

# Heritage Science Forum 2020



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Swedish National Heritage Board

Swedish National Heritage Board (Riksantikvarieämbetet)

P.O. Box 1114

SE-621 22 Visby

Phone +46 8 5191 80 00

[www.raa.se](http://www.raa.se)

[registrator@raa.se](mailto:registrator@raa.se)

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*Heritage Science Forum 2020*

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Author: Henrik Lundström

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## Summary

The third annual conference of the Heritage Science Sweden network was organised by The Swedish National Heritage Board during three consecutive days in November 2020, 17–19<sup>th</sup> November.

For the first time the conference was digital and for the first time the presentations were entirely held in English. Between 110–170 researchers and practitioners from the cultural heritage community from different parts of the world attended the conference.

During the conference more than 20 research projects within heritage science were presented. The presentations were divided in seven sessions with different themes:

- Session 1: Remedial conservation
- Session 2: Preventive conservation
- Session 3: New research on runes
- Session 4: Technical art history
- Session 5: Visualisation technology
- Session 6: Heritage science for historical research
- Session 7: Heritage science resources in Sweden and IPERION HS

There were also reports on the latest accomplishments and activities within the Heritage Science Sweden network as well as reports on the ongoing efforts to build a European research infrastructure in heritage science. The conference ended with a brief social session in which the participants got some time to make new contacts.

## Opening of the conference Heritage Science Sweden

Stefan Nilsson, the convenor of the Heritage Science Sweden network greeted all participants to the 3<sup>rd</sup> annual conference of Heritage Science Sweden.

The two earlier conferences had been physical meetings, in Stockholm and Gothenburg respectively. This year is a little different, Stefan Nilsson said in his brief welcome. Since the conference is held

digitally and for the first time also in English the conference has become more inclusive. It has made it possible for not only Swedish participants, but also people from different parts of the world to take part in this conference.

*Stefan Nilsson, Swedish National Heritage Board*

## Heritage Science Sweden

Heritage Science Sweden (HSS) was conceived in 2017 and formally launched in 2018, with the scope to establish a national research infrastructure for heritage science, that may open the possibility to join the European Research Infrastructure for Heritage Science (E-RIHS).

A large number of Swedish universities, research institutions, museums and other cultural heritage organisations have joined the HSS network. The network is managed by the Swedish National Heritage Board. Stefan Nilsson, the convenor of HSS, gave a brief history of the network and its accomplishments.

Activities in the HSS network include joint funding applications to research calls within Sweden and the EU, two annual conferences (Heritage Science Forum 2018 and 2019) as well as the creation of a website and a Facebook group. The network has expressed the need for a national infrastructure for heritage science to The Research Council and The Ministry of Culture. Furthermore, the network is responsible for the Swedish participation in the EU-project IPERION HS.

*Marei Hacke, Swedish National Heritage Board*

## Heritage Science international infrastructure

IPERION HS is a large EU-project contributing to establishing a heritage science research infrastructure. The consortium consists of 67 organisations from 23 countries, including four Swedish organisations. Half of the total budget of over six million euros goes to

three platforms: ARCHLAB, FIXLAB and MOLAB. The other half goes to joint research activities, e.g. the development of innovative methods for preventive conservation.

IPERION HS is the latest project with the purpose of building a research infrastructure in heritage science. The first project to build a pan-European research infrastructure in heritage science started in 1999 – IPERION HS is the 7<sup>th</sup> project. The effort continues within the new EU research framework programme, Horizon Europe, between 2021–2027.

The covid pandemic risked slowing down the efforts to build a European infrastructure, called E-RIHS, but it has actually had the opposite effect, Marei Hacke said. To meet online is actually much easier than to physically convene representatives from 23 countries.

## SESSION 1: REMEDIAL CONSERVATION

*Nicoletta Palladino, Royal Institute of Technology (KTH)*

### Nanomaterials for the consolidation of iron-tannate dyed textiles

Nicoletta Palladino presented conclusions from her master's thesis, in which she examined how nanomaterials can be used for the consolidation of iron-tannate dyed textiles. The project was a collaboration between Royal Institute of Technology (KTH), Chalmers and The Swedish National Heritage Board.

