stage of consecration must be dressed from the inner side in his robe and in his ordinary everyday clothes, above that with the priestly or clerical vestments, which demonstrate his rank. A priest shall above that be robed in the cassock, alb, girdle, maniple, stole and chasuble or violet cope [*pluviale*] (*Rituale Romanum VI*, 1.12-16).

This general Vatican law had to be followed from the early modern period until the middle of the 20th century. It was replaced in the 1960s with the Second Vatican Council (1962-1965) containing new regulations.

Fig. 1. Zwettl, grave of a priest with chalice, paten and textile fragments (Photo: Verein Archäologie Service).

Excavation, preservation and analysis

Catholic priestly graves can often be identified in archaeological excavations in early modern churchyards, Catholic cemeteries and crypts as a result of finding cloth fragments from chasubles, stoles and maniples (*e.g.* Bravermanová 2010; Cybulska *et al.* 2013, Fig. 1; Grupa 2015; Mittelstrass 2003, 138). Such archaeological contexts can have a variety of preservation conditions. The organic finds in graves buried in the soil in a graveyard are usually very fragmented. Parts of garments usually only survive when attached to metal objects. The analysis of such finds follows the general mode of textile analysis from archaeological contexts using microscopy analysis and Scanning Electron Microscopy for fibre identification, description of microstratigraphy and the like.

Compared to finds from the soil, burials in churches (in a sarcophagus, crypt etc.) display much better preservation conditions. Sometimes, even complete garments survive under dry conditions. Nevertheless, such finds are brittle and their conservation is a challenge.

Recent examples from the Czech Republic and Poland (Bravermanová 2010; Grupa 2010; 2015) have given good overviews of the conservation processes of finds from crypts and the possibilities of making them accessible to the public. Attempts were also made to make virtual reconstructions of such garments by means of computer graphics (*e.g.* Cybulska *et al.* 2013). Two priests' graves from Austria have recently been excavated that serve as examples for what can be achieved by analysing liturgical textiles from an archaeological approach: Zwettl and Hollenburg.

Textiles from the Zwettl graveyard (c. AD 1500)

An archaeological rescue excavation took place at Zwettl in Austria in a graveyard that was used between AD 1500 and 1850. Graves of men and women were identified by means of metal dress elements such as eyelets and hooklets attached to textile layers containing coarse linen fabrics as well as fine silk taffeta and damask (Grömer 2015). It is, however, not easy to decide to which garments they belonged as a result of the degree of fragmentation.

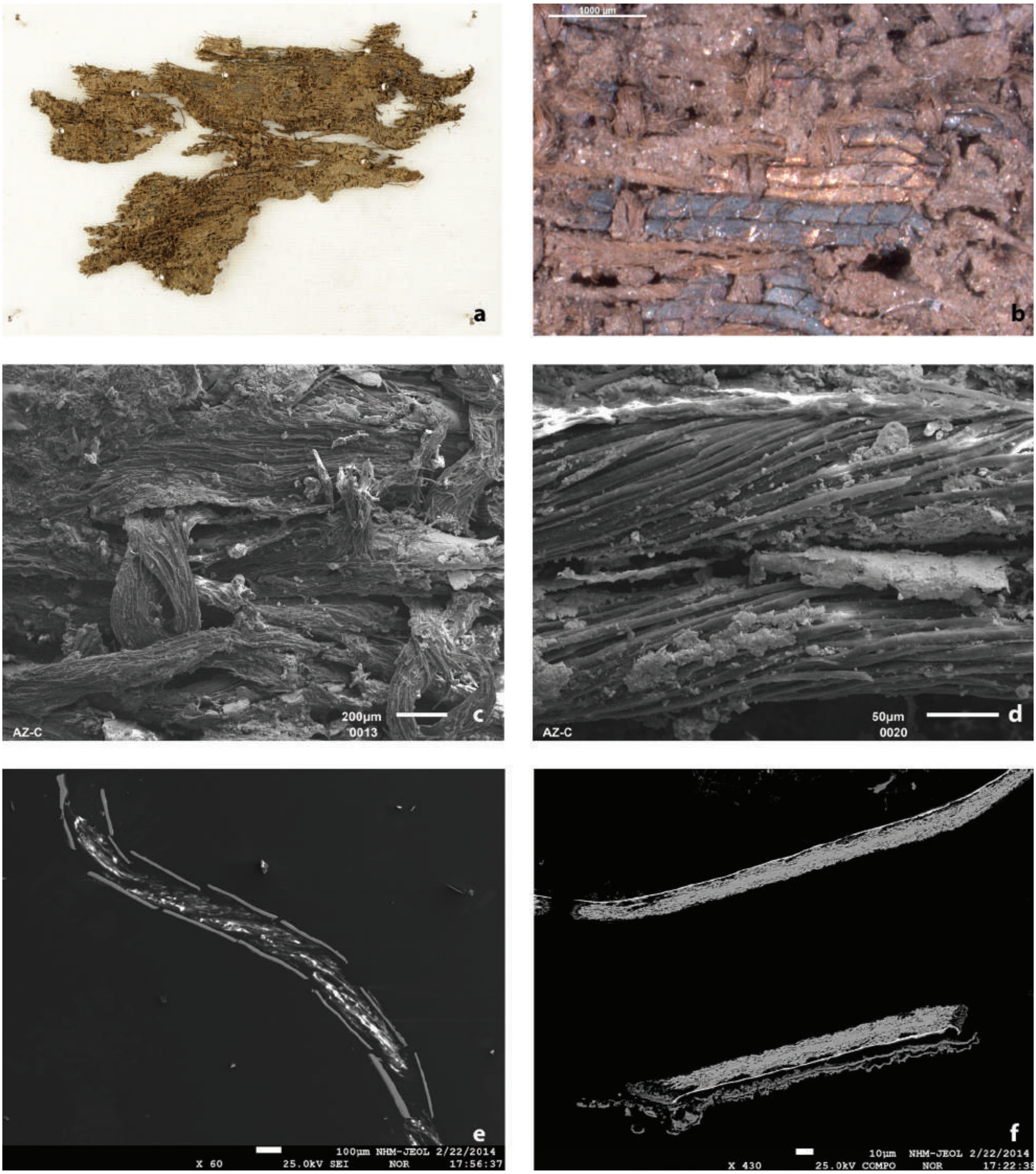


Fig. 2. Zwettl, grave of a priest: a-b) fabric of silk and gold threads; c-d) SEM pictures of weave and silk fibres; e-f) cut through gold thread (Photos: A. Schumacher, A. Kroh and D. Topa).

Among the graves was also one of a priest, and although most organic material was decomposed, his identity and status is clear from the liturgical objects in the grave: a chalice and a paten. The man was between 30 and 50 years old when he died. The shape of a vessel that covered and protected the chalice can be dated to c. AD 1500. Textile remains with gold threads were found lying in the region of the right forearm, and especially under this, which was detected during the excavation when the radius and ulna were removed (Fig. 1/right). The fabric belongs to a precious silk cloth (a composite weave with yarns 0.2 mm in diameter), patterned with small and larger lozenges. Due to the small size of the fragments, and the change of the colour to various shades of brown, an identification of the pattern is not possible (Fig. 2 a-b). In the late Middle Ages and early Renaissance, mainly Italian luxury silks, most likely from Florence, were exported all over Europe. The Italian silks are distinguishable on account of their imaginative patterns of flora and fauna (Geijer 1979, 141-153; Stolleis 2001, 20). Unfortunately, detailed statements on the provenance of the silk textiles from Zwettl cannot be made, since the fragments are too small and damaged.

The decorative gold threads were made on a still-existing thread wrapped with fine gold wire (see Barker 1980, 5-8; also Wincott Heckett 2015, Fig. 23.3). High-resolution SEM images indicate that it was made of a streaky-cut, thin, gold-coated silver metal (silver: 20 μm, gold: 5 μm) (Fig. 2 e-f). The gold wire was wound in S-direction around the silk carrier threads. Due to the corrosion of the silver the threads now appear dark (Fig. 2b).

It is not entirely clear to which part of the liturgical vestments (maniple, stole, chasuble or cope) the silk-gold textile fragments once belonged. The position of the fabric in the abdominal region under the arms indicate a chasuble. It is, however, interesting that so few pieces have survived. Comparable chasubles of such silk damask with gold threads would not be limited to such a small area, asymmetrical on the body, but would be spread throughout the whole area of the garment. Even if the silk had not survived, the gold threads should have been present in the grave, especially at the back of the body which represents the visible side of the garment and was usually designed more magnificently than the front (Stolleis 2001, 16-17). As the silk-gold textile was found at the right arm, it might thus derive from a maniple (a decorated band of silk or similar fabric that when worn, hangs from the left arm, Fig. 8b). Maniples are only used within the context of Holy Mass and are of the same liturgical colour as the other vestments.

Textiles from Hollenburg church (c. AD 1700)

During renovation works in a small church in Hollenburg, rescue excavations had to be carried out (Leib 2007). Under the floor of the *presbyterium* the graves of two priests were found, along with other burials. From the early Modern until the Baroque period, it was a privilege of the clergy and rich elites to be buried within the church. Laypeople had to be buried outside the church in the graveyard. Grave 2 (Fig. 3), dated to c. 1700, is the burial of an adult male. Since the bones are poorly preserved, the exact age cannot be determined. A wooden coffin grave was dug into the soil instead of being placed in a sarcophagus, so the garments are also in this case in a very bad condition. Nevertheless, the Hollenburg archaeological textile evidence is much clearer than the small fragments from Zwettl, and larger parts of the various garments are still visible. As the specific layers of the vestments of a Catholic priest are well known (compare Fig. 8b; Braun 1907; Fortescue 1934), it was easy to identify a cassock, an alb, a cingulum, a chasuble, a stole and a maniple in the grave.

Fig. 3. Hollenburg, priest's grave found in church (Photo: ASINOE).

