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LATE BRONZE AGE OXHIDE AND OXHIDE-LIKE INGOTS FROM AREAS OTHER THAN THE MEDITERRANEAN: PROBLEMS AND CHALLENGES

Summary. *Oxhide ingots are probably one of the most remarkable metal artefacts that ever circulated throughout the Mediterranean during the second millennium BC. From the Levantine coast to Sardinia, oxhide ingots were produced, exchanged, used and transformed for almost six centuries (c.1600–1100/1000 BC). They are generally regarded as a class of material that is found only in the Mediterranean area. However, there are a number of oxhide ingots that have been encountered far beyond the coasts of the Mediterranean. The aim of this paper is to throw some light on these items and their significance in order to increase our understanding of the complex and far-reaching Bronze Age metal supply networks in Europe. The application of a commodity branding model also allows the possibility of achieving a deeper understanding of these items as tokens of the long-lasting links between Continental Europe and the Mediterranean.*

INTRODUCTION

Since the second half of the twentieth century, and in particular after the discovery and publication of the Cape Gelidonya and Uluburun shipwrecks (e.g. Bass 1967; 2013; Pulak 1998; 2008), Late Bronze Age (LBA)[1] oxhide ingots have received a good deal of academic attention. The two main reasons for this can be clearly singled out: first of all the remarkable intensification of discoveries in recent years, and secondly the advance in science-based methods for the analyses of metal finds. In particular, the successful application of lead isotope analysis (LIA) to determine the original copper ore used to produce any metal object containing copper has provided an impressive groundwork for understanding the provenance and characteristics of oxhide ingots (e.g. Gale 1991; 2006; 2011; Gale and Stos-Gale 2012; Stos-Gale *et al*. 1997). Because their distribution is mainly along the Mediterranean coast and immediately beyond

[1] The chronological framework is roughly the second half of the second millennium BC, which in the Mediterranean is generally considered the local LBA. This terminology will be used throughout the text; however, when necessary, European regional chronological terms will also be utilized.

Correction added on 19 January 2016, after Online and Print publication in January 2016: In the Acknowledgements, Helene Whittaker's full name was previously misspelled and this has been corrected in this current online version.

Figure 1
Distribution map of oxhide ingots showing the sites named in the text.

(Fig. 1), oxhide ingots have been the subject of discussions concerning exchange and trade patterns primarily within that region. The purpose here is to study the ingots in a wider context and examine finds that might be related to what we can call the oxhide ingot phenomenon, although they come from outside the Mediterranean area. The idea is to discuss objects that look like exceptions to the general pattern and the extent to which they actually are so. To avoid simplistic interpretations, the most controversial items analysed in this study are called oxhide-like ingots.

Recent LIA of metal objects from Scandinavia has revealed that metal sourcing in northern Europe consistently involved the Mediterranean area (Ling *et al*. 2014). The large local production of metal objects during the second half of the second millennium BC suggests that the

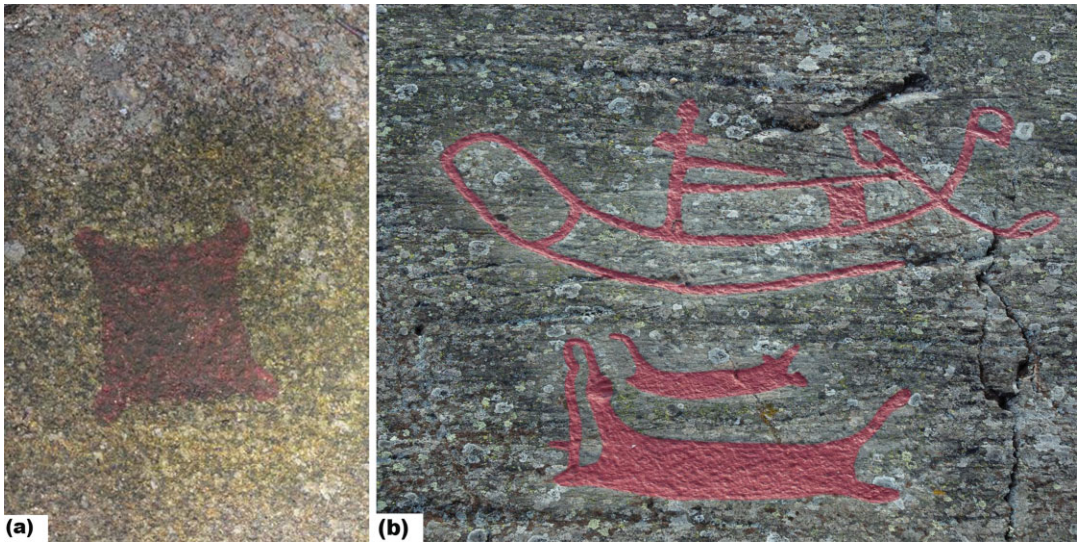

Figure 2
(a) The carved oxhide ingot from Kville 156:1, Torsbo, northern Bohuslän, Sweden (photo: A. Mederos). (b) The carved image from Östra Eneby 1:1, Norrköping, Östergötland, Sweden (photo: C. Bertilsson).