Iron-tannate dyes, whose chemistry is similar to that of the more studied iron gall inks, have been used for thousands of years to lend different brown and black colours to cotton, wool, silk and other materials. The problem is that these dyes also degrade the material.

Nicoletta Palladino has examined different nanomaterial-based treatments, i.e. nanosilica and nanocelluloses, and its consolidating effect on model textiles developed at the British Museum. The results are promising but need more work, e.g. further tests and characterizations of the nanomaterials and their interaction with textiles.

*Susanna Barros, Barros kultur och konservering*

## Examination of a 14th century crucifix – changes, construction and a possible reliquary

Susanna Barros presented some of the findings from the ongoing conservation and examination of the crucifix at Stenkyrka medieval church on the island of Gotland. The project is a collaboration between The Church of Sweden, i.e. The Stenkyrka Parish, and The Swedish National Heritage Board.

The project, which started in 2020, is supposed to answer three main questions: Does the crucifix contain any relics? Has the sculpture been painted in layers? Is the construction of the 1,50-metre sculpture original?

The crucifix has been examined using several techniques, e.g. multispectral imaging, X-ray fluorescence and scanning electron microscopy. Some of the conclusions so far: No relics were found; the crucifix has been painted using e.g. gold and silver and red lead; and the wings were added to the crucifix in the 17th century. The conservation work on the crucifix will be finished during 2021.

*Karin Hindborg, Konservatorsateljén*

## Electrolytic cleaning of silver threads – effects of electrolyte on the condition of silk

There is currently no widely accepted method to clean silver on silk. Tarnished silver embroidery on silk fabric is therefore typically left uncleaned.

The Pleco pen is an existing tool originally developed to treat metals by local electrolytical reduction, in which silver sulfide is converted to pure silver. Could the Pleco pen also be used to clean silver threads in silk? This was examined by Karin Hindborg in her thesis, which



was partly done in collaboration with The Swedish National Heritage Board.

Experiments were performed on a silver thread ribbon, dated 1716, attached to contemporary silk. After accelerated ageing, the textile was treated with different electrolytes. The salt residues in the textile were studied, also physical conditions of the silk were examined, e.g. tensile strength and colour.

The results were positive, indicating that local electrolytic cleaning of silver threads on silk with the Pleco pen could be a viable option. However, further examinations and tests are necessary.

## SESSION 2: PREVENTIVE CONSERVATION

*Thérèse Lilliegren, Moderna Museet*

### Lobster tail and cake – an anoxic contemporary conservation challenge

How should contemporary artworks, many of which are ephemeral and not meant to last, be exhibited and stored? How to find balance between artistic intent, curatorial issues and collection safety? These questions are at the center of an ongoing research project at Moderna Museet in Stockholm.

The project evolves around two artworks made by the Argentinian artist, Adrián Villar Rojas; *Pieces of the people we love* (2007), a sponge cake made by marzipan and milk caramel and *The theatre of Saturn III* (2015), which consists of 84 parts, including fish, a lobster tail, bread, fruits and vegetables.

Already when the second art work arrived at the museum insect infestation was present. In collaboration with The Swedish National Heritage Board the museum has started the planning to build an oxygen-free (anoxic) transparent case, suitable for both storage and exhibiting.

This also give rise to ethical questions. Would conservation action be conflicting with the intent of the artist? The artist Villar Rojas has been presented with the ideas of the project, and although he

has stated in interviews earlier that contemporary art is not meant to last, Villar Rojas has so far been very positive to the museum's solution for future storage of his artwork.

*Thea Winther, Swedish National Archives*

## Promote preservation through the choice of storage materials – presenting a new standard on how to measure emission effects of storage materials on paper-based objects

Paper-based cultural heritage objects, such as documents, drawings and maps, are often stored in boxes made out of paper or board. Break-down products, i.e. acidic emissions, from these boxes risk to accelerate the degradation of the cellulose in the stored paper objects. The standard ISO 23404 sets out a method to quantify this degradation.