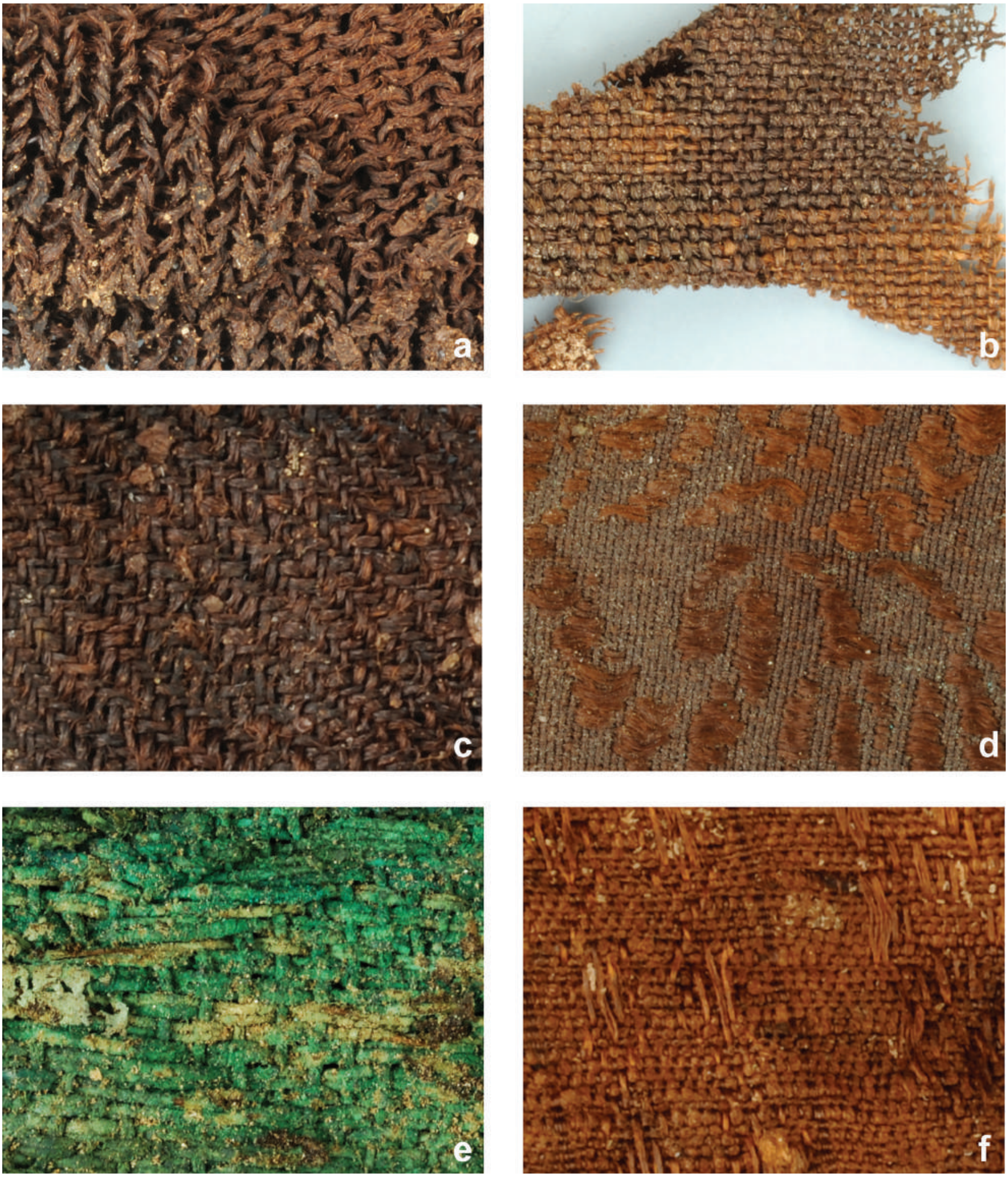


Fig. 4. Hollenburg, fabrics found in priest's grave: a) knitted stockings; b) linen tabby of the alb; c) wool twill cassock; d) silk of the maniple; e) metal lace: f) silk of the chasuble; all samples are 2 cm wide (Photos: A. Schumacher).

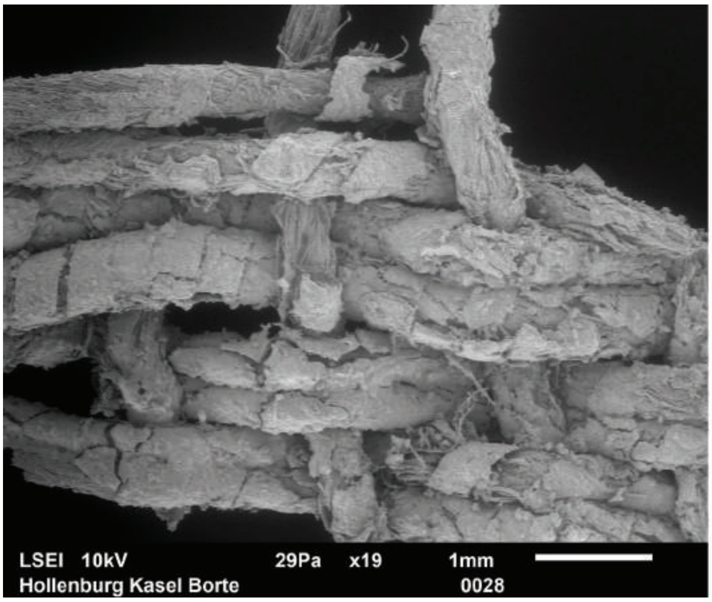
The priest was placed on a mattress covered with a medium-quality twill fabric (0.3-0.4 mm z-yarn; 18-20 threads per cm) and filled with wood shavings. He wore knitted stockings of a now brownish hue (Fig. 4a). Closest to the body the remains of a cassock were identified, made of a wool 2/2 twill of medium quality (0.3 mm z-yarn; 22 threads per cm) (Fig. 4c). Over the cassock the priest wore an alb, as prescribed. This consisted of a medium fine linen tabby (0.4-0.6 mm z-yarn; 20 threads per cm) of even and dense structure (Fig. 4b).

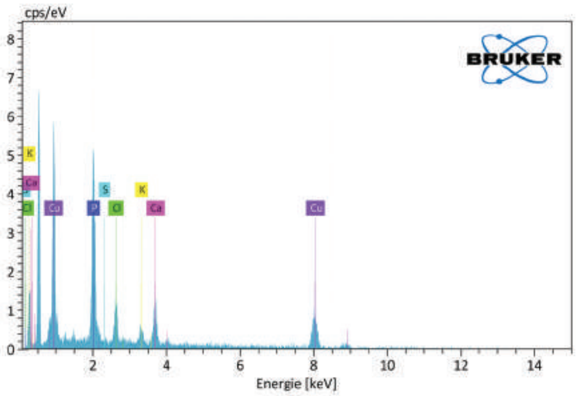
The maniple was made from a fine patterned silk with about 70 threads per cm; the visible colour is still purplish-brown (Fig. 4d). The decoration consists of stripes or zones with a stylised floral pattern (lancé on taffeta). The maniple was also decorated with metal lace braids (Fig. 4e) that form a cross and frame the ends of the maniple in a trapezoidal shape. To make the ends of the maniple stiff, it was lined with a very coarse and stiff open-weave tabby made of plant material (0.3 mm z-yarn, 10 threads per cm), which was glued onto the silk. Wool tabby was used as an additional lining for the maniple.

The arrangement of the metal lace braids can be clearly identified as linings and trimmings of a chasuble of the 'fiddleback' shape (compare Fig. 3 and Fig. 8b), which was developed in the late 1500s when heavy material and ornate embroidery made the chasuble very stiff. To accommodate the priest's movement, the front was cut away from the arms giving it the distinct fiddle-like appearance (for the development of the chasuble, see Braun 1907, 149-239). The same lace was also used to decorate the maniple (cross and frame). The fabric used for the chasuble (the sample was taken from the shoulder region) is a fine silk of purplish-brown colour and striped floral decoration (lancé on taffeta) (Fig. 4f). It does not exactly match the fabric of the maniple, so two different silks were used for these two items.

The threads of the laces consist of a metal filament wound around a silk core. SEM analysis and Energy Dispersive X-ray (EDX) analysis proved that it was copper (Fig. 5), and no traces of silver or gold could be found. For the Baroque style, silver or gold laces were common for vestments with the liturgical colours violet and black, but copper laces are not (see *e.g.* Sporbeck 2001, 112). The coloured appearance of the metal threads is now greenish due to the high content of copper, which changed by corrosion to the elements phosphorus, potassium and calcium (Fig. 5 right).

All of the fabrics now appear more or less brownish or blackish due to the decomposition of the human remains, and maybe also the degradation of the natural dyestuffs used for the silks. Due to church regulations we know that the alb must have been





Element	Ord. Z.	Lin. Ser.	Netto	Gew. [%]	Masse Norm. [%]	Atom [%]	abs. Fehler [%] (1 sigma)	abs. Fehler [%] (2 sigma)	abs. Fehler [% (3 sigma)
phosphor	15	K-Serie	4178	14,58	20,80	31,76	0,65	1,31	1,96
sulfor	16	K-Serie	36	0,14	0,20	0,30	0,05	0,10	0,15
chlorine	17	K-Serie	1030	3,89	5,55	7,41	0,22	0,44	0,66
potassium	19	K-Serie	426	2,31	3,29	3,99	0,17	0,34	0,51
calcium	20	K-Serie	1084	6,98	9,96	11,75	0,35	0,69	1,04
copper	29	K-Serie	1310	42,19	60,19	44,79	1,94	3,89	5,83
			Sum	70,11	100,00	100,00			

Fig. 5. Hollenburg, detail of metal lace, copper filament wound around a silk core (SEM pictures and EDX analysis: D. Topa).

Fig. 6. Storage facilities for liturgical vestments in Göttweig monastery (Photos: K. Grömer).

white in its original state (*albus* – white), a garment that symbolised cleanness and purity. The chasuble, stole and maniple were all violet, as prescribed in the *Rituale Romanum* (note the dye analysis of chasubles and stoles from Gniew in Poland: Grupa 2015, 194).
After examination and sample-taking, all remains from the grave, including the vestments, were reburied according to the wishes of the parish.

