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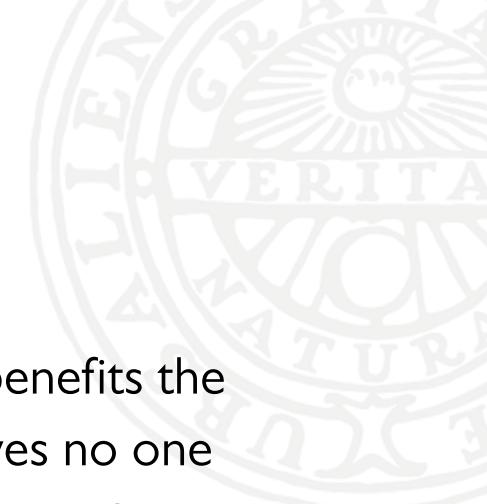
FAIR data for Heritage Science:

Developing a guide to good practice for open science within the
heritage sciences

Barbro Bornsäter
Scholarly Communication Division
University Library

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Open Science and FAIR data



“To ensure that science truly benefits the people and the planet and leaves no one behind, there is need to transform the entire scientific process.

Open Science is a movement aiming to make science more open, accessible, efficient, democratic, and transparent.”

https://en.unesco.org/sites/default/files/open_science_brochure_en.pdf



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Open and FAIR

EU Open Data Directive (EU) 2019/1024

(27) The volume of research data generated is growing exponentially and has potential for re-use beyond the scientific community. In order to be able to address mounting societal challenges efficiently and in a holistic manner, it has become crucial and urgent to be able to access, blend and re-use data from different sources, as well as across sectors and disciplines.

(...) and to support the dissemination of research data that are **findable, accessible, interoperable and re-usable (the FAIR principle)**

Vetenskapsrådet

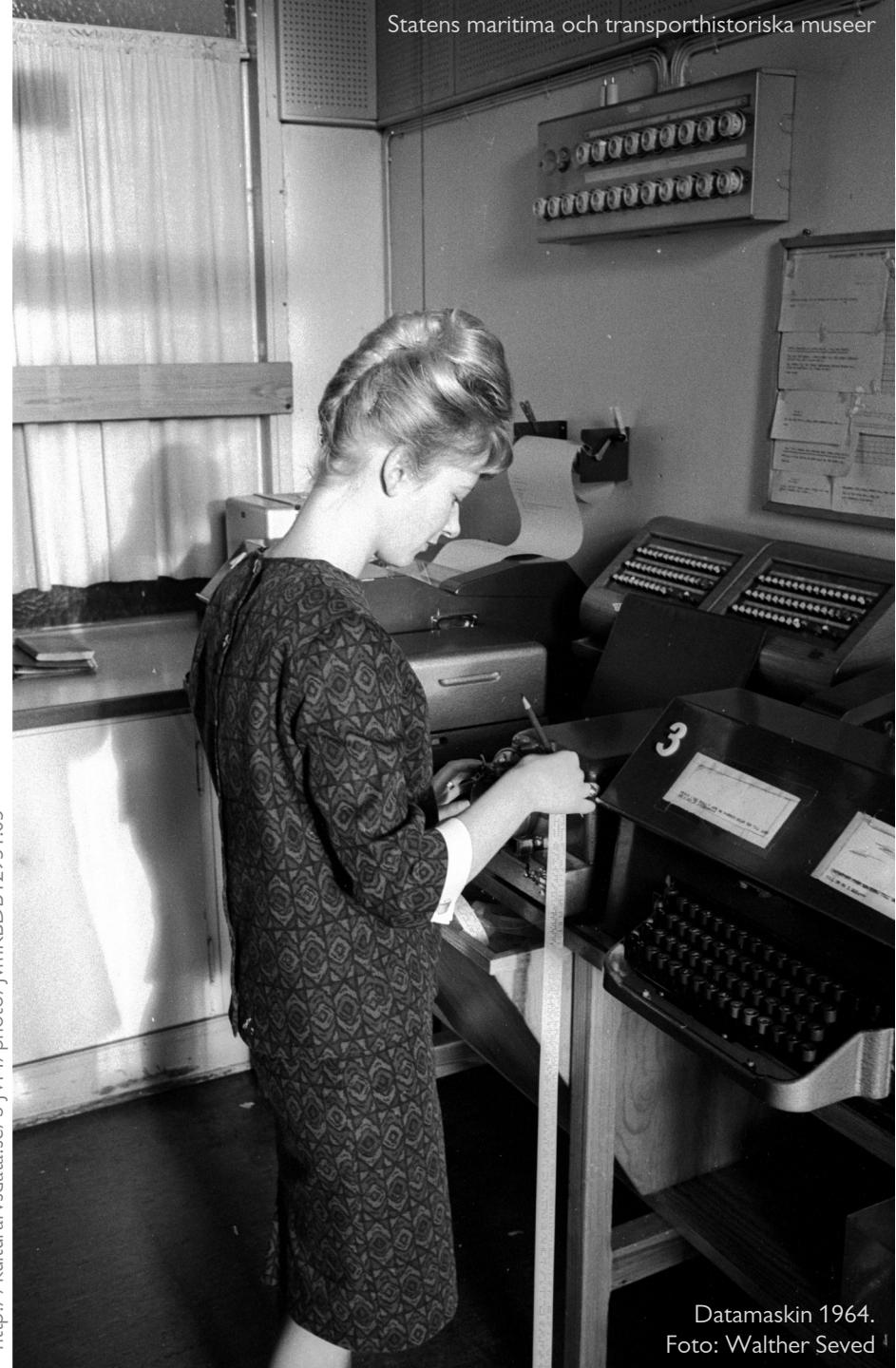
"De forskningsdata som finansieras av offentliga medel, och som enligt gällande lagstiftning får tillgängliggöras, publiceras öppet tillgängliga på internet inom skälig tid efter att forskningsresultaten har publicerats."