During 2018 and 2019, Swedish National Archives participated in developing the new ISO-standard. An early version of the standard was also tested at The Heritage Laboratory at The Swedish National Heritage Board.

The standard is based on a method originally developed in 2010. The method examines the degradation of the cellulose in the paper, measured as the degree of polymerisation. The degree of polymerisation in a reference paper, aged with the tested material, is compared with the degree of polymerisation in an unaged reference paper.

The scope of the recently published ISO-standard (ISO 23404) is to ensure safe storage material for preserving paper-based cultural heritage objects. The new standard can be used in procurement. Thea Winther also hopes that the new standard will increase the awareness of the possible influence of emissions on paper-based objects.

*Elyse Canosa, Chalmers University of Technology*

## New materials for preventive preservation – progress in the EU Apache project

It is well established that air-borne emissions contribute to the degradation of stored and exhibited cultural heritage objects. These emissions are mainly transmitted from the outdoor and indoor environment, but they may also come from the storage materials and even the objects themselves.

The ongoing EU APACHE project (2019–2022) will develop innovative technologies to control and prevent future degradation and loss of cultural heritage. Elyse Canosa is a postdoctoral researcher at Chalmers University of Technology – one of more than 30 partners in APACHE including industries, museums, research organisations and universities.

The aim of the research at Chalmers is to develop an affordable material that captures degrading emissions, e.g. acidic and formic acid. In order to do so, the research team produces, characterises and optimises new adsorbing materials, i.e. small polymer-enhanced silica particles. The work is performed both in the laboratory and through case studies at the Swedish National Archives and the Vasa Museum. A part of the research has been done in collaboration with the Swedish National Heritage Board. A long term goal of the ongoing project is to develop an adsorptive material that might be incorporated in packaging materials and display cases.

## SESSION 3: NEW RESEARCH ON RUNES

*Magnus Källström, Swedish National Heritage Board*

### Everlasting runes – a research platform for runic inscriptions

A new digital platform for runic inscriptions, including all known runes in Nordic countries and Nordic runes in other countries, was presented in December 2020. The platform contains data from Samnordisk runtextdatabas and Sveriges runinskrifter. Also many other documents have been digitized, including photos, drawings and notebooks from the collections of the two late Swedish rune scholars Olof Celsius and Otto von Friesen. All Dalecarlian runes are also included in the platform, and made searchable for the first time.

Rune inscriptions can be found by three major search criteria: text, signum and location. Every inscription has a page containing related images, documentation and further references. Rune inscriptions are also searchable on a map.

The platform has been realized as a part of Everlasting Runes, a research project carried out by the Swedish National Heritage Board and Uppsala university, Department of Scandinavian Languages. The project was funded by Riksbankens Jubileumsfond and the Royal Swedish Academy of Letters, History and Antiquities.

The platform Runor (only in Swedish) is found here:  
<https://app.raa.se/open/runor/search>.

*Laila Kitzler Åhfeldt, Swedish National Heritage Board*

### Runes, ogham and Pictish symbols on Orkney and Shetland

During the Viking period, Shetland and Orkney were settled by Scandinavians, mostly Norse people. They became overlords on the islands, and lived there side by side with the Picts and the Gaels.

A pilot project led by National Museums Scotland and the Univer-

sity of the Highlands and Islands aims to answer questions about the interactions between these people. The international research team are focusing on two sites – Cunningsburgh (Shetland) and Birsay (Orkney). Both are unique of having evidence of stone monuments inscribed with runes, ogham letters and Pictish symbols.

Stones from these sites have been 3D-scanned by the Swedish County Administration Board and the Swedish National Heritage Board is responsible for analysis of the carving technique by multivariate statistical analysis of the 3D-data. Some of the research challenges include finding patterns in carving technique and trying to distinguish between individual craftsmen. Were there even bilingual carvers?