Historical liturgical vestments in Austria
Austria is a Catholic country with a rich Catholic tradition. Most of the churches founded before 1900 own different sets of historical vestments. After the 1960s and the *Sacrosanctum Concilium* (the Second Vatican Council), a modernisation of how the Holy Mass took place and the style of liturgical vestments began. Today it is the choice of the priest whether to wear modern vestments or the old, historical ones. In the Catholic Church the paraments also belong to the holy inventory of the church, along with chalices, holy statues etc. Since the *Sacrosanctum Concilium* it has also been forbidden to throw away liturgical vestments, even if they are not used anymore (SC 126). This is why historical liturgical vestments are still stored in churches.
As liturgical vestments are ritually important but also fragile objects, there is in the churches a special focus on their conservation and restoration (Jägers 1998). As most garments are brittle, they should under ideal circumstances be stored in a horizontal position in a dark drawer. Many churches have such facilities in the sacristies for chasubles or stoles (Fig. 6). Larger items such as mantles (*pluviali*, copes) are usually stored hanging in cupboards, which in a long term perspective can cause great damage.
In most Catholic churches in Austria the priests today use modern liturgical garments, but especially for High Festivities in cathedrals and in monasteries the historical vestments are often still in use. For example, the Gothic St. Stephan's Cathedral in Vienna (the main cathedral in Austria) has a parament treasure consisting of c. 2500 individual items. The oldest objects date to the 16th century while most are from the Baroque period (17th and 18th centuries) (Inventory St. Stephan 2003). A valuable vestment is the so-called 'Kleiner Breuner Ornat' (Catalogue St. Stephan 1997, 218-220), consisting of a chasuble, stole, maniple and dalmatic. The precious fabric of the outer coat is red silk damask from Italy dating to between 1500 and 1540. In 1647 new vestments were made, using these 'old' fabrics. Such a 'reuse' of valuable textiles, which were given to the church, is a well-known phenomenon. Particularly female members of royal families and the elite donated precious textiles to be made into liturgical vestments. Some chasubles are stored in St. Stephan's which were made from the wedding gowns of different members of the Habsburg family (*e.g.* Eleonorenkasel) (Catalogue St. Stephan 1997, 238 and 253). These precious vestments are exhibited (Fig. 7), but are taken out of the displays and worn for one specific Holy

Fig. 7. St. Stephan's Cathedral, exhibition of the cope from the 'Großer Breunerornat' (Photo: K. Grömer 2015, courtesy of St. Stephan's Cathedral).

Mass a year before they are placed into the exhibition again. Other vestments from the 17th to 19th centuries stored in the sacristy of St. Stephan's are also worn. Usually this happens for specific High Festivities once a year (*e.g.* Eleonorenkasel on December 8th or Kleiner Breunerornat on December 26th in St. Stephen's).

Monasteries also possess and use historical garments, even of fur. The Premonstratensian monastery at Schlägl in Upper Austria was founded in c. 1200 and it holds a treasure of hundreds of liturgical vestments. Due to fire catastrophes in the 17th century the medieval inventory is very sparse; the oldest still existing chasuble was made before 1576 (Pichler 1978). At Schlägl, the capes of the traditional Premonstratensian monks are made of squirrel fur. Some of them were made c. 1750 and are still in use (see Fig. 8a).

Smaller churches like Vienna-Oberlaa also still possess old vestments. More than 20 historic chasubles in different colours from c. 1700 to 1900 are stored there together with the associated stoles, copes (*pluviali*) and maniples (Inventory Oberlaa 2013). The oldest garment still in use is a green chasuble with corresponding stole and maniple, dated to 1706 (Inventory Oberlaa 2013). These items were worn once a year until 2014 (Fig. 8b).

The decision to use or not to use old vestments rests with the priests but it also depends on the traditions of the church and the parish. In cathedrals and monasteries the vestments are usually used to emphasise a long and rich tradition, and especially monasteries have a strong semiotic system of referring to history and traditions. Therefore, if an old vestment is used, it is also handled with particular care. A chasuble is never worn directly on the skin, and linen and cotton undergarments such as the long-sleeved albs are used, while the stoles are protected with a narrow linen strap around the neck (Fig. 9a). The use of such garments in Holy Mass lasts about 1.5 to 2 hours, including taking it on and off. Nevertheless, there are problems of preservation involved in the use of old and sometimes brittle textiles. In particular, movements by the priest may harm the objects, and when the priest leans against the altar or if he sits down, the chasuble can be damaged. In some churches specific seats were installed to overcome these problems and to protect the valuable historic garments during their use. For instance, at St. Stephan's the *kathedra* of the bishop has a slit between the seat and seat back, so that the chasuble can hang freely without the priest sitting on it (Fig. 9b).

Conclusion

In archaeological excavations carried out in early modern graveyards and churches sometimes graves of Catholic priests can be identified. In cases of good preservation the liturgical garments in which the priest was buried can be identified. Ecclesiastical textiles (*vestes sacrae*) play an important role in textile history and our understanding of the history of Catholicism in Europe. It is important to describe new finds, and there are still old paraments from the 16th

Fig. 8. Liturgical garments in use: a) Schlägl monastery, rose vestments and squirrel cape from 1730-1750; b) Oberlaa, chasuble, stole and maniple from 1706 (Photos: K. Grömer 2014, courtesy of Oberlaa Church and Schlägl monastery).

Fig. 9. Protection of historical vestments during use in St. Stephan's Cathedral: a) priest wearing a stole and chasuble from 1740; b) seat of the bishop (Photos: K. Grömer 2015, courtesy of St. Stephan's Cathedral).

to 18th centuries stored in the sacristies of Austrian houses of worship, from small village churches to cathedrals and monasteries, that still need to be recorded. In some cases, historical textiles are still in use – not only garments from the 19th century, but also numerous Baroque paraments and even items from earlier periods.
An important aspect concerning the dating of objects found in graves has to be addressed here. As historical paraments are still in use in Catholic churches, at least in Austria, a discussion is needed about which garments have been selected for the burial of a priest: *i.e.* were they 'new' garments or ones that were already hundreds of years old, no longer suitable for daily service and therefore chosen to serve as funeral garments? This has implications for archaeological dating practice, as archaeologists tend to date graves according to the date of grave goods and clothing found within. It means that in some cases the dating of the grave (if there is a tombstone) and the dating of the liturgical garment found in it might differ. Finally, it is important to note that practice in the contemporary world is different: since the Second Vatican Council it is has been forbidden to bury historical liturgical vestments in graves.

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9. Reflections and Outlook – A multi-dimensional approach for textile research

Some general remarks based on more than a decade of archaeological textile studies and participation in the European scientific community are made here to suggest what kind of insights could be gained in the future and trends in relevant research. The importance of considering textiles and textile tools from archaeological sites for our understanding of technical, economic and social aspects of past societies can no longer be overlooked. Archaeological textile research is a heterogeneous field. The original textile finds are a significant source for the activities and studies of the author using different applied analytical methods. Nevertheless, basic research is still needed to gain statistically relevant data about textiles, especially from the Prehistoric and Early Medieval periods in Central Europe. In addition, textile tools, archaeological contexts and pictorial evidence as well as written sources are of relevance in understanding textile production and their economic and social implications in a specific area and time period.

In the following discussion, the multi-dimensional approach is summarised with further consideration of objectives for future research. The **establishment of specific research strategies** to gain basic data, interpretation and contextualisation is vital. Within the scientific textile research community in Europe, especially in the last 20 years with major research projects, overview publications, series of edited volumes and monographs of on-site textile and tool related studies, techniques and theoretical background have been of importance. These activities have been covered by individual scholars from universities and museums as well as major institutions with textile research focus (e.g. Centre for Textile Research Copenhagen; Landesamt für Denkmalpflege in Baden Württemberg and Bavaria) with a focus on regions such as Scandinavia, Greece and the Ancient Near East and Central Europe. Above all, those activities served to gather different methods and strategies and to set standards. This embraces both the field of data mining and the analytical tool kit. In the last two decades, Austrian research and experimental studies have also been adopting new methods of research and dissemination; and, for example, the publication of the Hallstatt textiles monograph (GRÖMER et al. 2013) set new standards in terms of how to present the technical details about the material and related research.

9.1. Analytical tool sets for future research

In modern textile research, a broad spectrum of methods and techniques (Fig. 9.1) enables a deeper insight into aspects of design, production and use of textiles from an archaeological context than was possible in the past.

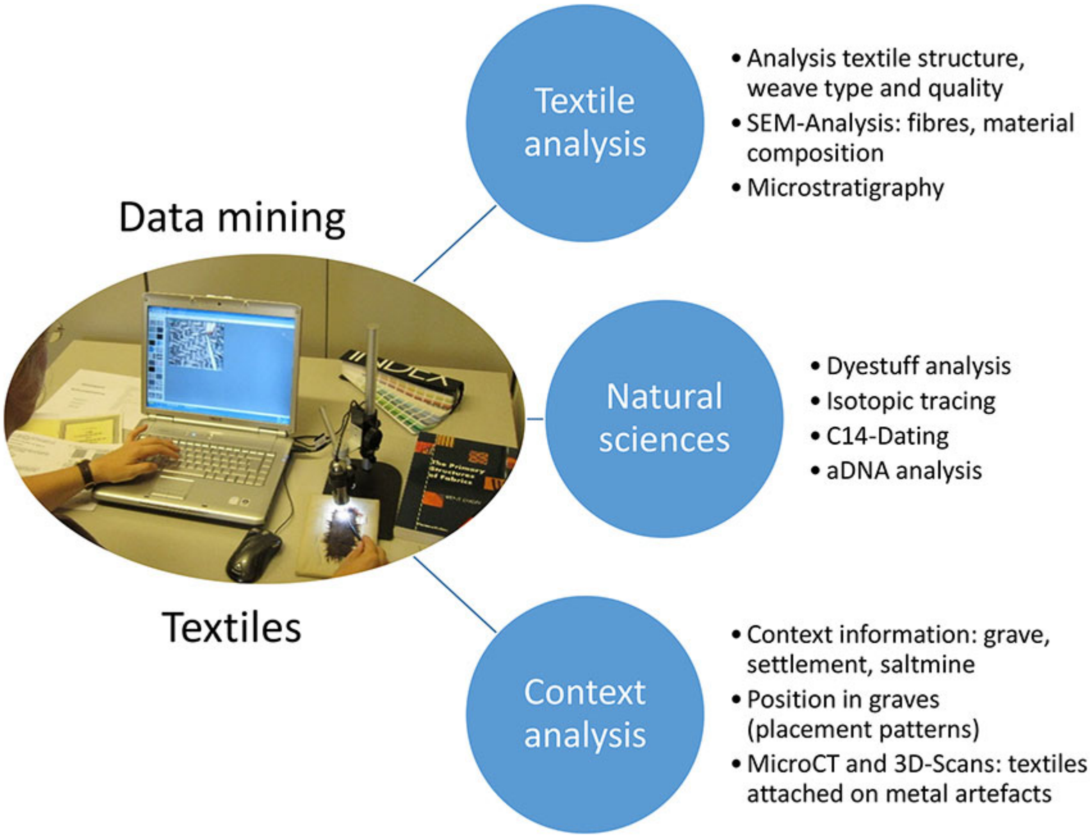

Fig. 9.1: Data mining for textiles from archaeological contexts and the analytical tool kit used.