metal did not derive from a single import. Moreover, it must have been part of a web of mutual exchanges, the effects of which are not always easy to detect. From this perspective, the non-Mediterranean oxhide-like ingots are a very interesting phenomenon that has not yet been studied. The hypothesis laid out in this paper is that a better understanding of them will provide useful insights into the LBA metal exchange patterns throughout the European Continent. In order to do so, an attempt will be made to apply a commodity branding model for the interpretation of such items. Given the well-known high demand for metal in general and copper in particular in both the Mediterranean basin and Europe, the long-lasting circulation of particularly standardized objects such as oxhide ingots is regarded as evidence of an international market making use of branded commodities (Bevan 2010; Wengrow 2008; 2010). The brand itself guarantees, among other things, the quality, origin and necessary specialized labour behind the production of commodities. The existence of brands implies somehow the existence of competition, which can be expressed by the presence of similar products and/or of potential imitations. From this perspective, the very existence of non-Mediterranean oxhide ingots and their peculiar characteristics seems to support and at the same time gain significance through the commodity branding hypothesis.

OXHIDE INGOTS IN BRIEF: SHAPE, DISTRIBUTION AND CHRONOLOGY

As a brief introduction to the material, we can say that oxhide ingots consist mostly of copper and less frequently of tin. In shape they are generally rectangular with elongated corners and narrowed long sides (cf. Fig. 1). The similarity of such a peculiar shape to a stretched ox-hide has led to their conventional name (e.g. Bass 1967, 69; Kassianidou 2012, 12). Other designations are also used in the archaeological literature; particularly common is the term

Keftiubarren (e.g. Buchholz 1959; Primas and Pernicka 1998) where the word *Keftiu* is borrowed from Egyptian sources, in which it is used to refer to the land from which some ingots were brought (e.g. Cline 1994; Rehak 1998; Panagiotopoulos 2001; Wachsmann 1987).

It is now generally acknowledged that their shape was most likely determined by the need for ease of carriage (Jones 2007, 85, with previous bibliography). Copper oxhide ingots weigh approximately between 20 and 40 kg. The weight of the majority of them clusters around 30 kg, and this has led to the hypothesis that one ingot might have been the equivalent of a talent (e.g. Jones 2007, 84; Kassianidou 2012, 12; Muhly 2009, 18; Parise 1986, 308). Although much debated, the association between any such ingots and a talent weight unit appears possible if we take the practice of double counting into consideration (e.g. Parise 1968, 128; Zaccagnini 1986; Pulak 1988, 8). Quick loading and unloading procedures could have been carried out by counting each piece as a talent, while for the final transaction/payment actual weighing would have defined the effective weight and value of each ingot.

Early studies attempted to classify oxhide ingots, and in particular to correlate shape variations with chronology (Bass 1967; Buchholz 1959). The increase in archaeological evidence has, however, shown that different types/shapes are used contemporarily. Only the first of Buchholz' types, the handles of which are less protruding than those of his other types, appears to have an archaic character.

Oxhide ingots are archaeologically documented in several forms. First, there are the full-size ingots the majority of which were manufactured from very pure copper (e.g. Giumlia-Mair 2011) or less frequently from tin (e.g. Pulak 1998, 199–201). Ingots of this type have been found intact, in halves and quarters, and as fragments.[2] Second, we have miniature versions (e.g. Giumlia-Mair *et al*. 2011; Hadjisavvas 2011). Third, ingots are known from various types of figurative representations: a) paintings and reliefs from Egypt (Bass 1967; Wachsmann 1987); b) bronze stands, cultic statuettes and cylinder seals from Cyprus (Knapp 1986; Papasavvas 2009; 2011); c) Mycenaean ceramics from Cyprus and Linear B tablets from Knossos, Crete (Knapp 1986; Papasavvas 2009); d) rock art panels from Scandinavia (Ling and Stos-Gale 2015). It is this diverse evidence which suggests that complex narratives can be associated with this class of material (cf. Sabatini in press).