The ongoing research project is difficult and truly cross-disciplinary, Laila Kitzler Åhfeldt concluded, since very few experts master all these languages, and historical sources about these cultures are scarce.

## SESSION 4: TECHNICAL ART HISTORY

*Lena Dahlén, Sara Ferrari & Cecilia Heisser, Nationalmuseum*

### Italian paintings in the Nationalmuseum – market, musealization, materiality

Nationalmuseum is currently conducting analyses of 60 paintings made by Italian artists between the 14<sup>th</sup> to the 18<sup>th</sup> century. The aim is to understand the historical, natural and economic processes influencing the meaning ascribed to the artworks today. The project focuses on market (sale catalogues, dealers, auction houses), musealisation (from private collection to public display) and materiality (object-focused analysis, frames, labels, collector's marks etc.)

One of the case studies concerns the painting *The Infant Virgin and Saint Anne, surrounded by a group of nuns* by Leandro Bassano (1557–1622). He was part of a prominent family workshop, and both his

father and brothers were also painters. In order to learn more about the painting – i.e. pigments used as well as finding possible hidden signatures, marks and compositions – the painting has been examined by using both IRR and X-ray imaging techniques.

The results of the ongoing project will be published online. The Swedish National Heritage Board is funding the digitisation as well as scientific analyses of a number of paintings.

*Malin Borin, Gothenburg Museum of Art & Tom Sandström, Swedish National Heritage Board*

## An international collaboration for the analysis of Vincent van Gogh's olive grove paintings

A collaborative research project led by van Gogh Museum and Dallas Museum of Art, involving ten international museums and several conservation scientists, has analysed the Olive Groves paintings, a series of works van Gogh finished in 1889.

Gothenburg Museum of Art has coordinated the technical analysis of one of these paintings called *Olive Grove St Remy*. The painting was analysed onsite by the Swedish National Heritage Board using a number of techniques, including X-ray fluorescence for pigment identification. The painting was also X-rayed, photographed with UV and IR light as well as using multispectral imaging technique.

Altogether a large amount of data was created from the technical analysis. The results will be revealed and contextualized for visitors in the exhibition *Van Gogh and the Olive Groves*, due to start in Dallas in October 2021.

## SESSION 5: VISUALISATION TECHNOLOGY

*Bea Uusma, Karolinska Institutet & Magnus Mårtensson, Swedish National Heritage Board*

### Andrée's last diary – revealing hidden text through contemporary technology

In 1897 the Swedish balloonist Andrée failed in his attempt to reach the North Pole. By unknown circumstances, he and the two other members of the expedition perished on White Island in the Arctic Ocean. Their last camp and remains were found in 1930, but their final days on the island are still a mystery.

In an attempt to shed new light on what happened to the expedition members in the last few days prior to their deaths, a research project has been launched to analyse Andrée's last diary. However, the paper in the diary is damaged and brittle and no one has been able to read the notes in full – not even the Swedish chemist and Nobel laureate Svedberg who analysed the diary in 1931.

Bea Uusma and her colleagues hope that by using modern techniques like X-ray fluorescence, trace elemental analysis and technical photography they will be able to decipher the diary. The conclusions will be presented in scientific papers and in a forthcoming book.

The ongoing project is a collaboration between several research institutions and organisations, including Karolinska Institutet and the Swedish National Heritage Board. Gränna Museum and the Swedish National Archives will also be participating.

*Håkan Thorén, The Vasa Museum*

### VASABAS – a 3D management tool for Vasa

Documentation about the 17<sup>th</sup> century Vasa ship has so far consisted of many different types – photos, drawings etc. – with no real coordina-

tion between them. In order to find a future management tool for the ship, The Vasa Museum decided a few years ago to start to digitize all information and to produce a 3D-model of the ship.

Usually archaeologists work with 2D-models, but since the Vasa ship is layered in decks and many artefacts were found in the seabed around the sunken ship, a 3D-model was found more suitable. The five deck-ship has been divided in small models. Each model has been georeferenced and then put together in a mesh model.