Data mining for archaeological textiles embraces systematic research on textiles from graveyards, settlements, bogs, hoards and saltmines; also including textile analysis on a micro- and macro-level. Basic methodologies for analysis of archaeological textiles is available for example in ANDERSSON STRAND et al. 2010, 152–153; BENDER JØRGENSEN & GRÖMER 2013; GILLIS & NOSCH 2007; GRÖMER 2014, 6–16; WALTON & EASTWOOD 1988; for studies of the microstratigraphy (as defined by HÄGG 1989) and their visualisation see NOWAK-BÖCK & VOß 2015. The microstratigraphical analysis has to be object-based on certain artefacts, but also context-based – the best results so far are from large block-liftings, as impressive examples from Southern Germany demonstrate (e.g. BANCK-BURGESS 2012; PEEK 2013).

Important recent tools for the interpretation of archaeological finds from block-liftings, but also for finds consisting of multiple organic and inorganic layers are **3D-Scanning, x-radiography, computer tomography** and **microCT-scanning**, enabling the investigation of hidden structures – often carried out in cooperation with specialists in textile conservation and restoration. In textile archaeology, such techniques have been applied for about two decades (e.g. CYBULSKA et al. 2010; PEEK & NOWAK-BÖCK 2007). The first time x-radiography and microCT-scanning was carried out successfully on archaeological textile material from Austria was in 2004 (from the Late Antique cemetery Mautern-Melkerstrasse: GRÖMER & MEHOFER 2006, 61–63; MÜLLER & SALABERGER 2010), in cooperation with the FH Wels (University of Applied Sciences Upper Austria – Research and Development, Research Centre Wels Campus).

MicroCT-scanning of a bronze belt buckle from Mautern with multiple layers of two different textiles not only brought to light diverse mineralised organic layers, but also the surface of the object with iron inlays was visualized and examined and such could be used for typological dating. Technological developments in both 3D-scanning and microCT-scanning promise interesting results in future research (e.g. STELZNER et al. 2010; WIESNER et al. 2013). The author has been involved in an application for a grant for state-of-the-art high-resolution microCT-scanning facilities to be employed at the Central Research Labs of the Natural History Museum Vienna (KROH et al. 2019). This enables further textile research to be carried out at the NHMW to integrate those tools and methodologies into textile studies.

An analytical approach to actual textile finds has become increasingly popular in recent decades, not least because of the increasingly refined methods available as well as improved technical equipment. For example, it was not possible for the pioneers of archeological textile research in Austria in the 1960s to well into the 1990s (e.g. HUNDT 1977; 1984) to carry out fibre analyses of mineralised textile residues attached to metal artefacts from graves. Only with the introduction of the **Scanning Electron Microscope (SEM)**, especially as it became increasingly available for textile archaeology from the end of the 20th century (FISCHER 2010), could real progress be made. The use of SEM is now included in the basic repertoire of textile research. Recently, a standard work about fibres from archaeological contexts has been published by Antoinette RAST-EICHER (2016), which is based on SEM imaging. The book also deals with issues concerning different preservation conditions of archaeological textiles, special cases such as carbonisation, fibre damage and the various levels of degradation.

Additionally, SEM has made a decisive contribution to the scope of textile studies, not only for identifying fibres, but also for more detailed analysis. With wool quality measurements (GLEBA 2012; RAST-EICHER 2008; 2013), it can be determined in sheep, for example, how far breeding success took livestock development – from hair sheep to more advanced sheep breeds. We also learn about the processing of fibres and the *chaîne opératoire.* Such studies have also been made by specialists working on Austrian material (including Hallstatt, Mitterberg, and Radfeld: RAST-EICHER & BENDER JØRGENSEN 2013), and here with increasing quantities of data in the future, interesting findings on sheep breeding can be expected.

Also, analysis of material composition for example of metal threads enable new insights into material culture. For this, Scanning Electron Microscopy, Energy-dispersive X-ray spectroscopy (SEM EDX) is employed for the identification of potential raw material sources and provides additional information on the crafting process (e.g. for metal threads from archaeological textiles: NOWAK-BÖCK 2015, 237–239; WINCOTT HECKETT 2015, 246–247). Pilot studies by the author from Early Modern finds from Hollenburg and Zwettl in Austria (GRÖMER & RUDELICS 2015; GRÖMER & TOPA 2015) will be soon followed by more studies in future.

Dyestuff analysis using High Performance Liquid Chromatography (HPLC) has for some time been amongst the most commonly used methods for the scientific analysis of textiles (e.g. HOFMANN-DE KEIJZER et al. 2005; 2013; VANDEN BERGHE et al. 2009), carried out as part of an interdisciplinary approach within specialised labs and institutions. Recent methods that are established in the investigation of polychrome surfaces for example of painted sculpture or pictorial art, have also been applied to the investigation of archaeological textiles, albeit quite sparsely and unsystematically. A recent study by Joanne DYER (2018) from the British Museum in London yielded promising results. She explored the use of multispectral imaging (MSI) techniques in the investigation of Late Antique textiles from Egypt. She used MSI to map the distribution of photoluminescence and reflective characteristics on textiles under different wavelengths of light, providing qualitative and holistic insights into the chemical composition of the materials. However, this material comes from dry contexts, and further studies would need to be carried out regarding their application to material from other archaeological contexts, where the preservation conditions of textile finds may be very different. In this regard, case studies with such non-destructive methods are also planned for textiles found in saltmines in Austria and from grave contexts, in order to test the boundaries and applications of the methods.

There are also attempts at integrating further new and sophisticated analytical techniques into textile research (ANDERSSON STRAND et al. 2010, 154–158), ranging from aDNA, mass spectrometer-based protein sequencing and proteomics to strontium isotope analysis. The implementation of such promising new methods in archaeological research at the beginning of the 21st century has been defined by Kristian Kristiansen as “Third Science Revolution” (KRISTIANSEN 2014, 19), leading into new theories and research fields. The application of those latest methods for textile research allows new insights into the origin of raw materials, shedding light on trade, but also on mobility of textiles together with their users.

The use of **strontium isotopic tracing** in textile research still is based on exceptional preservation conditions. So far, isotopic tracing was successful for example on textiles from wool textiles from medieval anoxic waterlogged contexts in Northern Europe (VON HOLSTEIN et al. 2016), as well as on textiles from the specific preservation conditions of oak coffin graves or bogs. Investigation of the bog textiles also led to new insights. One of the ground-breaking results can be demonstrated with the Huldremose II tubular-woven garment “peplos” from a bog in Denmark. This garment has been previously thought as being of local provenance, but strontium isotopic results point to the fact that yarns of local and non-Danish origin have been used (FREI 2013). Recent studies on strontium and its relevance for the origins of the so-called Egtved girl and her garments, from a Bronze Age oak coffin grave in Denmark gave some reason for scientific dispute of the analytical methods and their interpretation (FREI et al. 2015; THOMSEN & ANDREASEN 2019[1]). First attempts to use this method to textiles attached to metal artefacts, have been successful, but still, only if textile material has been preserved in an organic state (e.g. Voldtofte: BERGFJOLD et al. 2012).

[1] see reply to Thomsen & Andreasen 2019 on 13 March 2019; https://natmus.dk/nyhed/nationalmuseet-fastholder-egtvedpigen-kom-langvejs-fra/ (accessed 14 March 2019).

Strontium Isotopic studies have also been applied to the Achaemenid and Sasanid mummies and their clothing from the saltmine Chehrābād, Iran (RAMAROLI et al. 2010), where the author is involved with textile analysis (GRÖMER & BAGHERPOUR 2018). In the first isotopic analyses, the focus has been on the origin of the mummies to gain knowledge about social mobility and technical innovation in Iran during the Achaemenid period. Further isotopic studies of textiles are planned, especially to distinguish local products from traded ones and determine their place of their origin. Of specific interest are the textiles from the Sasanid layers (4th – 6th century CE) of the saltmine, as decorative elements on some of them point to the Late Antique Roman Empire.

The potential for studies of **ancient DNA** for the investigation of sheep wool has been tested on Bronze and Iron Age material in Denmark so far from bogs and oak coffin graves (BRANDT et al. 2011). But this technique is still challenging for the investigation of mineralised textiles. Applying proteomics to textile research is of interest for obtaining further information about protein based materials (SOLAZZO et al. 2013). This not only distinguishes different species of animals or even different sheep breeds, it also demonstrates protein degradation in different environments, even correlating certain modifications to the preparation of the wool and to the use of certain dyes and mordants (SOLAZZO et al. 2013, 140–142). One of the most impressive early protein studies applied to archaeological textiles is more than 20 years old. It was a test of Hallstatt period glossy fine patterned "silk" threads from princely graves at Hohmichele and Hochdorf in Germany (BANCK-BURGESS 1999, 234–237). Protein analysis revealed that the finds identified as silks via standard microscopic investigation, are of a plant material, namely extremely fine processed flax. Far-reaching interpretation about the presumed evidence for early silk in Prehistoric Europe north of the Alps, implications relating to trade between Hallstatt/Early Latène Culture and China and other far-reaching theories had to be reassessed (BENDER JØRGENSEN 2013).