"Vetenskapsrådet rekommenderar att de forskningsdata som framställs genom forskning hanteras i enlighet med **FAIR-principerna**."

Implementering ska vara genomförd 2026

VR Rekommendationer forskningsdata

(Prop. 2020/21:60, s 101)



<http://kulturarvsdata.se/SjVM/photo/jvmKBDB12931:03>

FAIR data principles

How to make data *machine readable*, so that it becomes *useful for people*

Findable 

I want to **find** data/documents/images etc

Accessible 

I want to access and **download** the information

Interoperable 

I want to **combine** data from different sources

RReusable 

I want to know how I can **reuse and publish** what I found



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The Project: FAIR Data for Heritage Science



<http://kulturarvsdata.se/bhm/object/UM000333>

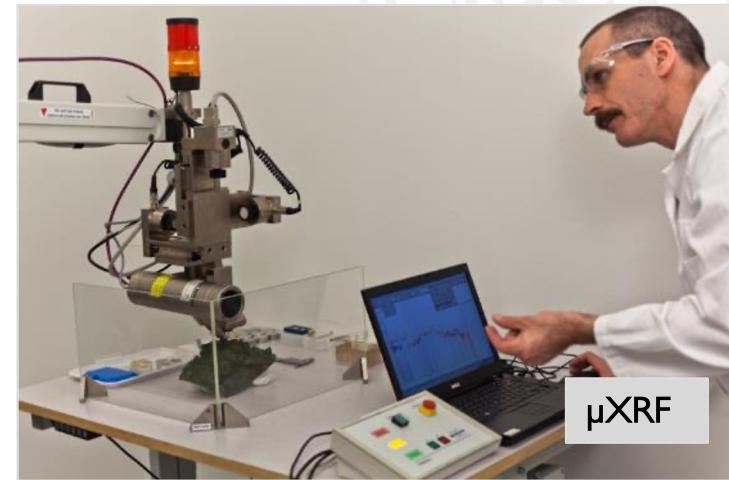


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Heritage Laboratory at the National Heritage Board

Museums, heritage institutions, universities etc can apply to use expertise and technology available at the **Laboratory free of charge**



Projects must meet certain criteria and the results must be made **open** to the public after completion



From Open Access to Open Science – a journey



2020

Reports published online

Internal server for data storage –
available on request

Varied data practices, documentation
within the Laboratory

Mindset:

- Why should I spend time on this?
- Where do I start?