Early on in the project it was decided to use photogrammetry instead of laser scanning, since it is relatively cheap and gave easier access to cramped spaces throughout the ship. The drawback is that photogrammetry needs good lighting. Efforts have been made to avoid glossy surfaces, since much of the old oak in the ship is preserved with polyethylene glycole (PEG).

The Vasa museum are currently working to finish the 3D-model, called VASABAS. VASABAS will not only be used as an efficient management tool, in the future it will also allow the museum to welcome visitors onboard a virtual ship, Håkan Thorén said.

## SESSION 6: HERITAGE SCIENCE FOR HISTORICAL RESEARCH

*Anna Lagerqvist Alidoost, Swedish National Archives*

### In the hands of queen Christina and cardinal azzolino – elemental analysis of the 17th century inks in the Azzolino collection

Following her abdication in 1654, the Swedish Queen Christina moved to Rome where she developed a close friendship with Cardinal Azzolino. Their joint archives, called the Azzolino collection, comprises 57 volumes, including letters to and from Christina but also financial records, literate endeavors and scientific notes.



In a pilot study the iron gall ink of 24 documents in the Azzolino collection have been analysed using micro X-ray fluorescence ( $\mu$ XRF). The project aimed to answer two main questions: Is it possible to relate the ink composition to specific writers or geographic location? Is it possible to relate the ink composition to the conditions of the document and the degree of ink corrosion?

The project was based on a collaboration between the Swedish National Archives and the Swedish National Heritage Board, with the help from experts in both France and Italy.

*Emma Jansson, Stockholm University*

## Making in context – reconsidering Anders Zorn's oil paintings

Anders Zorn is one of Sweden's most famous painters, also internationally. He was active in the late 19<sup>th</sup> century and in the beginning of the 20<sup>th</sup> century. In her ongoing PhD in Art History, Emma Jansson focuses on Zorn's oil paintings, combining technical research as well as literature studies.

In a collaboration with the Zorn Museum and the Swedish National Heritage Board a number of Zorn's oil paintings have been technically examined – among them *Midnatt* (from 1891), *Omnibus I and II* (1892) and *Natteffekt* (1895). Also, Zorn's studio material has been analysed. The techniques have included raking light, multispectral and IR photography as well as X-ray fluorescence.

The technical analyses have focused on understanding more about Zorn's painting technique. Although Zorn painted in thick layers early on, the ongoing project has shown that later in his career he applied paint more thinly. Examinations of studio material and pigments also indicate that Zorn's palette, while still using a restricted number of colours, was broader than previously thought.

*Dag Avango, Luleå University of Technology, Gunnar Almevik, University of Gothenburg & Jonathan Westin, University of Gothenburg*

## Cultural heritage in Antarctica

In 1901–1903 Otto Nordenskiöld led the first Swedish expedition to Antarctica. More than a hundred years later, an Argentinean-Swedish expedition went back to the historic remains in late 2019 and early 2020.

The expedition Cultural Heritage Antarctica 2020 (CHAQ<sub>2020</sub>) was set up to collect data for the research project CHAQ, but also in order to contribute with Swedish conservation and documentation expertise to the future management of the built cultural heritage of the Nordenskiöld expedition. The Argentinean organizations for Antarctic research, DNA-IAA, organized and funded the expedition.

Researchers from Luleå University of Technology, KTH, IAA and experts from the University of Gothenburg, commissioned by the Swedish National Heritage Board, conducted conservation work and created high resolution digital representation of the remaining monuments.

The monuments were found to be in good condition, with only small damages. The greatest threat to conservation was climate change. Due to rising temperatures and melting permafrost, land erosion is putting the monuments under an increasing risk to be literally swept into the Antarctic Ocean. According to Gunnar Almevik the time frame for preservation is twenty years, but probably not much more.