For Kristian KRISTIANSEN (2014, 17–19), the Third Science Revolution is also defined by the power of **Big Data** for systematic surveys via databases, as well as new methods of quantification and modelling. Digitalisation and making data accessible to the public via modern media are as global challenges an important task in our postmodern world and such also big issues in sciences and in heritage management. The state of Austria has funded such "infrastructure projects" in digitalisation to make collections and supplemental data accessible. In the last few years, public heritage collections in Austria, including the Natural History Museum in Vienna, have been involved in such "Digital Heritage" activities. As Kristiansen points out, for archaeological research in the future, connecting Big Data from various studies and collections is the only way to extract new knowledge from them, through such recent innovative study fields as landscape modelling, agent-based modelling or the world system theory (KRISTIANSEN 2014, 20–22) which generate new understandings of our past. In textile research, a great deal more has to be done. Yet, taking together the results of data mining and diverse analytical tools, Big Data about archaeological textiles is already being generate. A limitation is that it is usually still kept in local databases within institutions not online with open access for all. A first attempt at making data about archaeological textiles available has been the database about Anglo-Saxon textiles and clothing from Great Britain by Penelope WALTON ROGERS[2] with data from c. 2000 graves, made online in 2007. A Bronze Age textile database has been one of the outputs of the project *CinBA – Creativity in Bronze Age*[3]. This offers over 1,000 entries on Bronze Age textiles from the whole territory of Europe.

The macro-level approach using Big Data facilitates enables comprehensive chronological and supra-regional overviews. The integration of statistical methods is of equal importance to the critical evaluation of the data and the methodologies employed to generate it. Statistical data and hierarchical clustering analysis have not only to be generated for textile finds, but also for context analysis – for example to dress fittings in graves in order to understand what has been worn together. Contextual analysis of textiles found in graves, settlements or other contexts such as mines, and placement patterns in graves are still the basis for further interpretation. The same applies to textile tools and studies about their distribution in settlements. Textile tools include not only spindle whorls and loom weights, but also spools, needles, heckles, weaving combs, weaving swords, shears and the like.

Standardised metric analysis of textile tools such as the Tools Database developed by the Centre for Textile Research Copenhagen (e.g. MÅRTENSSON et al. 2009; OLOFSSON et al. 2015) are vital for describing but also for interpreting tool assemblages in terms of the kinds of textiles which might have been produced with them. In this, physical parameters such as shape, size and weight measurements of tools are interpreted in terms of functionality. Use-wear analysis, integrating investigation of tools from experiments with microscopic analysis of original artefacts is also helpful for the understanding of the functions of tools. Contextual analysis of distribution patterns of textile tools within settlements, and mapping the numbers and distribution of the tools, provide information about how important was textile production for a specific site or region. Additionally it tells about the scale and mode of production (see e.g. ANDERSSON STRAND & NOSCH 2015). The major limitation of this ground-breaking work is that the textile tool database is not directly accessible to the public via the world wide web.

A large-scale project to allow access to all textile tools stored in the archives of the Natural History Museum Vienna based on standardised recording was initiated in 2018 (SCHIERER 2019). More than 4000 textile tools, including spindle whorls, loom weights, sewing needles weaving swords or flax hackles will be recorded, with a time-span from the Stone Age to the Early Medieval, covering large parts of Europe. The tools will be recorded using the standards of the Tools Database by the Centre for Textile Research Copenhagen. It is planned that at the end of the project, all data will be made available through open access. It will be accessible on the "Textile Research" page of the website of the Natural History Museum Vienna's Department of Prehistory.

[2] Anglo-Saxon database at the University of York, section cloth and clothing: https://archaeologydataservice.ac.uk/archives/view/clothing_eh_2007/ (accessed 19 February 2019).

[3] *CinBA* Bronze Age textile database: http://cinba.net/outputs/databases/textiles/ (accessed 19 February 2019).

9.2. An integrated and interdisciplinary approach to textile research

Interdisciplinary research within different disciplines of the **humanities** is nothing new in the 21st century. For archaeological textile research, a long tradition of integration of different studies of iconography and written sources has been vital for understanding textile production, dress and appearance. The studies require specialists from various historical disciplines. The same applies to **ethnographic** and **folkloristic-historical** (German: *Volkskunde*) studies about textile techniques and the use of garments in early research activities about the Iron Age garments found in bogs in Scandinavia (e.g. BROHOLM & HALD 1940; HALD 1980). However, using ethnographic or historic data for the interpretation of how specific textiles might have been made or how cloth might have been draped around the body, calls for critical evaluation. Nevertheless, these perspectives broaden the scope of ideas about textiles and dress in the past and help to overcome assumptions of which researchers from other disciplines may not even be aware.

Combining archaeological textile research with different concepts and perspectives from a wide variety of historical disciplines concerned with clothing (Prehistory, **Classical Archeology, Art History**, **History**) grew out of the diversity of sources consulted (e.g. HARLOW & NOSCH 2014; HARLOW et al. 2014; MIKHAILA & MALCOLM-DAVIES 2006, 7–47; MICHEL & NOSCH 2010; MÜLLER 2003; OLSON 2008; SCHRENK et al. 2012). For example, for the first half of the first millennium CE, papyrologists, epigraphers and specialists on Greek and Latin literature identified a multiplicity of different terms for outerwear upper body coverings in terms of "mantle" or "cloak" (e.g. CROOM 2002, 49–55, 89–92; CLELAND et al. 2007). Examples are *pallium, sagum, chlamys, paludamentum, abolla, endromis, palla* or *amiculum,* to name just the most common among them. They differ according to written sources in terms of shape, length, colour or decoration but also according to the person wearing it, as expressed through gender and age, or the social status of the person in charge – or even the occasion when it was worn. However, these many different names do not map easily to the few types of mantles shown in pictorial media (reliefs, statuettes, frescoes, mummy portraits and the like: e.g. CROOM 2002, plates).

The dilemma becomes even more evident when, for example, different kinds of sources are compared and fragmentary archaeological textile material needs to be interpreted. An example is trace evidence of overcoats in a Late Antique inhumation grave 96 of an adult male person in Zwentendorf in Austria (GRÖMER 2014, 128, 266–267, taf. 39). In this case, cloak or mantle fragments can be identified by a functional placement pattern of a fibula on the upper body area with an attached (pinned) textile. The man also wore a military belt with textiles attached on the inside which suggest that he also wore a tunic. Detailed information about the cloth can be identified, such as the raw material used, the quality, weave type and – under perfect conditions – maybe the colour. The functional placement pattern of the fibula in the grave indicates that the textile belongs to a garment that has been pinned on the upper body. Such a garment, a cloak, is also shown in contemporary pictorial sources such as the Monza diptych of general Stilicho (CROOM 2002, fig. 8, 39). However, it is not possible to assign this textile fragment from the inhumation grave in Mautern a certain type and name of cloak, as there are many options for it in the written sources. Nonetheless, textile archeology is an invaluable resource for understanding Roman clothing and an important complement to classical archeological sources for clothing as it deliveres detailed and concrete technical data about textile types in use.

Nevertheless, iconography and written sources need careful assessment too (Fuchs & Oltrogge 2013; Olson 2008, 2–4; Paetz gen. Schick 2013). What do ancient authors want to say in the written sources? What did they want to express with different types of garments? Does the terminology also refer to matters of identity with economic, political and mythological hints; and which other attributes or values are attached to specific words? Likewise, what were the aims of the originators of pictorial sources: what were the thoughts of the producers and of the people paying for them and/or using them? This not only applies to the Greek and Roman written and pictorial sources, but also to much of the Middle Ages and Modern era (e.g. Mikhaila & Malcolm-Davies 2006, 7–47). Written sources are also important to the understanding of the symbolism and meanings of textiles and garments, as well as the metaphors they generate (e.g. Gaspa et al. 2017). These questions are also pertinent to the study of archaeological textiles from prehistoric evidence.

Fig. 9.2: Word cloud illustrating an integrated and interdisciplinary approach for archaeological textile research (cloud generator: WordArt.com).

In studies concerning archaeological textiles, the *Zeitgeist* also influences where the research focus falls and the particular interdisciplinary approach selected. For example, there was emphasis on the explanation of how different textile techniques were carried out (e.g. tablet weaving) in the beginning and middle of the 20th century. Interdisciplinary research at that time included intensive ethnographic, folkloric and historical studies. Such studies are still carried out to some extent but the *Zeitgeist* has now shifted interdisciplinary research in the direction of the natural sciences to obtain more information about date, provenance or material composition, a trend deriving from the Third Science Revolution (KRISTIANSEN 2014).

Aside from these analytical collaborations with applied sciences such as chemistry, as discussed in the section about analytical tools, multidisciplinary research also embraces cooperation with research in bio- and geosciences. For archaeology, this has deep roots, as natural sciences such as **Physical Anthropology, Geology, Biology** and **Zoology** can be seen as traditional partners for archaeological research in general (e.g. EGGERS 1959, chapter I) at least since the turn of the 19th to 20th century. Geology and mineralogy have been consulted to learn about the raw materials of stone artefacts. Physical anthropology is vital to gain information about the gender and age of human remains found in graves, for example. This kind of information enables further interpretation of burial gifts, dress accessories and – for textile research – garments in a grave. Archaeozoology and archaeobotany enable insights into the mechanisms of interactions between humans and their natural habitats in terms of animals and plants.

For textile research, archaeozoological and archaeobotanical data, together with data from landscape archaeology, geology and environmental studies help to explain textile production within the economic and subsistence system of a specific area and time period (e.g. BECKER et al. 2016; GRÖMER & SALIARI 2018; KARG 2011). It explains the fibre materials used, dyes of plant and animal origin exploited in different geographical areas and time periods, and developments in animal husbandry and breeding which enhanced and diversified the quality of textile materials. These perspectives contribute to the comprehensive understanding of human strategies in the use of natural resources.

There is great potential for the understanding of grave contexts in the application of the methodological framework of **forensic sciences** (e.g. GRASSBERGER & SCHMID 2014; HAGLUND & SORG 2002; İŞCAN & STEYN 2013). For textile research, this deals with questions such as: How and when can textiles survive if buried in the ground together with a body? What are the mechanisms behind their degradation and/or decomposition – as has been demonstrated in Chapter 2.3. Applied and systematic cooperation between the forensic sciences and archaeology to answer archaeological research questions concerning burials, has intensified in the last decade (e.g. ASPÖCK 2011). But this collaboration works in both directions. Even contemporary criminology uses archaeological methods such as excavation techniques and prospection methods like georadar for crime scene investigation (DIRKMAAT & ADOVASIO 2006; İŞCAN & STEYN 2013, 12–13). In Vienna, some attempts have been made to connect experimental archaeology and forensic science.