A vast literature is available on the distribution and chronology of oxhide ingots. Useful works including detailed catalogues of the known finds have been published over the years with accurate lists of previous references (e.g. Bass 1967; Buchholz 1959; Doncheva 2012; Gale 1991; Kassianidou 2009; 2012; Liard 2010; Lo Schiavo 2009a; 2013; Lo Schiavo *et al*. 2005; Jones 2007; Sabatini in press). The geographical spread of this class of material is impressive (Fig. 1). However, even more impressive is its durability over time. In fact, while the earliest evidence can be dated to the sixteenth century BC, the latest seems to belong to the end of the second millennium BC. A chronological analysis of the oxhide ingot distribution pattern (Sabatini in press) suggests that they might not have been in use contemporarily in every area in which they have been found. Rather, the networks through which they were distributed seem to have been sensitive to socio-political and economic changes, alternating moments of transformation and expansion. Their earliest occurrence appeared until recently to be limited to Crete and the eastern Mediterranean. However, newly discovered oxhide ingot images from

[2] The term 'fragmentary' may refer to halves, quarters and small parts of a complete oxhide ingot. It has been observed that while small fragments often appear to be connected with metalworking activities, quarters or halves are frequently related to cultic contexts (Caloi 2006).

Swedish rock art might also date to the sixteenth century BC (Ling and Stos-Gale 2015; Sabatini in press). This could indicate that oxhide ingots had a wide distribution from the very beginning. The moment of major expansion appears so far to have been between the fourteenth and the thirteenth centuries BC. It has been demonstrated through LIA that the copper used to produce ingots during this period came almost exclusively from Cyprus, and in particular from the Apliki ore, in the Solea mining district of the island (e.g. Gale 2006; 2011; Gale and Stos-Gale 2012; Stos-Gale 2011). The Cape Gelidonya shipwreck, which is generally dated to the end of the thirteenth or the beginning of the twelfth century BC (Bass 1967; 2013), remains the best evidence for the long-lasting value of oxhide ingots as a means of transporting copper in trading ventures. Towards the very end of the second millennium, oxhide ingots are more commonly found in the central and western than the eastern Mediterranean. They are particularly common in Sardinia (Lo Schiavo 2013; Lo Schiavo *et al*. 2009). However, evidence from Mesopotamia and Israel (e.g. Ben Yosef 2012; Jones 2007, 72, 425) suggests that they continued to circulate in the eastern Mediterranean as well.

NON-MEDITERRANEAN EVIDENCE FOR OXHIDE INGOTS

The non-Mediterranean oxhide ingots examined in this article come from a number of European countries. They include full-size ingots and fragments, miniature ingots, and images carved on rock. The material will be presented by geographical provenance, from the northernmost examples to those found in the neighbourhood of the Mediterranean and the Black Sea.

Northern Europe

Recent and intriguing discoveries on rock art panels from Sweden open up new areas of research as regards the metal trade and networking patterns.[3] The representation of a Buchholz type 1 oxhide ingot (Fig. 2a) has been detected on the rock panel Kville 156:1, at Torsbo in northern Bohuslän, western Sweden. Dating rock art is not uncomplicated, but the representation of the ingot may be contemporary with the carved boats dating to the sixteenth century BC, in the vicinity of which it was identified (Ling and Rowlands 2013; Ling and Stos-Gale 2015). Another conceivable representation appears 'on board' a peculiar ship (Fig. 2b) carved on a panel from Östra Eneby 1:1 (Ling and Stos-Gale 2015). This representation is particularly interesting because the ship on which the probable oxhide ingot is depicted does not appear to be of Scandinavian type. It has what looks like a stern-mounted steering oar, a device that is uncommon in Swedish rock art (e.g. Kaul 1998; Ling 2014) but which is found in Mediterranean boat representations (e.g. Wachsmann 1998; 2013).

Other possible representations of oxhide ingots on Swedish rock art panels have also been proposed (Ling and Stos-Gale 2015), although the interpretation of some of them probably

[3] Collaboration between scholars dealing with European and Mediterranean archaeology has increased over the last few years (e.g. Alberti and Sabatini 2012; Maran and Stockhammer 2012; Wilkinson *et al*. 2011). An illuminating example of the potential achievements of such collaboration is the outcome of the interdisciplinary conference 'Italy, Mediterranean and Europe in the Bronze Age – Göteborg, 26–27 April 2013'. Thanks to the various areas of expertise, during the conference excursion the Kville 156:1 oxhide ingot (Ling and Rowlands 2013; Ling and Stos-Gale 2015; Sabatini in press) was recognized as such!

deserves further discussion. All the possible oxhide ingot images detected on rock panels so far are dated within the same chronological timespan as the oxhide ingots found in the Mediterranean area (1600–1100 BC).