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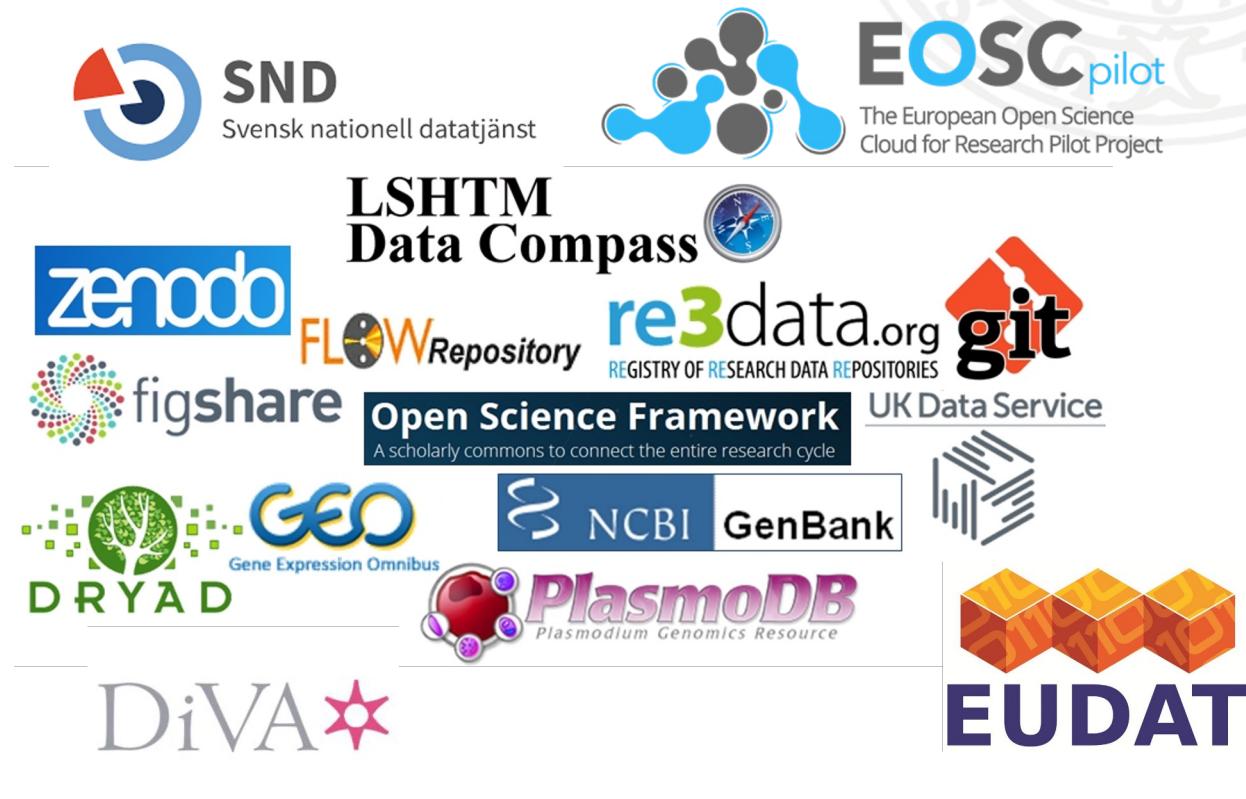
Preliminary study 2020-2021: platforms and solutions

Requirements for

- Laboratory staff
- Collaborators
- Heritage Science Sweden network
- Swedish National Heritage Board

FAIR data principles compliance

Good user interface for uploading and accessing data



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Findable and Accessible Research Data

zenodo

Search Upload Communities

June 23, 2021 Dataset Open Access

Fracturing and coloring of cremated bones from a Neolithic mortuary house at Bollbacken, Sweden

Larsson, Åsa Maria

Thesis supervisor(s)
Kaliff, Anders

Spreadsheet containing analysis of types of fractures and coloring of cremated human and animal bones found in a mortuary house at the site Bollbacken, Västmanland, Sweden. The site belonged to the Pitted Ware culture and was dated to ca 2600-2300 BCE. The analysis was done as part of a PhD project studying cremation practices in 3rd millennium BCE Sweden, particularly evidence of whether the dead had been cremated shortly after death, or when they were de-fleshed.

Preview

Site	Site ID	Parish	County	Feature ID	Find ID	X	Y	No	Species	Anato Reg
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Canis familiaris	Extr
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Canis familiaris	Extr
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Canis familiaris	Pedis
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Homo sapiens	Upper
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Homo sapiens	Manus
Bollbacken	L2002:2423	Tortuna	Västmanland	95	643	020	667,5	1	Homo sapiens	Cranii

Files (93.3 kB)

Cite as

Larsson, Åsa Maria. (2021). Fracturing and coloring of cremated bones from a Neolithic mortuary house at Bollbacken, Sweden [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.5018689>

Authority for the upload

Metadata (free text)

Metadata with link (authorities)

Related publication

ORCID: Authority for me

OpenAIRE

Publication date: June 23, 2021

DOI: DOI [10.5281/zenodo.5018689](https://doi.org/10.5281/zenodo.5018689)

Keyword(s): Osteology, Archaeology, cremations, Sweden, Neolithic, Pitted Ware culture

Subject(s): osteology, archaeology, cremations, European neolithic, Middle Neolithic, Sweden, Västmanland, Tortuna parish, L2002:2423, SHM 34553

Awarding University: Uppsala University

Related identifiers: Documented by <http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-107370> (Thesis)



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Problem solved...?

Finding a *technical* solution is not enough.
Questions remained:

- Which data to share?
- How to prepare data?
- How to describe data?

Data management templates were too **general** to offer practical, discipline specific guidance

Compilations of controlled vocabularies were **too extensive** - difficult to know which were “best”

Too little information, and too much information

They needed something that was *just right*



2022: Research and Development Project

- Investigate how to implement FAIR principles in everyday practices in a heritage laboratory
- Identify the most relevant vocabularies for metadata for the Heritage Science.
- Curate a list with pre-selected options for common metadata/authorities.
- Guidance to good practice for research data management, relevant to the Heritage Laboratory.
- Extra help needed! Research data advisor was brought in for the project.