In the last few years, **experimental archaeology** by the author has also focused on the understanding of certain evidence: archaeological features, contexts and taphonomy. Recent experiments on cremation burials had the aim of understanding the dynamics of incineration of textiles on a pyre (Fritzl et al. 2019; Grömer 2018; see also Pany et al. 2013, 210)[4]. Important for textile research are the circumstances of how and for how long textiles could last during a cremation pyre (e.g. did they fall down from the pyre before being completely destroyed) and how they might have been collected and deposited together with metal artefacts in urns. Following such cremation experiments, further work on the process of decay in cooperation with forensic scientists could be revealing in the future pigs' leg dressed in linen and wool cloth and adorned with bracelets are to be buried and re-excavated after the passage of months and years. This will shed light on our understanding of the mechanisms and timing of metal corrosion and textile preservation in grave contexts. This follows a series of similar experiments, which have been carried out by forensic scientists in the USA (Janaway 2002). They used cotton and modern synthetic fibres, and sometimes wool and linen, for crime scene investigation and questions about post-mortem intervals (time that has elapsed since a person has died). In our experiments, the focus is on archaeological research questions, but cooperation with forensic scientists enable cross-fertilisation for actual crime scene investigation as well.

Aside this more context and taphonomy based approach, experimental archaeology in terms of archaeological textiles is usually carried out by the author but also by the scientific community with a technological and craft-centred approach (see also Andersson Strand 2010; Olofsson et al. 2015; Ræder Knudsen & Grömer 2012; Ulanowska 2016). Three examples are given in this Habilitationsschrift (Chapter 3) to explain the authors attempt in using experimental archaeology for the reconstruction of textile techniques. This kind of experiments is also an interesting contact-point between academic research and the interests of todays society. Experimental archaeology also helps to visualise techniques and can be used for dissemination work. In this context, it is noteworthy that since c. 10 years **motion capture technology** is used for visualisation and data collection at the Natural History Museum in Vienna in cooperation with the media company *7reasons*. Experiments to study the sequence of movements of hauling work in the saltmine at Hallstatt were also carried out with motion capture. This enabled extensive data collection in order to be able to do agent-based modelling. This computational models simulate the actions and interactions of entities (in the case of the mine this are the workers) to understand the work-flow in the saltmine (Reschreiter 2018, 175).

In addition, textile production has been studied using motion capture technology and the mechanics of weaving with a warp-weighted loom have been explored and visualised with this technique (Fig. 9.3). In 2015, a promising new project which used the motion capture technique was launched by the Centre for Textile Research in Copenhagen (Andersson Strand et al. 2016).[5] It aims to reveal the mechanics of spinning and also to document this part of our intangible heritage.

[4] https://motherhoodinprehistory.wordpress.com/2018/07/11/the-pig-must-burn/ (accessed 1 March 2019).

[5] https://ctr.hum.ku.dk/research-programmes-and-projects/capturing_our_intangible_past/ (accessed: 19 February 2019).

Fig. 9.3: Capturing movements in weaving on a warp-weighted loom at the open-air museum Schwarzenbach in 2009 (© 7reasons, NHM).

For textile research, extensive collaborative networks in the fields of applied cultural studies are becoming increasingly important. Integrating archaeological research into the needs of contemporary society requires the application of theoretical frameworks from **socio-psychological disciplines** to textile studies. This represents a paradigm shift how we view what clothing meant for prehistoric and historic societies (see also HARLOW & NOSCH 2014). A concept deriving from the discipline of **psychology** is used in these circumstances even though it is not based on empirical evidence. The concept of human motivation as explained by Abraham MASLOW (1954) defined human needs not only as the obvious, i.e. physiological and safety needs such as food, clothing, shelter and physical safety. For him, as a psychologist, he also expanded his ideas to include social needs, belonging as well as aesthetic and cognitive needs to be of importance (MASLOW 1970). The desire for symmetry, order, elaboration, balance and form are among aesthetic needs. Cognitive needs manifest themselves as the desire to understand, to explore, to know, to be creative and to solve problems. Maslow's theory is often visualised as pyramid, with at the base the physiological and safety needs and at the top the need for self-actualisation. There is criticism about ranking needs into a definite hierarchy (WAHBA & BRIDWELL 1976). However, it has been argued that the needs as Maslow defined them, are universal and are found throughout all periods and in all cultures. For textile and especially clothing research, Maslow's human needs are of interest, as they provide a framework through which to consider different aspects of human nature. Serving basic physical human needs, but also aesthetic, belongingness, and cognitive needs, dress and textiles can be understood as being among the key drivers for technical innovations (in textile and patterning techniques), as well as in social development. One of the basic physiological needs of humans is also addressed by the theories of Ian Gilligan, who explained in his ground-breaking work, the intermingling of climate and clothing as crucial in human evolution

(GILLIGAN 2007; 2019), the development of clothing out of a need for "portable thermal protection" during the Palaeolithic era and its role in major technological innovations.

Sociology studies the culture of everyday life, social relationships and patterns of social interaction. Gender diversity and the ageing of society are today among the major global challenges, influencing all aspects of our lives, including education and the population pyramid. To set such global developments into a wider perspective, there is a need for worldwide historical studies concerning **gender and age**. Historical overviews about children and society's view of them were pioneered by the French historian Philipe ARIÈS (1960), who wrote a rather pessimistic timeline of childhood from the Stone Age to the Industrial Age. A critical view with more positivist arguments can be seen for example in more recent research in the USA and UK (e.g. SOFAER 2006; STEARNS 2006), as well as in projects about motherhood at the Austrian Academy of Sciences (REBAY-SALISBURY 2017). Definitions about how children and childhood have been referred to during history are just one range of the outputs from those studies. Gender and age studies are of relevance to archaeological textile research because they are important for understanding different aspects of textile production, both who the producers are and who the consumers are. Special reference to this has been given in the research project *DressID* (PAETZ GEN. SCHIECK & TELLENBACH 2010; TELLENBACH et al. 2013*)*, with a specialised study group dealing with the topic of gendered dress and the expression of age groups via textiles and garments from the 1st millennium BC to the 1st millennium CE. Furthermore, children's clothing has been addressed in recent studies (e.g. in the Early Modern period by HUGGETT & MIKHAILA 2013) and has been the main theme of conferences such as the one at Textilmuseum Krefeld in 2013 (PAETZ GEN. SCHIECK 2015).

Clothing and garments as distinct elements of non-verbal communication are among the main topics considered here by the author. Pierre Bourdieu's **sociological concept of *habitus*** is of relevance in understanding the wider impact of personal appearance on society. He refers to *habitus* as how people interact with their social space, the physical embodiment of cultural capital as seen in habits, skills, and also in the choice of food, clothing, taste for art or body language (BOURDIEU 1984; 1990). *Habitus* explains how individuals perceive the social world around them and demonstrates their reaction to it. For research on textiles, this concept offers information about communication strategies via clothing, but also about all kinds of tacit/embodied knowledge and skills. Recently, the *habitus* concept was discussed in a masters thesis at the University of Vienna (FRAGNER 2019) in relation to depictions in the Stuttgart Psalter (8th century CE), comparing its content with contemporary finds in inhumation graves and surviving garments and jewellery.

Studies in **semiotics** (CHANDLER 2002) work with visual codes such as colours, physical appearance, and also body language, which relate to a direct, non-verbal communication and such interaction between people. Signals sent for example with clothing, jewellery or headgear, together with gestures, posture, and stance, are unconsciously read by the receivers who then decode and understand them. There are also specialised connotations, meanings and ideological codes reflecting particular social, political, moral, and aesthetic values (for the application of such concepts in discussing archaeological finds, for example placement patterns in graves see Sørensen 1997 or Wells 2008).

Further sociological and psychological study fields which are worthwhile contributors to research about prehistoric and ancient dress are those which explore the wider psychological effects of wearing clothes. Theoretical issues routinely discussed in **modern fashion theory** (Calefato 2004; Eicher & Evenson 2015) such as aspects of body language and ranges of movement (e.g. Watkins & Dunne 2015) offer interesting insights on issues such as space requirements (Lehnert 2013, 67–74) of clothing. Those concepts were applied to the study of prehistoric garments by the author for the first time using case studies (e.g. Bronze Age garments from Franzhausen, see Chapter 8.2.), as well as illuminating wider phenomena (Chapter 8.1.). For research on clothing, the author's attempts at reconstructing prehistoric garments also provides data, especially in demonstrating the difficulties of interpreting placement patterns in graves in a critical way (see e.g. Grömer 2016, 423–427; fig. 237).

Studies about the **sensory aspects** of textiles and dress, about touch, feel, smell and sound are also among modern fashion concepts (e.g. Johnson & Foster 2007). Such concepts have not been much used in archaeological textile research although some authors have, in the last decade considered them for example for understanding Bronze Age garments (thoughts about touch and feel, soft wool vs. hard metal elements: Bergerbrant 2007, 62–65, 139–140) or in discussing mesolithic textiles (Harris 2014). The aim was to employ a phenomenological framework about sensory perception to add an extra level to research on the material culture of past societies. The sensory aspect has also been discussed by the author with a Middle Bronze Age ensemble from Winklarn in Austria (Grömer, Rösel-Mautendorfer & Bender Jørgensen 2013). It is an inhumation grave with massive spiked pendants and long sharp pins, which were worn on the upper body region and found only in the graves of rich women of the Middle Danube area. For the specific shapes of the pendants it has to be considered what psychological effect such a hard and shiny "distance-holder" might have had to the contemporary society. The impact of sound can also be easily explored by considering the rattling pendants worn as dress fasteners in the Hallstatt period (Grömer 2016, 441–442) as markers of social groups. If they were high-ranking individuals, the sound had the effect of announcing the approach of a member of the elite.

Latest theories on **functional clothing design** (e.g. Watkins & Dunne 2015) could provide further insights for the study of prehistoric and ancient garments. The saltmine of Chehrābād in Iran presents a specific and valuable resource with fully dressed workers (Aali & Stöllner 2015) wearing more or less completely preserved garments (Grömer & Aali 2019). These salt miners, dating from the 4th century BC to the 4th century CE, were found in a very specific context. They died as the mine collapsed while they were working; although this is evidence of a human tragedy, it also offers a unique opportunity to study garments worn during heavy physical work in ancient times. The aim of the research is to study what kinds of cloth and garment shapes were chosen for occupational dress in order to be able to move in an appropriate way for manual labour and how the garments protected the wearers from the rough surroundings in the saltmine. Here, too, state-of-the-art technology such as 3D-modelling will provide further opportunities in the future, by comparing modern measurements, clothing designs, testing regies for the durability and load capacities of historical and even prehistoric textile objects. Above all, analysis of the functionality of the materials and construction under the stress applied to the garments in wear and movement will be considered. This promising new field of research is now being explored by a group of researchers from Ivanovo State Polytechnic University and Saint Petersburg State University of Industrial Technologies and Design, who have so far dealt with digital reconstruction of garments from the 18th and 19th centuries (KUZMICHEV et al. 2017; 2018). In cooperating with this research group to obtain new data about the garments of the saltminers from Chehrābād, it will be possible to make a critical assessment as to which kinds of methodology from the modern textile industry can be used for the interpretation of archaeological finds.