We cannot assume that these depictions indicate a direct acquaintance with the oxhide ingot-related networks in the Mediterranean, but conversely we cannot deny that they might. In particular, the combination of a ship of foreign appearance with an oxhide-like image at Östra Eneby 1:1 suggests a twofold form of acquaintance with the Mediterranean, with remote seafaring techniques and with the oxhide ingot phenomenon. In southern Scandinavian, and in particular in present-day Denmark, we can see from *c*.1600 BC an increase not only in the use and production of metal objects, but also in contacts with the rest of the Continent (e.g. Giumlia-Mair 2013; Kristiansen 1998; Vandkilde 1996; 2010). Recent studies of the copper provenance of bronze objects found in Scandinavia (Ling *et al*. 2014) suggest that the copper supply networks during the second millennium BC were complex. Such networks appear to stretch all over the Continent, connecting in various ways the Mediterranean and Continental Europe (see also Rowlands and Ling 2013). In this respect, there is a significant chronological correlation between the Kville 156:1 representation of an oxhide ingot in Swedish rock art and the presence of Cypriot copper in Scandinavian artefacts from the sixteenth century BC (Ling *et al*. 2014).

Germany

Four relatively large fragments of oxhide ingots made of Cypriot copper, which were found in a hoard at Oberwilflingen in Baden-Wüttenberg, Germany, have been the subject of much discussion with regard to their significance as evidence for the connection between local social and economic changes and large-scale metal circulation (Primas 1997; Primas and Pernicka 1998). The hoard contained other metal objects and has been dated to the end of the fourteenth or the beginning of the thirteenth century BC (Primas 1997; Primas and Pernicka 1998). The recent discoveries from Sweden and the presence of these ingot fragments provide the basis for discussion as to whether oxhide ingots were transported beyond the Mediterranean on single occasions and perhaps accidentally, or on a more regular basis. I have argued elsewhere that the copper market embodied by the circulation of oxhide ingots might have been in need of continuous expansion (Sabatini in press). Convincing arguments that the production and consumption of various types of commodities in the Mediterranean during the second millennium BC caused the structural need for expansion can be found in earlier research (Sherratt and Sherratt 1991). In addition, during the LBA, and in particular after the fourteenth century BC, so-called secondary powers, such as Cyprus, from where most of the copper used to produce oxhide ingots seems to have come, become more prominent in the Mediterranean economy. They also seem to be trying to create their own sphere of economic expansion (e.g. Papadimitriou and Kriga 2013). The demand for metal in Europe was high (e.g. Kristiansen 1998; Pydyn 1999; Rowlands and Ling 2013; Vandkilde 2007). Although other types of ingots such as the so-called bun ingots appear more commonly all over Europe (e.g. Doncheva 2012; Hansen *et al*. 2012; Pare 2013), the fragments of oxhide ingots from Germany, as much as the Swedish rock art images, seem to prove that the main Mediterranean copper production/circulation networks were not ignoring the need for metal in Continental Europe.

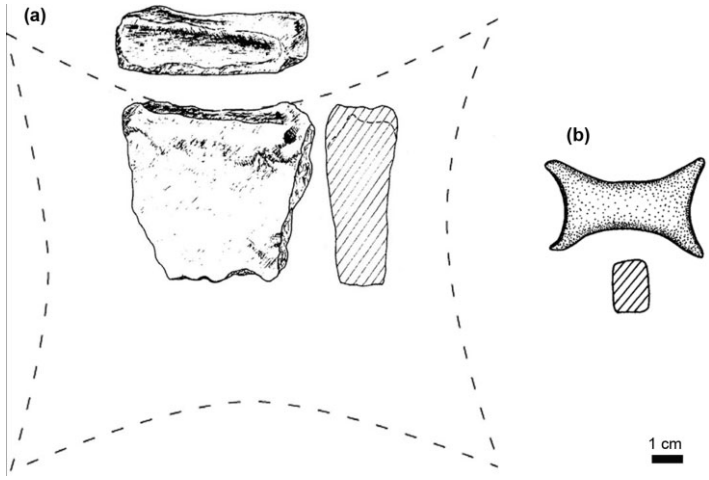

Figure 3
(a) Reconstruction of the oxhide-like ingot from Pălatca, Transylvania, Romania (from Rotea *et al*. 2011, pl. VI.7). (b) A miniature oxhide-like ingot from Cluj-Mănăstur, Transylvania, Romania (from Wittenberger 2008, pl. 12.2).

Romania

Oxhide-like ingots have been found in the heart of the Carpathian Basin. A relatively large ingot fragment was found at the site of Pălatca (Fig. 3a), Cluj county, in Transylvania, Romania (Rotea *et al*. 2011, pl. VI.7; Schuster 2005; Wittenberger 2008). It has been dated to the Bronze Age D (BzD)/Hallstatt (Ha) A or in terms of absolute chronology between the thirteenth and the mid-eleventh centuries BC (cf. Ciugudean 2010, fig. 4). It was found together with other artefacts in what has been interpreted as a bronze workshop (Rotea *et al*. 2011, 11). A sample from the ingot has recently been analysed using the AAS method and the piece has been shown to have a rather atypical composition (Giumlia-Mair 2011). It consists of *c*.92 per cent copper and has a relatively high percentage of arsenic (3.39 per cent). The peculiar composition of this ingot is unknown among Mediterranean oxhide ingots, but it has some affinity with the metallographic conformation of the Bronze Age (BA) central European so-called pick ingots and with a specific class of high-status female ornaments, the so-called wheel-pendants (Giumlia-Mair 2011). Both types of artefacts are commonly made of copper with a high quantity of arsenic which produces their characteristic silver colour. No LIA has been done on the piece.[4] The Pălatca oxhide-like ingot is the first example of its kind for two reasons. It is the first oxhide-like ingot made of this particular combination of copper and arsenic, and it constitutes the first evidence for the use of this metal alloy in BA Transylvania (Giumlia-Mair 2011).

At least six miniature oxhide-like ingots are also known from Transylvania, Romania (Wittenberger 2008, pl. 12; Schuster 2005) (Fig. 3b). They were found in a hoard from Cluj-Mănăstur, Cluj county, and have been dated to Ha A1, thus within the twelfth century BC. To my

[4] As Hauptmann *et al*. (2002) demonstrated, the composition of the Uluburun oxhide ingots is not always extremely pure; rather, there are several pieces that have a copper content of between 90 and 97%. According to the same authors, the Caucasian copper ore may contain extremely high natural quantities of arsenic.

knowledge, these pieces have not been subjected to any metallurgical analyses. It would be of the utmost interest to investigate the origin of their copper. Given their chronology and their shape, it is here proposed that we should not reject the possibility that there was some sort of link between these items and the Mediterranean copper trade. With regard to shape, these miniatures, as much as the ingot from Pălatca, do not have any parallels among Transylvanian metal artefacts.

Some metal fragments from the hoard of Cugir I, Alba county, also from Transylvania, which have been published as bronze ingots, appear worth another look, to judge from the photograph in the publication (Ciugudean and Aldea 2005, fig. 14). The hoard has been dated to the Ha A period (between the mid-twelfth and the mid-eleventh centuries BC; see Ciugudean 2010). In addition to the ingot fragments, it contained 24 gold rings, which might also constitute important evidence for trade and metal circulation in the region. According to Horia Ciugudean (2010), the weights of the gold items from the hoard fall within three groups: one weighing between 3.15 and 3.43 g, a second between 5.9 and 6.8 g and a third between 12.77 and 13.47 g. Despite the rather consistent variation within each group, it is quite clear that there is a relationship of 1:2:4 between the three groups which, as it has been noted (Ciugudean 2010), cannot be casual and suggests that they might have been weight units.[5]

Another possible oxhide-like miniature ingot, weighing 157 g (Carol Kacsó, pers. comm., March 2014), has been reported from the hoard of Bicaz II, Maramures county, also in Transylvania (Kacsó 2004, 57).

Hungary

Five miniature oxhide-like ingots have been found at different sites in the Hungarian Plain. They have been considered as a manifestation of a connection with the Mediterranean world (Ilon 1992). However, their scattered presence, variation in shape and limited number make them somewhat problematic in this regard. One example, from the Birján hoard, appears to be a 'genuine' oxhide ingot (Fig. 4) (Moszolics 1985, pl. 62.6). It is dated to the local Kurd Horizon, which corresponds approximately to Hallstatt A1, i.e. the twelfth century BC (Ciugudean 2010, fig. 4). Another item comes from the Szentgáloskér hoard (Moszolics 1985, pl. 114.1) and is dated to the eleventh century BC (Ilon 1992, 253), while the pieces from the Beremend and Lovasberény hoards (Moszolics 1985, pls. 245.10, 252.1) seem to belong to the Gyermely horizon, corresponding approximately to Ha A2 and thus to the twelfth–eleventh century BC (Ciugudean 2010, fig. 4; Schuster 2005). A sandstone mould apparently for a miniature oxhide-like ingot was found at the site of Gór-Kápolnadomb (Ilon 1992, fig. 6.2). The mould comes from a pit, the function of which is not clear, which also contained various types

[5] As far as the higher value is concerned several links can be drawn. A hemisphere from the Tătărăni hoard, which has been considered a weight (Turk 2001, 253), measures 131.7 g which is almost exactly ten times the Cugir I higher value. The latter is also close (Rahmstorf 2010, 99) to weight no. 1 (13.73 g) from Steinfurth (Hesse, Germany) dated to the BzD or to the thirteenth century BC. In addition, it has been proposed (Malmer 1999) that 26.6 g (or almost double the 13.47 g from Cugir I) was the average standard for a few Scandinavian items interpreted as BA weights. Some years ago, Renato Peroni (1998) proposed the existence of a European BA weight unit around 26 g. In support of this is the evidence from the Kanalski Vrh I hoard, Slovenia (Turk 2001), where a group of wheel-shaped pendants with eight spokes and an internal circle was found. Their weights cluster around 27 g, thus also almost exactly twice the 13.47 g from Cugir I.

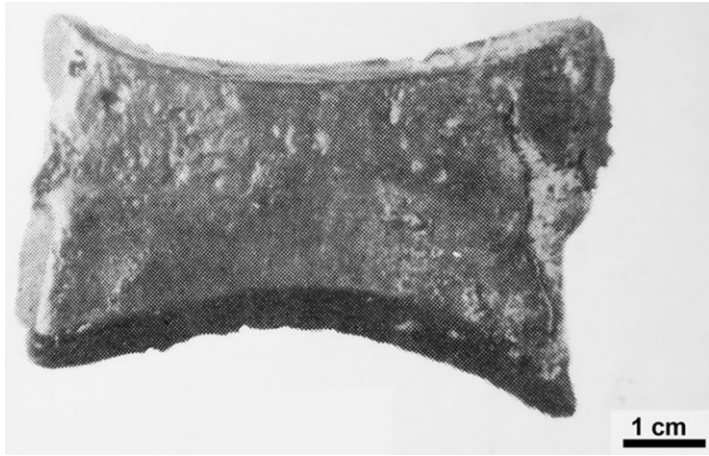

Figure 4
The oxhide-like miniature ingot from the Birján hoard, Baranya county, Hungary (from Moszolics 1985, pl. 62.6).

of material and human remains. The chronologically diagnostic material from the pit dates the whole context to the Hallstatt B2 period and so do the carbon dates from the same context, which point to 1032–928 BC.

None of the items from Hungary has yet been thoroughly studied or chemically analysed. The question of whether they are 'authentic' oxhide ingots or imitations of Mediterranean ones, or belong to a different system, is a problematic and interesting issue worth further investigation. The fact that the miniature ingots from Hungary have been considered as possible weights should also be taken into account. According to Pare (1999, 494, table 10), the weights of these items can easily be converted into the units used in the eastern Mediterranean world, in which case they provide evidence of connections between the two areas. Two of the Hungarian oxhide-like ingots weigh 158 g which is almost exactly 12 times 13.16 g; while another is 211 g, which is almost exactly 16 times 13.15 g. In other words, they seem to represent multiples of the aforementioned weight units found in the Cugir I hoard from Romania.[6] A recent analysis of the miniature oxhide ingots from Cyprus (Giumlia-Mair *et al*. 2011) has come to the opposite conclusion: that they should not be considered as weights. The issue is therefore open to debate, although the limited number of available objects might represent a considerable obstacle to a full understanding of the question.

Croatia

Two miniature oxhide ingots come from Croatia. One of them is probably from an area close to the Mediterranean Sea; however, as its exact provenance is not completely certain, it has been considered appropriate to present it here. It is a miniature oxhide ingot, which was probably found in a hoard, somewhere close to Makarska in Croatia. Its provenance, although likely, has

[6] In this respect, it is interesting that the possible miniature oxhide-like ingot from the Bicaz II hoard, Romania, weighs 157 g (Carol Kacsó, pers. comm., March 2014).

been a matter of debate over the years (Sherratt 2012; Vagnetti 1971). If the composition of the hoard, currently in the Ashmolean Museum in Oxford, could be confirmed, it would most likely be dated to the thirteenth–twelfth century BC (Sherratt 2012). A second miniature ingot comes from a hoard discovered at Kloštar Ivanić, in north-eastern Croatia, which is dated to the Hallstatt A2 period or to the twelfth–eleventh century BC (Forenbaher 1995).

Bulgaria

A remarkable number of oxhide or oxhide-like ingots have been found in present-day Bulgaria. Regrettably none can be precisely dated. Nevertheless, the geographical position of their find-spots represents significant evidence for the complexity of the metal-production/consumption networks that existed beyond the Mediterranean area. At least one, from Čerkovo (Burgas province), is a real oxhide ingot, which is like the Mediterranean examples made of Cypriot copper (Stos-Gale *et al*. 1997, table 6).

Interestingly enough, since they all come from places that lie far from the sea,[7] they demonstrate the importance of inland interaction systems at least as far as the Balkan Peninsula is concerned. They were found in various river valleys that must have played a key role in the local communication systems. Consequently, they are also of relevance to the debate about contacts between the Aegean and the Black Sea (e.g. Doncheva 2012) and seem to provide support for the hypothesis (Kolb 2004, 592–3) according to which it might actually have been more profitable to use the land routes offered by the south-eastern part of the Balkan Peninsula than to sail through the Bosphorus and the Dardanelles to reach the Black Sea.

Besides the fragment from Čerkovo, mentioned above, full-size oxhide or oxhide-like ingots or fragments of them have been found at Kirilovo and Černozem, both in Yambol province. The LIA of the ingot from Černozem suggests a Cypriot origin for its copper.[8]

A miniature oxhide ingot has been recovered at Yabalkovo, Haskovo province (Doncheva 2012, 692–5; Leshtakov 2007, 451).[9] A couple of oxhide ingots have also been reported from Kamenovo, Razgrad province, another inland site, this time from the north-eastern area of Bulgaria, not far from the Danube Basin. The two ingots from Kamenovo are associated with material known as belonging to the so-called Pobit Kamak hoard (Doncheva 2012, 694–5); however, their archaeological context is uncertain. From the point of view of shape and weight they seem 'authentic' oxhide ingots (Doncheva 2012, fig. 13a–d), and despite consisting of *c*.8 per cent iron and only *c*.91 per cent copper (Rusev *et al*. 2006), they are rather unique pieces. Unfortunately no LIA are available for these pieces.

[7] There is one ingot, found underwater at Cape Kaliakra, near Sozopol, which has an odd oxhide-like shape and an unconventional weight and content. Recent studies of the item suggested a chronology for it of AD 1300–1450 (Doncheva 2012, 683); it has thus been excluded from this work.

[8] The LIA (Lichardus *et al*. 2002, 173–6) of this item were carried out with techniques and apparatus which allow a relatively high error (1%); nevertheless, the original interpretation of the metal as belonging to the Cypriot field still appears valid (Zofia Stos-Gale and Alessandra Giumlia-Mair, pers. comm., March 2014).

[9] According to Leshtakov (2007, 451, n. 31), the composition of this miniature piece is as follows: Cu 92.53%, Sn 4.11%, As 1.22%, Zn 0.75%, Pb 1.26%, Ag 0.13%. It therefore has a very high level of tin, noticeably diverging from the purity (*c*.99% Cu) of the Cypriot miniature ingots from Enkomi (Giumlia-Mair *et al*. 2011, table 2.1).

DISCUSSION

The earliest known oxhide ingots have been found on Crete. Most of them come from so-called non-utilitarian deposits (e.g. Liard 2010; Soles 2004). These same earliest items represent a riddle since they are the only ingots whose original copper ore has not yet been identified (Stos-Gale 2011). Zofia Stos-Gale has suggested that the metal and the idea behind this successful shape might have had their origin in the Mitanni kingdom (ibid.). However, Egyptian paintings from the Theban tomb of Rekhmire (cf. Wachsmann 1987, 50) show that Aegean people (perhaps from Crete?) were involved in the early distribution of oxhide ingots. Although neither archaeology nor scientific methods like LIA have yet provided other evidence for this, the Egyptian figurative records offer some indication that Aegeans might have been involved in the circulation if not manufacture of oxhide ingots at an early stage.

Some time in the fourteenth century BC, Cyprus appears to take control of the production of oxhide ingots (Kassianidou 2012; Sabatini in press). Practically all the known oxhide ingots since then so far appear to have been produced with Cypriot copper (Gale 2011). It has therefore been argued that their peculiar shape, besides its original, practical purposes, with time also came to fulfil an economic necessity. According to Wengrow (2008), standardized packaging together with the spread of sealing practices played a major role in the development of early economies, which made use of commodity branding in order to qualify and protect their specific productions. It is believed that a commodity branding model (Wengrow 2008; 2010) is particularly suitable for the interpretation of oxhide ingots (Bevan 2010; Sabatini in press). Oxhide ingots from at least as early as the fourteenth century appear very much to embody the basic characteristics of a branded commodity. Given the relative homogeneity of the material as far as shape and content are concerned, it seems possible to propose that they provided receiving markets with a guarantee of the origin and the purity of the copper of which they were made (Bevan 2010; Sabatini in press).

During the thirteenth century BC, Sardinia, in the centre of the Mediterranean, appears to gain importance as a centre for the distribution and consumption of oxhide ingots (e.g. D'Oriano 2013; Lo Schiavo 2013). The substantial number of oxhide ingots on the island during the twelfth and the eleventh centuries BC has led to the hypothesis that an oddly manufactured oxhide ingot from Sète in southern France (Lo Schiavo 2009b) might have been Sardinian. If future LIA could confirm this, we would have evidence for a new, but probably short-lived attempt to take over the oxhide ingot brand for the production and circulation of copper.