Sjöhistoriska museet

http://kulturarvsdata.se/smm-sm/photo/Fo179059_11DIG



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Research and Development Project



Desired effects:

- The Heritage Laboratory's operations will be more discoverable
- It will be easier to reuse and to keep building on the knowledge
- Support and inspiration to others (i.e. Heritage Science Sweden, IPERION HS)
- Long term: Easier to find analysis and research on cultural historical objects, buildings and sites



Marei Hacke at World Cultures Museum analysing khipus from Peru.
Photo: Beatrice Törnros



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Implementation

- In close collaboration with the lab team
- Initial meetings one on one to get a case to work with
- Use the cases throughout the process of gathering information, and searching for relevant vocabularies
 - 18th century furniture
 - 20th century paintings
 - Medieval silver coins
 - Viking Age shield
 - Pre-columbian textiles from South America
 - Tests on modern exhibition materials



Marei Hacke showing Barbro Bornsäter the laboratory.
Photo: Åsa M Larsson



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Implementation

- Follow up with the lab team to show what we found
- Workshops with everyone to go through their case and how we worked with it
- Zenodo workshop towards the end of the project

The screenshot shows the Zenodo website interface with a blue header bar. The header includes the Zenodo logo, a search bar, a magnifying glass icon, an 'Upload' button, a 'Communities' button, and two buttons for 'Log in' and 'Sign up'. Below the header, the title 'Heritage Laboratory' is displayed. A green button labeled 'New upload' is visible. The main content area shows three recent uploads:

- XRF maps of Paracas textiles and threads**
June 21, 2021 (v1) Dataset Open Access
XRF dataset used in two publications: Javér, A., M. Hacke, C. Thays Delgado, and K. Thuresson. 2017. Paracas textiles – Colour and condition. Investigation of the mordants and state of degradation of the Paracas textile collections in Peru and Sweden. In ICOM-CC 18t
Uploaded on June 21, 2021
- Undersökningar av Paracastextilier. Dokumentation av gästkollegeprojekt**
February 13, 2018 (v1) Dataset Open Access
Summary of data and analyses reports that form the background to the publication: Javér, A., M. Hacke, C. Thays Delgado, and K. Thuresson. 2017. Paracas textiles – Colour and condition. Investigation of the mordants and state of degradation of the Paracas textile collections in P
Uploaded on June 21, 2021
- Paracas textiles – Colour and condition. Investigation of the mordants and state of degradation of the Paracas textile collections in Peru and Sweden**
September 4, 2017 (v1) Conference paper Open Access
Javér, Anna; Hacke, Marei; Thays Delgado, Carmen; Thuresson, Kaj;
ABSTRACT During the course of the repatriation of a collection of Paracas textiles from Sweden to Peru, an investigation of the textiles' physical conditions and a study of their colourant auxiliaries were undertaken. Conservators from the National Museums of World Cul
Uploaded on June 21, 2021

On the right side of the page, there is a sidebar with the following information:

- Heritage Laboratory**
The Heritage Laboratory of the Swedish National Heritage Board is a central facility for the development and application of heritage science, including conservation science, archaeometry and art historical research.
- As a national laboratory resource we foster implementation of best practice and collaboration on a national and international level. We use experimental and analytical techniques to examine, document and identify materials and to study their ageing and working properties. Our investigations may extend from minute fragments of objects or single materials to entire collections, buildings, sites and landscapes.**
- [Read more](#)
- Curated by:**
Heritage_Laboratory
- Curation policy:**
We accept articles and data deposits from members of the Heritage Laboratory and our guest colleagues and collaborators .
- Created:**
July 8, 2020
- Harvesting API:**
OAI-PMH Interface

https://zenodo.org/communities/heritage_laboratory/



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- Some data sets had already been uploaded to the Heritage Laboratory community on Zenodo but with very little metadata
- During (and after) the workshop a lot of metadata was added
- Using both Keywords and Subjects makes it more likely for the data to be found in less specific searches

June 21, 2021

XRF maps of Paracas textiles and threads

Hacke, Marei; Javér, Anna; Thuresson, Kaj

XRF dataset used in two publications:

Javér, A., M. Hacke, C. Thays Delgado, and K. Thuresson. 2017. Paracas textiles – Colour and condition. Investigation of the mordants and state of degradation of the Paracas textile collections in Peru and Sweden. In ICOM-CC 18th Triennial Conference Preprints, Copenhagen, 4–8 September 2017, ed. J. Bridgland, art. 1804. Paris: International Council of Museums.

Sabatini, F., Bacigalupo, M., Degano, I. et al. Revealing the organic dye and mordant composition of Paracas textiles by a combined analytical approach. *Herit Sci* 8, 122 (2020). <https://doi.org/10.1186/s40494-020-00461-5>

41 views 18 downloads See more details...