9.3. *Long durée, chaîne opératoire* and supra-regional perspectives

A *long durée* perspective that traces social, technological, and economic developments over time has become increasingly important to the author's work over the last decade. Archaeologists working with a specific time period and/or region tend to have similar questions and concerns that may limit investigation, for example archaeologists focusing on the Bronze Age in Central Europe are usually researching metal technology, or Iron Age specialists often debate status and prestige. Valid reasons for this might be the material culture of a time period or the influence of current trends or the *Zeitgeist* and the particular dynamics of a specialised group of researchers. A longer term view presents new perspectives on the same material.

Through cross-disciplinary research, we come to a deeper knowledge of the *chaîne opératoire*, the mechanisms of how, when, and where certain textile techniques, developments, and trends evolved. A basic concept about the dynamics of textile technique development in Central European prehistory (2nd to 1st millennium BC) have been achieved by intensive diachronic and wide regional studies in the last ten years (GRÖMER 2016, fig. 140). This is one of the fundamental insights the author was able to contribute to the scientific community. The concept of the *chaîne opératoire* is based on an idea developed by Claude LEROI-GOURHAN (1964 [1993]) for describing any productive practice. For textile archaeology, it has usually been adapted to describe the complexity of textile craft and the mechanical sequence of textile production steps, which have been visualised by various scholars in the past few decades (e.g. ANDERSSON STRAND 2010; BELANOVÁ-ŠTOLCOVÁ & GRÖMER 2010, fig. 3.1; HARLOW & NOSCH 2014, fig. 1.2; MILLER 2007). Textile archaeology goes beyond the simple understanding of technology and the *chaîne opératoire.* Leroi-Gourhan noted the necessity to search for social and cultural influences on each step. As such, textile archaeology also has to ask questions about the people behind the craft – about the producers, but also the consumers of textiles in different societies, and the places they worked and lived – to understand production practices as an enmeshed societal activity. It is our aim to understand textile technology, the interactions of all the people involved, and the transmission of knowledge between the actors. This could be achieved through apprenticeship, implicit learning strategies of tacit knowledge, bodily learning and skill (see also BENDER JØRGENSEN 2012) because textile techniques consist of a range of repetitive movements such as spinning, but also highly skilled techniques such as patterned tablet weaving. Such studies are, of course, a challenge when working with prehistoric finds from societies without written records.

Studies about ideological concepts attributed to specific textile techniques and objects are quite common in ethnographic studies, but not in studying prehistoric eviedence. It is about the tight ritual interplay between cultural appropriation of material, practices and meaning, or even ritual narratives. As an example, traditional weaving of *Kente* cloth in Ghana in Africa (GILFOY 1987) is a task that respects different taboos and narratives which are about who is allowed to produce the cloth, who will use it and the rituals concerning this. Understanding such social practice is a challenge when depending only on archaeological sources without written ones. Is it possible to apply such concepts of ritual narratives also on the production of complex patterned tablet weaves in Hallstatt Culture, for example? Evidence for a certain social and ritual value added to special textile products is provided by Greek and Roman sources (e.g. DROß-KRÜPE & WAGNER 2014; WAGNER-HASEL 2006). Thus, cultural meaning is also an important concept in the discussion about innovation and adaptation of decorative and production techniques, access to material and exchange patterns.

In the past decade, intensive research has been carried out on the *long durée* perspectives of mechanisms and modes of textile production and work organisation in prehistoric societies in Central Europe (ANDERSSON 2003; 2007; ANDERSSON & HELLER 2016; GLEBA 2008, 180–194; GRÖMER 2016, 241–290; ULANOWSKA & SIENNICKA 2018). This is not assigned exclusively to domestic production as household work, but also takes into consideration higher levels of production, namely specialisation and mass production. Raw materials, half-finished and ready-made goods for trade and other aspects of ancient economies are essential considerations in this context.

The unique potential of textile research from a long-term perspective focusing on temperate Europe is to explore not only how textiles were made and the mechanisms of handicraft development, but also to see the economic impact of textile production because resource management and long-term planning for it is substantial. The role of textiles in the development of social organisation in prehistoric societies and beyond is not to be underestimated. It is not appropriate to give a concise overview of textile technology through the ages here e.g. the beginnings and early textile use have recently been addressed in dedicated conference volumes (e.g. BRENIQUET & MICHEL 2014; MICHEL & NOSCH 2010; SIENNICKA et al. 2018; ULANOWSKA & SIENNICKA 2018) and in a research project by TOPOI in Berlin (BECKER et al. 2016). But a few words about how the author's own research has contributed are pertinent. Significant differences and developments can be identified in the use of certain raw materials and the associated spikes in innovation. Thus, for example, innovations in certain patterning techniques (e.g. textile dyeing or spinning direction patterns) or weaves (twill weave, tablet weaving) are connected with the use of sheep's wool. Those techniques can be observed in Central Europe in the Middle Bronze Age dating to 1500 to 1200 BC. On the other hand, textile innovations such as twill or spin pattern are not common in the 2nd millennium Bronze Age in the Eastern Mediterranean, and can therefore be seen as Central European/Circumalpine innovations (BENDER JØRGENSEN & RAST-EICHER 2016; GRÖMER et al. 2016, 135–136). In this region, a specific need for innovation in textile production emerged, which was still increasing in the Late Bronze Age and especially in the Hallstatt period. In contrast, in the Late Iron Age, textile cultures are simpler, pointing to the beginning of mass production (see e.g. GRÖMER 2016, 252–259). Here it is clear that in the Hallstatt Culture textile aesthetics, qualities, colour and glamour played a vital role in the representation of elites and the higher strata of society. This is additionally highlighted by the use of metals, especially gold, in association with textiles. Within the last ten years, many similar studies by various authors, involving the whole territory of Europe and a timespan from prehistory to the 1st millennium CE have added material to this overview. They are published in edited volumes such as "*Textiles and Textile Production in Europe from Prehistory to AD 400*" by Margarita GLEBA and Ulla MANNERING (2012).

To set the *long durée* perspective in textile technology into a context with innovations, we follow developments from prehistory far into modern times. We know that textile technology was employed to attempt to make this important production more efficient, and, as such, it was a forceful driver of far-reaching innovations that still have relevance in our lives today. Together with the iron industry and steam power, textile production has also been one of the main factors in the Industrial Revolution of the 18th century. This – with its transition from hand manufacturing processes to machines – is one of the turning points in history with far-reaching economic, structural and social changes. Technological innovations such as (to name examples from textile technology) James Hargreaves "spinning jenny", the "flying shuttle" patented by John Kay, and Jacques Vaucanson's fully automated loom were crucial to this (GRIFFIN 2010, 86–104). Automation with replacable punch cards and binary codes to control the sequence of patterns was first employed for a loom by Joseph-Marie Jacquard in 1804. This innovation, in a further consequence, generated the idea for modern computers (ESSINGER 2004). It can be argued that textile production not only played a critical economic role in the Early Modern era but also served as a motor for financial and technological change. Is too far fetched to further argue that this innovative power goes far back into Prehistory? Machines are one of the most significant developments of humankind: mechanised production processes continue in society from invention of the loom in the Neolithic period (with its mechanised way of lowering and lifting threads). In addition, the notion of a rotating axis derived from spindles, this made wheels and all kinds of carts and carriages possible – innovations that have been an important step forward in human history.

9.4. Textile research perspectives in cross-craft interaction, function and social meaning

For integrated technological studies of textiles and tools, one of those important aspects is cross-craft interaction, which studies how textile production and design is connected with other crafts. In general, the concept of cross-craft interaction is a useful framework to investigate how different crafts mutually influence each other (BRYSBAERT 2007; 2008; MCGOVERN et al. 1989). Conceptually, it has many overlaps with the *chaîne opératoire,* which examines the production, distribution, use and deposition of artefacts. For textile studies, information about interaction between the people making the textiles with people making the tools is also of interest. Not only technological details, but also the social setting of the craft activities is under scrutiny; the technological and social interactions that arise from doing different crafts are worth studying (GRÖMER et al. 2018, 276). In future, this aspect of textile research might be even more in focus. Different modes of cross-craft interactions in textiles have recently been explored in Bronze Age Greece (ULANOWSKA 2018). These cross-craft interactions may result from shared workspace or from shared technology (e.g. naval technology, metallurgy or the production of pigments).

Aside from people involved in certain crafts and the social and economic impact on society, the framework of cross-craft-interactions offers more insights. Among the many manifestations of cross-craft interaction in the archaeological record (BRYSBAERT 2007, 335–337) is skeuomorphism, the transfer of characteristics of one medium to another. This does not mean simply e.g. the definitive depiction of textiles and dress in paintings (see a case study for the Bronze Age Aegean: ULANOWSKA 2018, 250, 253). In terms of textiles, skeuomorphism can be seen when features typical of textile design are used in various forms to decorate pottery through, for example, textile imprints or braided bands painted on the surface (e.g. BANCK-BURGESS 2014; RAST-EICHER 2012). In this context, a phenomenon of cross-craft design from the Early Bronze Age is noteworthy: For the "*Litzenkeramik*" Culture, the imprints of textile cords forming bands were a main pattern type. Textile impressions were so dominant as an aesthetic ideal for the decoration of pots that even metal wire and metal combs were used to imitate the desired optical and tactile cord effect (GRÖMER et al. 2018, 283–284).

How far-reaching textile products are spread through all aspects of life can be recognised in detailed studies about the functions of textiles. Owing to the relative scarcity of finds, this is often reduced to the obvious – namely clothing – and yet all other aspects of life and even death are surrounded and supported by textiles: in settlements and houses, in work contexts such as salt mines, in religious and funerary contexts (BANCK-BURGESS 2012; GLEBA 2014).

The interpretation of the function of certain archaeological finds is based on the context in which they are found and on the technical characteristics of the fabrics. The raw materials as well as the way they were made lead to specific properties of the textiles (e.g. GRÖMER 2016, 292–293; HARRIS 2010). Thus, various different functions of woven textiles in prehistoric Europe can be observed, even less obvious ones such as textiles as soft furnishings (wall hangings, cushions, and similar items), sacks and bags for transportation or technical use and utilitarian textiles (linings for belts, scabbards, and sheaths). Textiles played an integrated role in every area of human life – in the domestic, ritual, representative, and religious spheres. It is also possible to distinguish between primary and secondary functions of textiles (GRÖMER 2016, fig. 171). Foremost among primary functions – that is, for what a specific cloth or textile product was originally made – is that of clothing (see Chapter 8), but textiles used for soft furnishing or for technical purposes might also have been produced primarily for this function. Hints at secondary uses may be identified by use-wear analysis and through contextual analysis. Prehistoric and historical textiles fulfil roles in funerary practice and are routinely recycled. Those observations about textile functions contribute to further research questions about human behaviour, the impact of textiles on society, and resource management strategies.

In textile research, among all others, a focus lies on dress and identity, as one of the primary functions of textiles is that of clothing. As terminology often is mixed up in discussions by archaeologists, Marie-Louise STIG SØRENSEN (1997, 96, fig. 2) suggests a clear definition. For her, "cloth" means the actual fabric or textile of which a garment "clothing" is made of. This can be a skirt, dress, tunic, trousers or the like. The term "costume" is then to be used for the whole ensemble of garments/clothing together with dress accessories like belts, pins and fibulae and jewellery. This also embraces foot and head covers. For archaeological research this distinctions of terms is vital, as for the discussion of placement patterns (placement of dress accessories and jewellery in relation to the buried person) in graves, usually no actual cloth or clothing are available, but only the traces of the whole costume (the metal elements).

Cloth (through its textile structure, colour and pattern) represents the essence of the garment to which it belongs. Clothing as a characteristic feature of any culture is something that has been explored from archaeological finds in Central European prehistory since the first Bronze Age oak coffin graves and Iron Age bog textiles were discovered in the 19th century. The new analytical tools of the last decades inform us even further about their provenance, former colour and other characteristics. Significant steps forward have also been taken in studies about the social function of clothing as an important factor in non-verbal communication. Studies on dress accessories and placement patterns in graves as indicators of the social hierarchy and funeral rites are among the long-standing traditional research fields for continental European archaeologists. Today, we gain more information and insight by combining different sources through interdisciplinary work and applying new theoretical concepts, as it has been discussed in section 9.2. To name just the most important: Studies on visual perception in ancient societies, as published in the groundbreaking work of the archaeologist Peter WELLS (2008), and theories about visual codes as a subcategory of non-verbal communication (CHANDLER 2002) provide useful and revealing perspectives through which to consider textiles in the past. Also discussions about semiotics from a social psychologists perspective (SOMMER 2013) and theories about human needs by psychologists (MASLOW 1954) have to be taken into account.

9.5. Perspectives: The textile past in our future society

Textile research in the 21st century needs to be interdisciplinary and integrated into the challenges of our time[6] such as the use of resources, access to cultural heritage, perpetuation of techniques and skills belonging to intangible heritage, people's identity, mobility, or migration. For the author, this culminates in different theoretical and interdisciplinary approaches to research about the technical, economic, and social aspects of textile production and clothing. The investigation of data using a wide range of analytical tools and the integration of results from the perspective of different disciplines to form interpretations and narratives aims to bring knowledge gained from archaeological textile studies to bear on the modern world – both for the scientific community and for dissemination to the public. This potential to resonate outside academia will demonstrate that archaeology and specifically textile research has relevance to current debates.

Addressing the challenges of our time with our deep history perspective can be exemplified with the topic of resource management. Textiles can be rediscovered as remnants of a widespread recycling economy, and examplars of the careful and efficient use of resources. How people a long time ago acted in a sensible and sensitive way towards textiles with reuse and recycling (see Chapter 6.3) can provide role models for today's discourse and it is possible for us to learn from the past. Today, this is of relevance more than ever as the textile industry and economy are among the main industrial pollutants worldwide and textile resource management is a particularly demanding task.

One aspect of textile resource management is how people dealt with natural fibres and dyestuffs. One aim of the *HallTexFWF* project was to offer modern textile producers (e.g. AVANI in India, Blueprint workshop Joseph Koó in Steinberg, Austria: Hartl 2012; Wandl 2012) information about ancient dyestuffs and dyeing techniques in order to be able to revitalise them and to replace poisonous synthetic chemical dyes with natural ones for a sustainable future. This also meets modern requirements for eco-awareness and sensitive exploitation of natural resources.

Keeping and sharing our intangible cultural heritage (see also Andersson Strand et al. 2016, 11–14) is an important goal today. Textile techniques such as spinning or tablet weaving, that have been employed for thousands of years, are now more or less obsolete in our modern world where textile work in general is mechanised. Keeping these handicraft skills alive, documenting, and recording them, is an important part of our cultural heritage. The above-mentioned project *HallTexFWF* with its reference to Iron Age dyeing techniques and contemporary applications also resulted in a specific outcome by one of the cooperation partners, Joseph Koó company in Austria, which applied for the traditional European

[6] http://canadiancor.com/top-10-global-challenges-defined-world-economic-forum/; http://107.22.164.43/millennium/challeng.html (accessed 10 March, 2019).

handicraft *Blaudruck* (blueprint) to be registered as international intangible cultural heritage by the UNESCO commission, which was then accepted in 2018[7].

Knowledge about ancient craft techniques and experimental archaeology (HURCOMBE 2004; 2008) concerning such techniques to reconstruct archaeological objects makes a link between academic research and the interests of today's society. Some examples go beyond purely keeping intangible heritage alive. One of today's trends today, which is an antidote to worldwide carelessness in the use of resources and pollution of the planet, is the Do-It-Yourself-movement (WOLF & MCQUITT 2011). DIY practitioners have a very creative aim in exploring artisanal techniques and crafting with their own hands. Some of them have a strong urge to employ "authentic" and "antique" techniques and to refer to "antique artefacts" and work with a deep history perspective. In those cases, the DIY practitioners rely on archaeological finds and are particularly interested in the reproduction of historic artefacts (see e.g. KEME project – Knitting in Early Modern Europe: MALCOLM-DAVIES 2018, 3–5). Such mechanisms have also been studied by the author concerning Iron Age textile design and technology with reflections gathered via the internet (GRÖMER 2017). The impact of academic publications with the technical details of tablet-woven bands from Austrian saltmines and their distinctive patterns have been followed via online activities on social media but also on picture posting websites such as Pinterest and Tumblr and personal websites. Thus, even the academic activity of publishing data about archaeological textiles can have a notable impact on contemporary society, culminating in diverse activities, most notably by people using published academic material for their own hobbies, reproducing and re-interpreting original material. This not only includes reenactors or other hobbyists with a specific interest in archaeology. People are also integrating such objects into their everyday life (e.g. reproduced tablet woven-bands from Hallstatt used as hair bands or handles for bags) and some are even becoming commercial concerns reproducing and selling of such artefacts as consumer goods.[8]

The expression of identity via garments and clothing has been a human concern since the Stone Age. Bridging contemporary discourse about dress and identity with historical perceptions of how people acted and reacted in various periods with their mechanisms, challenges and problems can put what are often emotional debates into a new perspective. As responsible archaeologists, we also have the duty to contribute to such "difficult" debates – e.g. wearing *hijab* in European countries for expression of certain identities (which is a quite political discussion). The author's own activities include a contribution to a project called "Young Scientist Ambassador", where scientists of different disciplines from universities and research institutions cooperate with schools, visiting them, talking about their research and its relevance for today's society. It is a dissemination project of academic research in primary and secondary schools led by the Austrian Ministry of Education (Bundesministerium Bildung, Wissenschaft und Forschung). The Young Scientist Ambassador activities of the author include

[7] https://ich.unesco.org/en/RL/blaudruck-modrotisk-kekfestes-modrotlac-resist-block-printing-and-indigo-dyeing-in-europe-01365; https://www.unesco.at/presse/artikel/article/immaterielles-kulturerbe-oesterreichische-blaudruck-tradition-international-gelistet/ (accessed 9 March 2019).

[8] Selling tablet woven bands after patterns from Hallstatt via Etsy.com: Artist AriaDiBari. https://www.etsy.com/de/listing/607924636/gewebte-karten-streifen-muster-hallstatt (accessed: 19 February 2019).

accepting invitations to speak in primary and secondary schools about the field of "Dress and Identity" and, in particular, from a deep history perspective. This stimulates discussion about the role of dress in identity building[9]. Using historical examples free debate about "sensitive" topics such as the use of certain garments and how they may connote something positive or negative in society. An example is the Roman habit of referring to themselves as *togati* – that is, the people wearing the toga (with a positive connotation) and calling the people living north of the Alps the *bracchati* – that is, *Germani,* those wearing trousers (with a negative connotation). In using a 2000 year old example about perspectives on garments as identity holder, one of the main aims and challenges is to integrate the experiences of pupils who have come to Austria as migrants or refugees from the Middle East, and to gain acceptance and understanding for their different dress codes.

Similar activities which aim to foster understanding between peoples with different dress codes and to strengthen integration experiences through handicraft skills with refugees have also been undertaken by the Centre for Textile Research in Copenhagen (MALCOLM-DAVIES & NOSCH 2018).

Archaeological textile research needs a strong commitment to public outreach and education, and this is not just to deliver what the public wants to hear. In a sensitive way, we can inspire people to think about such questions as identity, resource use and our heritage, among other things through the lens of deep history. With careful and critical evaluation of our primary source material and intelligent application of our interpretation of it, archaeological textile research may not provide all the answers but it is still is of relevance for contemporary society.

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[9] https://youngscience.at/de/nc/angebote/young-science-botschafter/suche/?tx_contact_contacts%5Bcontact%5D=31&tx_contact_contacts%5Baction%5D=show&tx_contact_contacts%5Bcontroller%5D=Contact&cHash=c705a9d18277804f539fcf6eb5903bec (accessed 6 March 2019).

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