## SESSION 7: HERITAGE SCIENCE RESOURCES IN SWEDEN AND IPERION HS

*Stefan Nilsson, The Swedish National Heritage Board*

### IPERION HS – an overview

IPERION HS is a consortium of 67 partners from 23 countries that contributes to establishing a pan-European research infrastructure

on heritage science. It offers training and access to a wide range of high-level scientific instruments, methodologies, data and tools for advancing knowledge and innovation in heritage science. The project budget is over six million euros over three years, from April 2020 – March 2023.

The Swedish National Heritage Board is one of four Swedish partners in IPERION HS. The board manages the Heritage Laboratory, a national research infrastructure offering analytical services and also collaborative research projects on cultural heritage – so called guest colleague projects.

The other three Swedish partners in IPERION HS are Gothenburg University, Umeå University and Uppsala University.

*Philip Buckland, Umeå University*

## Heritage Science meets environmental archaeology – in reality and virtually

The Environmental Archaeology Lab, established at Umeå University in 1994, acts as a national research infrastructure in environmental archaeology. There are many connections between environmental archaeology and heritage science, e.g. common analysis methods, and data infrastructure needs

The Environmental Archaeology Lab is managing and developing the Strategic Environmental Archaeology Database (SEAD). The database was initially developed for the archaeological research community, but its open data access and analysis tools make it useful for many cross-disciplinary research applications, including heritage science.

SEAD is a member of Heritage Science Sweden and also a partner of the European infrastructure for heritage science within IPERION HS. Heading towards a future permanent digital infrastructure for cultural heritage, Philip Buckland sees many opportunities for collaborations between SEAD and the heritage science community.

*Magnus Lundgren, Uppsala University*

## The SciLifeLab Ancient DNA facility – a community resource

Ancient DNA can be extracted (from bone, teeth, tissue and sediment) and analysed in order to study a range of topics, e.g. human evolution and demography, evolution of life and human migration.

The SciLifeLab Ancient DNA facility provides state-of-the-art ancient DNA analysis to a wide community of users, e.g. academic researchers, governments, museums and NGO's. The staff can assist users throughout the process, from initial project planning to report delivery – e.g. in DNA sampling (in lab or on-site), DNA extraction as well as data production and custom bioinformatic analyses.

The Ancient DNA facility is part of SciLifeLab (Science for Life Laboratory), a national research center combining technical expertise with advanced knowledge of molecular bioscience – starting in 2010 as a joint effort between four large research institutions in Sweden. SciLifeLab Ancient DNA is a member of Heritage Science Sweden and a partner of IPERION HS.

*Gunnar Almevik, University of Gothenburg*

## The Craft Laboratory

The Craft Laboratory was established in 2010 in cooperation with heritage organizations, craft enterprises and trade organizations as a means to bridge the gap between research and practice in heritage conservation. The Craft Laboratory, located in Mariestad and belonging to the Department of Conservation at Gothenburg University, focuses on practice-based craft research.

The infrastructure includes lab equipment, archives, e.g. historic building materials, as well as a network of heritage sites and conservation projects. This allows researchers to implement research questions in practice in heritage sites and also in full scale tests in workshops, including masonry, carpentry, painting and horticulture gardening.

Many cultural heritage sites are products of craftsmanship, and safeguarding the cultural heritage requires skills in traditional crafts.

Although craftsmanship seldom appears in the context of heritage science, it is very reasonable to systematically involve craftsmanship in the research of heritage science, Gunnar Almevik concluded.

## Workshop

In a brief workshop at the end of the Heritage Science Forum 2020 the participants were able to meet in digital break-out rooms. They also discussed different topics to develop heritage science, e.g. competencies, digitisation and possible future co-operations.

## Summary

Stefan Nilsson at The Swedish National Heritage Board ended Heritage Science Forum 2020 by saying it had been a very interesting three days. The covid pandemic made it necessary for the Swedish National Heritage Board to explore new ways of organising the forum. For the first time it was held digitally and in English, and in the end this proved to be highly successful. More than 300 participants from the heritage science community all over the world signed up.

Looking ahead to Heritage Science Forum 2021, