

Geology collection policy of the Finnish Museum of Natural History

Arto Luttinen[‡], Risto Väinölä[§], Jaana Halla[‡], Björn Kröger[‡], Kari Lintulaakso[‡], Aino Juslén[§], Markku Oinonen[‡], Pasi Sihvonen[§], Marko-Tapio Hyvärinen^l

[‡] Natural Sciences Unit, Finnish Museum of Natural History, Helsinki, Finland

[§] Zoology Unit, Finnish Museum of Natural History, Helsinki, Finland

^l Botany Unit, Finnish Museum of Natural History, Helsinki, Finland

Corresponding author: Arto Luttinen (arto.luttinen@helsinki.fi)

Reviewable v 1

Received: 21 Oct 2021 | Published: 25 Oct 2021

Citation: Luttinen A, Väinölä R, Halla J, Kröger B, Lintulaakso K, Juslén A, Oinonen M, Sihvonen P, Hyvärinen M-T (2021) Geology collection policy of the Finnish Museum of Natural History. Research Ideas and Outcomes 7: e76875. <https://doi.org/10.3897/rio.7.e76875>

Abstract

The Geology Collection is part of the national collections of the Finnish Museum of Natural History Luomus. General principles and guidelines for the collections are defined in the General Collection Policy of Luomus. The Geology Collection Policy is subordinate to the General Collection Policy of Luomus, clarifying its content with reference to the special characteristics of the geological collections. The Geological Collection includes mineral, rock, and meteorite specimens worldwide and from all geologic ages to support Finnish research and educational projects. The coverage emphasizes specimens from Finland, Scandinavia, Africa, and Antarctica. The Geology Collection Policy defines the purpose of the collections, the objectives, the distribution of responsibilities for collection management and maintenance in the organisation, and the principles of collection accumulation, preservation, accessibility and use to public.

Keywords

collection management, natural history collections, minerals, rocks, meteorites, University of Helsinki

1. Status, purpose and implementation of the Geology Collection Policy at the Finnish Museum of Natural History

Status and implementation

The Collection Policy of the Finnish Museum of Natural History Luomus is hierarchically structured. General principles and guidelines are defined in the General Collections Policy (Hyvärinen et al. 2020). Subordinate collection policies for the individual collections adhere to and implement the General Collections Policy and specify its guidelines and instructions: The Geology Collection Policy guides all curating activities related to geological collections (excluding palaeontological samples which are governed by the Palaeontology Collection Policy (Kröger et al. 2021)).

This policy document has been prepared in the Natural Science Unit, reviewed by the Collections Steering Group, and approved by the Luomus management group on 11 May 2021. The Geology Collection Policy is implemented and executed by the Geology Team - as well as by every team member and visiting researcher that use the collections while working on behalf of Luomus and with its collections.

Goals of the collection policy

The goal of the collections policy is to ensure the high scientific quality of the collections and the data associated with them, and to enable optimal physical and digital access to the collections for the purposes of scientific research and education. The policy document defines the purpose of the collections, the objectives and content of the procedures and activities related to them, the division of responsibilities for the administration and care of the collections within the Luomus organization, and the principles of collection acquisition, preservation, and accessibility and of use on a general level. Related specific practices and processes are separately documented in the operational instructions of each team (Museum wiki or equivalent).

Definition of a collection

A collection is a compilation of systematically organized scientific specimens and their metadata, from which the specimens can be retrieved on the basis of either collection data files or of the physical location of the specimens. Specimens which have not yet been thus organized are not considered to be part of the collection. Datasets included in the collections (e.g., specimen databases) may also be stored and organized together with data that do not make up part of the collection (e.g., observation data). The Luomus Digital Data Policy applies to all these kinds of data. Collection databases are thus governed by two data policies, those for collections and those for digital datasets.

The geological collections

All specimens belong to one of the main collections: (1) the Mineral Collection, (2) the Rock Collection, and (3) the Meteorite Collection. A specimen, or research material derived from it, may also belong to a subcollection. Principles of the organization of the subcollections with examples are as follows:

1. Specimens donated by a renowned geologist or institute
 - Th. G. Sahama's Mineral Collection
 - GTK (Geological Survey of Finland) Collection
2. Specimens of high historical value
 - Axel Gadolin's (1828-1892) Mineral Collection
3. Specimens related to economic importance
 - Ore Collection
4. Specimens with special chemical, physical, or other characteristics
 - Radioactive Mineral Collection
5. Specimens from specific or inaccessible geographical areas
 - Fennoscandian Rock Collection
 - Antarctic Research Collection
6. Specimens with specific purpose
 - Teaching Collection

Purpose and value of the geological collections

The primary mission of the collections is to accumulate and preserve scientific specimens representing geological diversity for the purposes of research, education, and public outreach. The collection serves as a physical repository that facilitates reproduction of published research.

The scientific interest of the geological collections lies in the origin and evolution of Earth and the solar system. The collection specimens document the compositional and structural diversity of natural terrestrial and meteoritic minerals and rocks as well as their geographical distribution and evolutionary stages. The collections promote the knowledge of geological materials in Finland, Earth, and across the solar system, and increase understanding and appreciation of geological and planetary processes and geodiversity. They make part of a global network of natural history collections that is a key resource for geoscientific research, a common infrastructure that has been built up over centuries by the international and Finnish research communities.

The value of geological specimens and collections can be assessed in different ways. The collections have:

1. *scientific value* in measuring global change in geodiversity, the variety of materials, forms, and processes that constitute and shape Earth,
2. *historical value*, especially in the form of the influence of the along-with-science-development of collections on the society,

3. *monetary value* which the private collectors and public have raised because of the rarity or splendor of certain meteorites and minerals,
4. *educational value* when the collections are used as a resource of learning or inspiration at academic to public levels, and
5. *aesthetic value* when the visual look or other characteristic feature or history of a specific rock, mineral, or meteorite specimen is deemed unusually valuable.

The legislation, general principles and strategies pertaining to the Luomus collections are discussed in the General Collections Policy. The geological specimen collections make a part of the Luomus national natural history collections, as referred to in the Universities Act of 2009. For their part, the collections implement the mission of Luomus to be “responsible for the preservation, accumulation and exhibition of the national natural history collections and for research and education relating to them”.

Collection responsibilities in the Natural Sciences Unit

The Unit Director carries the overall responsibility for the preservation of the geological as well as paleontological collections of Luomus. The geology curator and the paleontology curator act as scientific curators of the geological and paleontological collections, respectively, and are responsible for the maintenance, expansion, documentation, and use of the collections according to the geological and paleontological policy documents. The Geology Team Leader is responsible for the operations carried out by the scientific curators and other team members.

2. Principles of collection acquisitions

Material to be added into the collections

New material to the collection is added systematically based on the objectives specified in the Geology Collection Policy and General Collection Policy. Acquisitions shall focus on the designated strengths of the collections (see below) and on collections that support those strengths, on rare materials, and on type specimens. The scientific value of the strength areas is enhanced by expanding and supplementing the collections, and by complementing and replacing deficient materials.

The growth of the collection is guided by the potential information content of the new materials and by their utility for research and education. Specifically, this is related to the documentation of 1) mineral and rock diversity (classification), 2) variation within individual mineral and rock formations (e.g., mineral assemblages and volcanic stratigraphy), or 3) distribution in space and time.

The primary means of collection growth is active, high-quality collection-oriented research. Material is acquired through specimens obtained by Luomus staff as part of their work as well as through material donated by other researchers, students, authorities and private individuals. In addition, specimens may be acquired by exchange between organizations or

through purchases. As a rule, all material relating to geological research, theses or dissertations completed at Luomus must be documented and submitted for inclusion in the relevant collection. Final decisions on whether or not a specimen will be added to a collection are made by the Team Leader, however.

At the general level, specimens to be accessioned are prioritised as follows:

1. Scientifically valuable and technically high-quality specimens that support the strengths of Luomus and are important for current or future research.
2. Specimens which supplement existing scientifically valuable collections and add to their coverage (e.g., represent missing compositional or structural types of minerals and rocks, complement or expand stratigraphic series or broaden the geographical or classification scope of the collection).
3. Specimens with no immediate research value, but which may serve other societal interests such as environmental education or the public outreach in presentation of geological diversity.

Specimens may also be added to the collection if they together with collections of other museums form a scientifically coherent and valuable resource. When specimens are acquired through collecting activity in connection with other collection-related research or research that supports other Luomus collections, their incorporation can be justified by the synergy created between collections, and accessioning can be partly opportunistic.

Collection strengths and responsibilities

Acquisitions to the geological collections aim to develop the strengths of the permanent collections to better serve the purpose outlined in this collection policy. The focus areas that guide the accumulation of the collections are based on the collection strengths and research objectives (cf. The geological collections; section 1):

1. Minerals of Finland,
2. Rocks of Fennoscandia,
3. Meteorites and impact-related rocks,
4. Minerals and rocks of eastern and southern Africa (University of Helsinki Africa Program 2021-2030)
5. Archaean rocks

Additional areas of responsibility include:

6. Rocks and minerals of Antarctica (Finnish Antarctic Research Programme; Antarctic Treaty).

Quality criteria for specimens

Development of the collections is guided by the quality criteria for specimens and related metadata listed in the General Collections Policy. These criteria are applied when

amassing and deaccessioning the collections, to enhance the quality of the content of the collection.

Quality criteria for a geological specimen:

1. Relevance to the purpose of the collections and activities of the museum (scientific, cultural, and historical value), whether the specimens genuinely expand the content and coverage of the collection or duplicate existing materials
2. Potential to be used for research, exhibition or teaching
3. Technical quality and current condition
4. Completeness, reliability and accuracy of the accompanying document(s)

Ethics and legality

The collections are expanded in line with the principles and practices for protecting and promoting geodiversity (e.g., IUCN resolutions 040, 048, 083; <https://www.iucn.org/theme/world-heritage/our-work/global-world-heritage-projects/geodiversity-world-heritage-and-iucn>). Specimens must be collected and imported in accordance with the laws and provisions of Finland and the countries of origin, as well as with international conventions ratified by Finland (cf., *Gounelle and Gounelle 2019*). When accessioning new specimens, the required information on the legitimacy of the specimens and on their terms of use is entered into the collection management system. Those providing specimens may be required to supply written documentation on the origin of the specimens and their terms of use.

National division of responsibility

The geological collections of Luomus are part of the national network of natural history collections and represent by far the largest and presently the only professionally curated geological collection in Finland. Knowing and recognizing the focus areas of collections from other institutions is intertwined with designation of the strengths of the Luomus collections, however. This knowledge will help in directing the expansion of various collections in a way that will enhance the value of individual collections while at the same time responsibilities are distributed in a rational manner.

The mineral and rock type collection of the Geological Survey of Finland (GTK) includes rocks, minerals gems, fossils, meteorites, and soil types from Finland and world-wide. In 2018, GTK donated most of their mineral and rock collections to Luomus. The part of the collection which remains at GTK includes ca. 3,000 samples. Additionally, GTK holds research material such as the national drillcore collection and an archive of mineral separates and rock powders analyzed at GTK laboratories. Geological collections are also maintained by the University of Turku (ca. 13,000 specimens), Åbo Akademi (ca. 11 000 specimens) and University of Oulu (ca. 13,000 specimens), but these are no longer actively curated. Minor mineral and rock collections are held by other museums and exhibitions in Finland: Meteorite Center, Lappajärvi; Tankavaara Gold Prospector Museum, Sodankylä (2,500 specimens); Eräjärvi Stone Museum, Orivesi; Yläjärvi Gem Museum,

Lappeenranta; Kemi Gemstone Gallery; Kieppi, Kokkola Museum of Natural History; Outokumpu Mining Museum; Parainen Industrial Museum; Tytyri Mine Experience; Tampere Mineral Museum; Heureka – the Finnish Science Centre, Vantaa.

3. Receipt and accessioning of specimens

Accessioning and cataloguing

New specimens become part of the collection only when formally accessioned. When a new specimen is accessioned into the collection, its data are entered into the collection management system (CMS) Kotka (Heikkinen et al. 2019) and it is assigned a unique identifier. Material previously organized in the collection belongs to the collection even if it is not yet digitally registered. Cataloguing or digitising this type of existing material does not constitute expansion of collections.

New sample lots or private collections offered to and received by the museum will nevertheless be registered into the collection management system as separate larger entities (donations) already before the potential accessioning of the specimens. This enables the monitoring of incoming material from donations. Metadata on sample lots expected to be acquired in the future can also be registered in the collection management system.

Decision-making

The inclusion or accessioning of specimens to the collection requires a decision by the scientific curator. These decisions are made in accordance with the principles of the General Collections Policy and the acquisition quality criteria stated in this document. The scientific curator may delegate decisions on individual specimens to other collection staff. Decisions of accepting extensive collections are made by the director of Luomus on a proposal by the Unit Director based on communication within the Unit.

When accessioning new collection materials, the following points must be considered:

1. Availability of resources (storage space, staff, etc.) and possible special requirements (e.g. radioactivity, safety issues related to high monetary value) to care, store and preserve the specimen
2. Availability of all rights, without restrictions or demands for the use, handling, storage, etc. of the specimen
3. Accessibility to specimen locations (e.g., ore and mineral deposits, construction sites, and remote areas)
4. The status of a specimen as a part of a larger collection or research entity, particularly in relation to Luomus' focus areas
5. Special historical context
6. Ethics criteria related to specimen collection

Terms attached to the receipt of specimens

As a rule, no such specimens or collections will be accepted whose release is subject to terms or conditions other than those related to the collecting permit practices. If the material is exceptionally valuable, Luomus and the donor may agree on an embargo period of up to two years before accessioning the material into the collection and opening it for use. Such agreements are approved by the director of Luomus on the proposal by the Unit Director based on communication within the Unit.

4. Collection management

Collection management refers to the process of organizing and documenting the collections and related data. Compliance with the principles of collection management is monitored, and the practices of management are developed in the Geology Team under the supervision of the Team Leader. The Geology Team is currently bringing the Kotka CMS of Luomus into full use.

Metadata

Metadata about the structure of the geological collections, documenting the subdivision of the collections into subcollections as well as the composition, size and location of the collections is specified in the CMS and are openly available.

Historical documents related to a collection are part of the collection. Decisions on access to these materials will be based on practicality.

Specimen data and the collection database

Data related to individual museum specimens must be recorded in specimen labels, collection documents, and in the CMS. Specific collection and origin data on all new specimens will be entered into the CMS. Collection management aims to register the entire museum collection into this single database. Usage history and the physical consequences of specimen use are also recorded in the CMS.

Specimens are marked using unique identifiers that contain the most essential information on their origin along with a standard identifier that links them to the CMS and other catalogues. When replacing labels, all original labels and those with information that differs from the current information will be kept.

Recording specimen-specific data

The most important specimen information required for museum catalogues are the collecting locality and time. Specimens with no locality data should generally not be incorporated to a collection.

The catalogue record for specimen-specific data follows the standard defined in the CMS. The following information is the minimum requirement for new specimens to be entered into the database (quality criteria):

- Discovery location (state, locality, coordinates)
- Stratigraphic information
- Collection date (precise date or time period)
- Collector's identity
- Number of individual specimens comprising the sample/batch (or estimate)

Recommended additional information include:

- Old catalog number, if exists,
- Detailed description of the collection location,
- Reference to the collecting event (e.g., research project, excursion, expedition) and its metadata,
- Age or geological period
- Health risks (e.g. radioactive, poisonous, asbestos)
- References to research materials and data (composition, age) extracted from the specimen,
- References to publications which have used the specimen as research material

Physical organization of the collections

The geological collections are administratively divided into three main collections covering minerals, meteorites and rock specimens, and these have been further organized according to the principles of the organization of subcollections as stated in this document ([Section 1. The Geological Collections](#)). Physical organization follows the administrative organization where feasible.

The Mineral Collection is organized physically on the basis of the Dana classification scheme, 8th edition (Gaines et al. 1997), with the exception of some subcollections.

The Rock Collection is organized physically on the basis of discovery site; countries and administrative territories (provinces, regions, and municipalities) with the exception of some subcollections organized according to rock types or geological formations.

The Meteorite Collection is organized physically on the basis of their names defined in the Meteoritical Bulletin database (<https://www.lpi.usra.edu/meteor/>).

Details on the administrative and physical arrangement of the subcollections are found in the CMS.

5. Collection maintenance

Collection maintenance is conducted following the international standards of collection care in scientific collections. The aim is to ensure the preservation of specimens for the scientific community for centuries to come. This requires specialised methods for storage, pest control, specimen handling and the security of the collection facilities.

Collection facilities

The specimens are kept protected from light and dust and those kept in the main collection storage facility are also protected from water. The collection facilities are equipped with fire alarms and sprinkler fire extinguishing systems. Practical and standardised storage systems and containers are preferably used in the collections. Various storage systems and their development needs have been specified in the collection maintenance instructions (MuseoWiki or equivalent).

Current state of collections

The collections are divided into classes that reflect the level of supervision required for care and maintenance. The classes are based on the

1. relative scientific significance,
2. rarity or monetary value, and
3. physical or chemical properties of the specimens.

Strict supervision specimens: The specimens of the greatest scientific or monetary value or exceptional physical or chemical properties are designated as strict supervision specimens. They demand the highest level of supervision for use, management and conservation practices and the greatest security (e.g., high exhibition security and insurance when on loan). Type specimens, meteorites, gems, and fragile or hazardous specimens are included in this designation.

Moderate supervision specimens: The main part of the collections is designated as moderate supervision specimens. They are high quality specimens well-suited for research and reference material, for exhibits, for exchange, or for instructor use in educational programs. They demand supervised handling and careful management practices, but restrictions on use are not as high as with the first category.

Low supervision specimens: The category of low supervision specimens includes specimens that require minimal or no supervision for handling. This category includes specimens that do not fulfill the criteria of strict or moderate supervision specimens and may be used for hands-on teaching purposes.

Maintenance routines

The permanent technical staff monitors, manages and cares for the collection specimens and regularly controls the ambient conditions in the collection facilities. The specimen conservation and care follow the practices agreed upon with the Team Leader and the possible official regulations. The potential occurrence of pests in the collection facilities is also regularly controlled and monitored.

Safety

A safety coordinator has been appointed for the collection facilities. The staff has been familiarised with the rescue plan, which is also easily available in written form in the storage rooms. Occupational safety in general is controlled by the University's HR organisation.

The radioactive samples are stored and handled, and the condition of the ventilated facilities of radioactive specimens are monitored regularly according to STUK's (Radiation and Nuclear Safety Authority in Finland) Regularity Guides on Radiation Safety (ST) and Radiation Act (859/2018). Hazardous specimens (e.g. poisonous, radioactive, or asbestos minerals) and volatile substances are handled in fume hoods or in facilities equipped with local exhaust ventilation. The coordinator will also ensure the availability of personal protective equipment and clothing.

Visitors working with the collections will also receive orientation relating to key safety instructions and working practices. Occupational ergonomics and safety are developed in cooperation with other parties at the University in accordance with relevant general instructions.

Definition and scientific evaluation of the collections

Continued scientific evaluation of the collections and support for the work of visiting researchers by making the facilities available, are key attributes of high-quality collection maintenance. The permanent technical staff will evaluate and organize the collections primarily to a level at which they are readily accessible for use by specialist researchers.

Digitisation strategy

The digital availability of collection data (section 6) and, increasingly, the photographic documenting of actual specimens are central to the accessibility of the collections. As a general guideline, priority is given to the digitisation of type specimens, historically or scientifically significant collections, and entities related to collection strengths (focus areas).

The key targets for digitisation of the geological collections are

- the meteorite collection (macro and micro photography) and
- Karoo rock collection (micro photography).

Chemical and physical analyses and measurements of the collection specimens are compiled as a separate research database, in which the same collection IDs are used than in the main database.

6. Accessibility and use of the collections

The collections are to be used primarily for scientific research and university-level teaching, and secondarily for other types of education and environmental and science education. Research use of the collections takes place in Luomus' facilities, and collection material may be loaned outside Luomus free of charge according to international museum practices. (see Hyvärinen et al. 2020 §12).

The specimens of the Geological Collection and associated data are made accessible by:

- making data openly available,
- written or verbal requests,
- lending specimens, and
- physical access to the specimens.

Accessibility and access rights

Access to the collection is restricted to the scientific curator, authorized staff and students, and visitors under supervision. Authorized staff and students are those who need to use the collections for teaching and research. Visitors wishing to use the collection must request an appointment in advance and be approved by the scientific curator. Visitors must be accompanied by the scientific curator or authorized staff or student at all times. The following criteria are used when granting access to the collection:

1. the individual must have a legitimate reason for using the collection (e.g., scholarly research),
2. the individual must comply with security precautions and collection procedures,
3. the individual must be willing to work during regular departmental hours, and
4. the individual may be asked to demonstrate competence in the physical handling of specimens.

Visitors who have violated the rules e.g. by mishandling specimens may be denied access. Keys are not issued to non-Luomus personnel, except in rare cases and only with permission from the scientific curator.

Non-academic requests (private collectors, hobbyists, clubs, commercial users, artists, etc.) will be reviewed individually. Visits will be granted as the curator's schedule permits, if

at all. Such non-academic access (tours behind the scenes) will be closely supervised by the scientific curator or authorized faculty or students. Research and photographic equipment, and preparation materials will be made available whenever possible.

Openness of data

Metadata related to the collections and, as a rule, data already in digital form in the CMS are open data according to the Digital Data Policy of Luomus.

Specimen loans

Specimens from the collection are lent to other collection organisations and research institutes by the decision of the curator in accordance with international practices.

1. The relevant departments serve as the contractual parties: Loans will only be granted to persons holding official permanent positions in recognized institutions/ organizations. Students or temporary researchers will only receive loans under the approved address and signature of their position supervisor. This person will be responsible for the care and return of all loaned units. Should the borrower leave their receiving institution, either permanently or for an extended period, all loaned units must be returned.
2. Loans for commercial purposes are discretionary and will incur a fee.
3. Without exception, loans and related terms will be recorded in a written agreement and information about all incoming and outgoing loans is permanently entered into the CMS.
4. Loaned specimens must be handled as carefully as all collection specimens. The loan period is always defined by the agreement. By default, the period is 12 months, or 6 months in the case of type specimens. Renewal of loans must be completed in written form with an agreement equivalent to the original. Collection managers will send regular reminders of overdue loans.
5. Specimens may not be prepared, sampled or altered in any way without prior written approval of the scientific curator. General and case-specific restrictions may be set particularly for the lending of type specimens or other exceptionally valuable specimens. The sending of digital images instead of actual specimens is recommended.
6. As a rule, material to be loaned is digitised by imaging before sending. This applies to all particularly valuable material. Original labels will not be supplied with specimens, although digital copies can be provided upon request.
7. The scientific curator should be notified of any taxonomic changes or re-identifications especially for primary types. Any published or popular works, commercial products, public exhibitions, education and outreach materials or media publicity resulting from or involving loan units must carry due institutional acknowledgement.
8. Luomus must receive credit in any publications based upon the use of specimens from the collection. Authors shall make the scientific curator aware of and provide, if

possible, the DOI assigned to any publication based in whole or in part upon material loaned from the Geological Collection.

Destructive sampling

Museum specimens lent out are usually expected to be returned in their original condition. Any breakage or exposure to physical or chemical stress must be separately agreed on in connection with the loan agreement, and both the original specimen and the preparations made must, as a rule, be returned. Actual destructive sampling takes place, for example, when preparing cut, crushed, or powdered materials from museum specimens. The scientific curator can give permission for destructive sampling on a case-to-case basis. Decisions are based on the assessment of the scientific significance of the sampling in relation to the scientific value of the undamaged specimen. The damage to specimens caused by the sampling must be minimised. One should strive to sample one of paired appendages so that the other one remains intact. Samples extracted from individual specimens will be documented so that information on their individual identity is not lost.

Microscopy prepares, mineral separates, crushed or pulverized samples extracted from collection specimens and handed over will be formally treated as loan transactions. The ownership and right of use of such samples and compositional data extracted from them remain with Luomus, unless otherwise agreed. The loanee must report on specimen use.

Other use

The use of collection specimens in exhibitions or lending them out to parties other than scientific research or collections organizations is based on the guidelines of the General Collections Policy.

7. Deaccessioning

Deaccessioning is always based on the guidelines in the General Collections Policy and approved by the Unit Director, and decisions on deaccessioning individual specimens are made by the person in charge of the scientific value of the collection (usually the Team Leader) (see Hyvärinen et al. 2020 §13).

The deaccession process shall be cautious, deliberate and scrupulous. The term 'deaccession' applies to any specimen or specimen lot brought into the repository for research purposes whether or not it is catalogued. Before specimens can be disposed of, reasonable effort shall be made to ascertain that the Geological Collection has clear title to and is free to dispose of the specimens. If there is any question as to encumbrances on the specimen(s), the Geological Collection will seek advice of a legal counsel of the University of Helsinki.

The scientific curator will use the following criteria when removing a catalogued specimen or an uncatalogued lot:

1. the data on the origin of a specimen is missing,
2. the material does not fall within the scope of the collection as described in this policy,
3. the material lacks physical integrity or has deteriorated beyond usefulness,
4. the material is redundant, and no alternative use can be determined,
5. the material is occupying space and using valuable resources that could be better used to improve or strengthen the collection in order to further the goals of the policy.

Any reliable specimen observation data will be stored when deaccessioning specimens. Reliable observations and identifications will be stored in the collection database even if the deaccessioned specimens are in poor condition. When possible, the material will be digitised also by photography or other imaging system before deaccessioning.

Type specimens, meteorites, specimens with considerable monetary or historical value, and specimens acquired in conjunction with the Finnish Antarctic Research Program (Finnarp) may not be deaccessioned.

Acknowledgements

We thank Laurence Livermore (London, UK) for his invaluable technical help in the publication process.

Funding program

[H2020-EU.1.4.1.1. - Developing new world-class research infrastructures](#)

Grant title

[ICEDIG](#) – “Innovation and consolidation for large scale digitisation of natural heritage”, Grant Agreement No. 777483

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