Given this roughly sketched picture, how should we interpret the geographically and chronologically scattered evidence from Continental Europe?

Carved images on rock art panels from Sweden suggest that possibly by the sixteenth century BC oxhide ingots were already known in Scandinavia. The chronology of these images would seem to be corroborated by recent LIA of metal artefacts, which demonstrate that Cypriot copper was available in Scandinavia at this time (Ling *et al*. 2014). A couple of centuries later, around the transition between the fourteenth and the thirteenth centuries BC, we find fragments of oxhide ingots made of Cypriot copper in central Germany, not far from the northern bank of the Danube. We can hypothesize that they could have reached this location by either overland or river routes.

It is here suggested that intriguing finds from Transylvania, dating to some time between the thirteenth and the eleventh centuries BC, might also be evidence of acquaintance with the

Mediterranean phenomenon.[10] The shape of the oxhide-like ingots stands out among the abundant metal finds from Transylvania and remains a unique expression. However, the metallographic composition of the only item that has been analysed so far appears very different from that of the 'authentic' oxhide ingots from the Mediterranean.

A few contemporary miniature artefacts from the Hungarian Plain, again not far from the Danube corridor, reproduce an oxhide-like shape. There are no analyses available for these items either. A study of their weights seems to suggest that there was a common weighing system in use in the areas of Romania and Hungary where oxhide-like ingots have been found. The weight units that emerge appear to be consistent with the proposal of the existence of a European BA unit clustering around *c*.26 g and its submultiples, which would be exchangeable with eastern Mediterranean units (Malmer 1999; Peroni 1998; Pare 1999; see also Rahmstorf 2010).

At least two 'authentic' oxhide ingots have been found in Bulgaria. A number of oxhide-like pieces worth further investigation come from the south-eastern area of the country, from river valleys linking that part of the Balkan Peninsula with the Mediterranean shore in northern Greece. A couple of ingots have been found in north-eastern Bulgaria, relatively close to the Danube River. It is very unfortunate that none of the Bulgarian finds can be chronologically contextualized with precision; however, their geographical position hints at the existence of various communication routes in the area.

All in all, the evidence is multifarious and deserves more detailed study. In particular, scientific analysis of the ingots and of the objects found with them could probably add a fundamental thread to the pattern that has been woven so far. What appears striking is not only the chronological coincidence, when available, of the objects discussed above, but also their distinctive and unique shape. One might argue that the shape in itself is not so complicated as to exclude the possibility that it could appear independently in different places over the same period of time. However, the fact that they are so strictly related to metal consumption (when information is available the finds come from hoards and metal workshops) and communication (find-spots close to the Danube or in strategic river valleys as in the case of the Bulgarian finds, and on Nordic rock art) invites us not to exclude any connection between the Continental evidence and the oxhide ingot phenomenon in the Mediterranean. It seems actually possible to propose that they represent a local imitation of something not unknown, rather than a completely different, but contemporary, phenomenon which happened to use a similar shape. As briefly discussed by Andrew Bevan (2010, 42), imitation is one of the aspects of the brand system and should be interpreted as evidence for a successful branding practice. Branded commodities are the outcome of complex economic systems, responding to exigencies of quality and quantity control as much as of skilled labour and origin certification (Sherratt 1999; Wengrow 2010). Their very existence implies market demand and thus potential room for more than one actor to participate in the market system. The 'power' of the oxhide ingot shape, strengthened by its standardized reproduction over *c*.600 years, must have had a significant effect on the minds of those who were involved in the large-scale production and circulation of copper. Taking into consideration the complexity of the LBA copper production, circulation and consumption all

[10] A recent study (Stos-Gale 2014) of the silver finds from the Mycenaean shaft graves shows that a considerable amount of the silver was coming from Transylvanian ores. The Mycenaean material in question dates mostly to the sixteenth century BC and thus earlier than any of the finds discussed here. Nevertheless, the data prove the existence of exchanges between the Aegean and the Carpathians involving the supply of metal, which originated in the middle of the second millennium BC.

over the Mediterranean and Europe and applying the commodity branding model as an interpretive tool, the oxide ingots can be seen as part of a strategy to guarantee specific economies (such as fourteenth and thirteenth century Cyprus) consistent slices of the market. From this perspective, the appearance of scattered 'replicas' of a winning branded object in different territories gains an intriguing status. Their intrinsic characteristics and links with various forms of exchange practices throughout Europe strongly suggest that non-Mediterranean oxhide and oxhide-like ingots represent attempts to enter specific markets or to access larger circulation networks by making use of the communicative power of a well-known branded commodity.

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