Indexed in OpenAIRE

Publication date: June 21, 2021

DOI: DOI 10.5281/zenodo.5006689

Keyword(s): XRF, Paracas, textile, 3.5.1-01504-2017, 3.5.1-00106-2016, 3.5.1-03996-2017

Subject(s): Paracas, 1932.01.0014.C, 1935.32.0211.C, 1935.32.0212.C, 1935.32.0213.C, 1935.32.0048.C, 1935.32.0065.C, 1935.32.0206.C, 1932.16.10165.C, 1935.32.01224.C, 1935.32.01225.C, 1935.32.0173.C, 1935.32.0198.C, 1935.32.0179.C, 1935.32.0190.C, 1935.32.0188.C, Heritage Science, XRF, Textile Material, Native Andean

Related identifiers: Supplement to 10.1186/s40494-020-00461-5 (Journal article) <https://www.iicom-cc-publications-online.org/1615/Paracas-textiles-Colour-and-condition-Investigation-of-the-mordants-and-state-of-degradation-of-the-Paracas-textile-collections-in-Peru-and-Sweden> (Conference paper) <http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1330879&dswid=8105> (Report)

Communities: Heritage Laboratory

License (for files): Creative Commons Attribution 4.0 International

Versions

Version 1	Jun 21, 2021
10.5281/zenodo.5006689	

Cite all versions? You can cite all versions by using the DOI 10.5281/zenodo.5006689. This DOI represents all versions, and will always resolve to the latest one. [Read more...](#)

Share

Cite as

Hacke, Marei, Javér, Anna, & Thuresson, Kaj. (2021). XRF maps of Paracas textiles and threads [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.5006689>

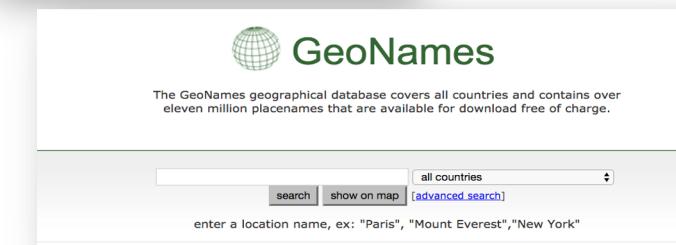
Start typing a citation style...

Controlled Vocabularies for Heritage Science

OK to mix terms and authorities from several different vocabularies

The aim is to help people find and understand your research data, not to find the perfect definition.

- MeSH (meshb.nlm.nih.gov/): Scientific methods and instruments, anatomy
- Gold Book (goldbook.iupac.org/): Scientific terms, units
- Getty Vocabularies (vocab.getty.edu/): Cultural objects, places, persons, materials etc
- VIAF (viaf.org/): Persons, organisations etc. Linking together library vocabularies
- Geonames (www.geonames.org/): Geographical locations
- Wikidata (www.wikidata.org/): Almost everything and possible to create new ones



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Metadata basics: Start with "good enough"

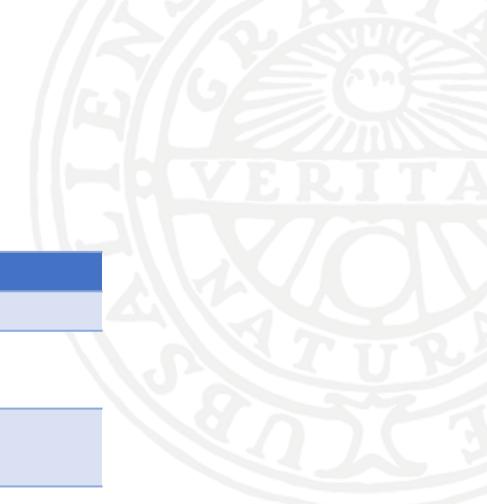
Prepare a template for common metadata for your research output

- Terms, and if possible, Unique IDs for
 - **Subjects** (e.g. Heritage Science, Archaeology, Art History, Literature etc)
 - **Geographical location** (Country, Province, City)
 - **Materials** (e.g. silver, pollen, bone, coin, pottery, pigment)
 - **Methods** (e.g. microscopy, photogrammetry, SEM-EDS, Xray)
 - **Time/Style Period** (e.g. Expressionism, Bronze Age, Tang dynasty)
 - **Person** (Artist, Subject)
- Unique IDs for
 - **Objects** (Artefacts, Art works, Sites, Buildings included in your research)



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Curated list for the Heritage Laboratory



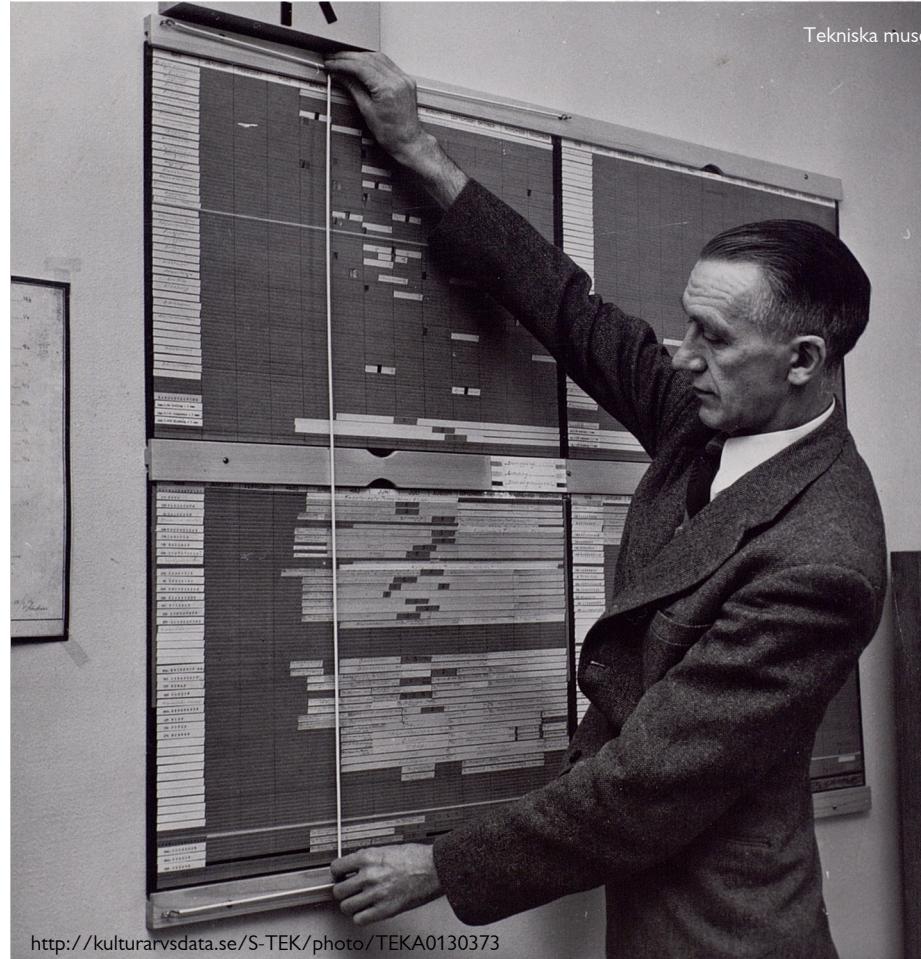
TYPE	VOCABULARY	SEARCH	COMMENT
Method/Instrument (HS)	Getty Vocabularies	http://vocab.getty.edu/	From a Heritage Science perspective
Method/Instrument (Alt.)	Medical Subject Headings, MeSH	https://meshb.nlm.nih.gov/	Complement to Getty - also for modern materials
Method/instrument (Swedish)	Kungliga biblioteket	https://id.kb.se/	Subject headings in Swedish
Scientific terms	IUPAC Compendium of Chemical Terminology	https://goldbook.iupac.org/	Terms, measuring units etc
Material	Getty Vocabularies	http://vocab.getty.edu/	Ex: gold, red ocher, teak, cashmere
Subject	Getty Vocabularies	http://vocab.getty.edu/	Ex: Heritage Science, Art History, Book history, Carpentry
Subject (Swedish)	Kungliga biblioteket	https://id.kb.se/	Ex: Byggnadsvård, Konservering, Arkitektur, Tryckerihistoria
Object type	Getty Vocabularies	http://vocab.getty.edu/	Ex: sword, coins, painting, chair
Object type (Swedish)	Kungliga biblioteket	https://id.kb.se/	Ex: svärd, orientaliska mattor, medletida handskrifter
Geographic location	GeoNames	https://www.geonames.org/	Ex: Continent, country, region, place
Geographic location historical	Getty Vocabularies	http://vocab.getty.edu/	Ex: Mesopotamia, Gallia Cisalpina, Birka, Plamyra
Person	Getty Vocabularies	http://vocab.getty.edu/	Mainly artists, creators
Person	VIAF	https://viaf.org/	OBS! Copy "Permalink"
Period/Style	Getty Vocabularies	http://vocab.getty.edu/	Ex: European Bronze Age, Gothic, Harlem Renaissance, Olmec
Numismatics	Nomisma	http://nomisma.org/browse	Numismatic terms, locations, people etc
Organisation ID	VIAF	https://viaf.org/	OBS! Copy "Permalink"
Object ID	Collection system or Kulturarvsdata (K-Samsök)	https://www.kringla.nu/kringla/	From organisation's Collection system. If K-samsök partner search ID via Kringla: Click to expand "Teknisk data". Copy "Objekt-URI"
Building ID (Sweden)	Kulturarvsdata (K-samsök)	https://www.kringla.nu/kringla/	Click to expand "Teknisk data". Copy "Objekt-URI" (Bebygglelseregistret)
Site ID (Sweden)	Kulturarvsdata (K-samsök)	https://www.kringla.nu/kringla/	Click to expand "Teknisk data". Copy "Objekt-URI" (Fornsök)
Runic inscription ID (Global)	Kulturarvsdata (K-samsök)	https://app.raa.se/open/runor/se/arch	Copy "Objekt-URI"
Anything	Wikidata	https://www.wikidata.org/	Also possible to generate missing authorities



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Guide to good practices for data management

- Plan for FAIR data management from the start of a project
- Good data practices
 - Create and describe data correctly
 - Save and share in open formats
- Use vocabularies and authorities (unique identifiers)
- Document output as structured data (think machine actionable)
- Plan for making the data available



<http://kulturarvsdata.se/S-TEK/photo/TEKA0130373>

Guide to good practices for data management

- Project life cycle
 - Plan for creating digital data
 - Project documentation
 - Naming and organising files
 - Good practice for datasets (database, spreadsheet)
 - Tips and tricks for

FAIR data

 - Findable data
 - Accessible data
 - Interoperable data
 - Reusable data
 - Open formats
 - Licensing



LMA Research Data Management Working Group CC BY-NC 4.0



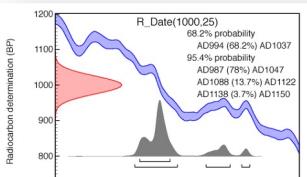
It is about practice, not technology

Describe your data

Heritage science	http://vocab.getty.edu/aat/300417282
Microscopy	http://id.nlm.nih.gov/mesh/D008853
Scanning electron microscopy	http://vocab.getty.edu/aat/300224957
Microscopy, Electron, Scanning	http://id.nlm.nih.gov/mesh/D008855
Fourier transform infrared microspectroscopy	http://vocab.getty.edu/aat/300391288
Spectroscopy, Fourier Transform Infrared	http://id.nlm.nih.gov/mesh/D017550
X-ray fluorescence	http://vocab.getty.edu/aat/300224161

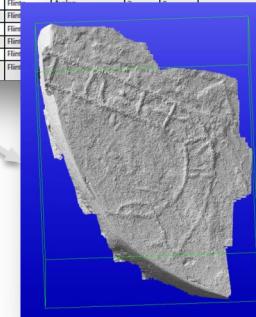
Document your material
(What, where, when, how)

För	Inträksid	Material	Sakord	Antal	Vikt (g)	Anmärkning	Id. Typ
394	1000417	Flinta	Avtag	8	33	2 brända	Graverhet
395	1000418	Flinta	Spän	2	9	Spänfragment. 2 brända	Graverhet
396	1000419	Flinta	Avtag	3	4		Graverhet
397	1000420	Flinta	Splitter	10	1		Graverhet
398	1000421	Flinta	Avtag	1	4		Graverhet
399	1000422	Flinta	Splitter	6	1		Graverhet
400	1000423	Flinta	Spän	3	9		Graverhet
401	1000424	Flinta	Spän	4	3	Spänfragment. 2 brända	Graverhet
402	1000425	Flinta	Avtag	9	33	5 brända	Graverhet
403	1000426	Flinta	Kärna	1	69	Plattformskärna C	Graverhet
404	1000427	Flinta	Ovrig flinta	19	93	11 brända	Graverhet
405	1000428	Flinta	Avtag	3	36		Graverhet
406	1000429	Flinta	Spän	1	3	Brand	Graverhet
407	1000430	Flinta	Spän	1	1	Brand	Graverhet
408	1000431	Flinta	Spän	2	9		Graverhet
409	1000432	Flinta	Avtag	8	13	1 bränd	Graverhet
410	1000433	Flinta	Avtag	9	43		Graverhet
411	1000434	Flinta	Avtag med retusch	1	8	Steckel?	Graverhet
412	1000435	Flinta	Kärna	1	22	Ryggplåt	Graverhet
413	1000436	Flinta	Avtag	2	9		Graverhet
414	1000437	Flinta	Avtag	15	28	7 brända	Graverhet
415	1000438	Flinta	Splitter	5	1		Graverhet
416	1000439	Flinta	Avtag	3	21	1 bränd	Graverhet
417	1000440	Flinta	Avtag	14	41	4 brända	Graverhet
418	1000441	Flinta	Spän	4	5	Spänfragment. 2 brända	Graverhet



See your data!

För	Inträksid	Material	Sakord	Antal	Vikt (g)	Anmärkning	Id. Typ
402	1000435	Flinta	Avtag	9	33	5 brända	Graverhet
403	1000436	Flinta	Kärna	1	69	Plattformskärna C	Graverhet
404	1000427	Flinta	Ovrig flinta	19	93	11 brända	Graverhet
405	1000428	Flinta	Avtag	3	36		Graverhet
406	1000429	Flinta	Spän	1	3	Brand	Graverhet
407	1000430	Flinta	Spän	1	1	Brand	Graverhet
408	1000431	Flinta	Spän	2	9		Graverhet
409	1000432	Flinta	Avtag	8	13	1 bränd	Graverhet
410	1000433	Flinta	Avtag	9	43		Graverhet
411	1000434	Flinta	Avtag med retusch	1	8	Steckel?	Graverhet
412	1000435	Flinta	Kärna	1	22	Ryggplåt	Graverhet
413	1000436	Flinta	Avtag	2	9		Graverhet
414	1000437	Flinta	Avtag	15	28	7 brända	Graverhet
415	1000438	Flinta	Splitter	5	1		Graverhet
416	1000439	Flinta	Avtag	3	21	1 bränd	Graverhet
417	1000440	Flinta	Avtag	14	41	4 brända	Graverhet
418	1000441	Flinta	Spän	4	5	Spänfragment. 2 brända	Graverhet



Do not aim for perfect!
Anything is better than nothing

"Research data" is what you have created or compiled, which you base your published analyses, interpretations and results on (e.g. photos, tables, diagrams, calculations, distribution maps).

Necessary for reproducibility and credibility



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Reflections – what more did we learn?

Some things are difficult to find as open resources that are accessible to individuals

- Time periods: There is a bias benefitting the Western world, and the major civilisations.
- Geographic entities that are culturally defined and/or time specific (e.g. 18th Century Sweden, Sápmi)
- Cultural-historical terminologies that are specific to certain regions or time periods. E.g. archaeological artifact types.
- Instruments - technical definitions may vary depending on use
- Unique identifiers for specific objects (sometimes there is only an ID for a group of objects in the collection)



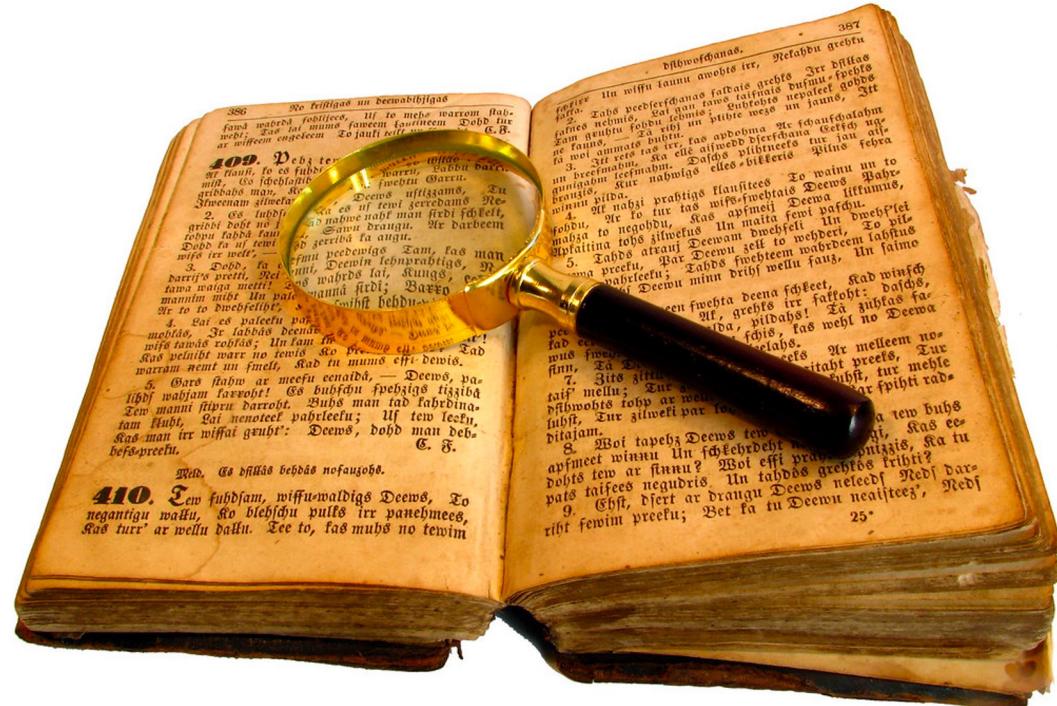
<http://urn.kb.se/resolve?urn=urn:nbn:se:alvin:portal:record-91791>
Uppsala universitetsbibliotek



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Reflections – what more did we learn?

- Do we know how people search?
- How can we predict what search terms will be used?
- The importance of good quality metadata
- Adding both Keywords and Subjects to your Zenodo post
- Link to publication and other relevant objects
- Use a researcher ID



"an old book with a looking glass" by ēst smiltis no ausīm is licensed under CC BY 2.0.



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Reflections – what more did we learn?

What are the main challenges in completing the transition no later than 2026?

- Educating and training young researchers, preferably already at Masters level.
- Good data practice is necessary in all fields
- Security - how to store and share sensitive data
- Law - what can we and what can we not share
- Ethics - what ethical questions do we need to deal with considering research data



Teaching by Nick Youngson CC BY-SA 3.0 Alpha Stock Images



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Reflections – what more did we learn?



Beyond the Ivory Tower...

- Researchers outside of Academia often lack the support and solutions available to University employees
- Museums, archives and non-profit organisations are often forgotten in systems constructed for Open Science
- Can small organisations with few researchers and specialists afford the set-up required for effective FAIR processes?
- Is there a danger of an even greater divide between Academia and the GLAM sector with increased demands from research funders?



Foto: Eriksson, Elisabeth

<http://kulturarvsdata.se/nomu/object/NM0269313>

Nordiska museet



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Thank you!

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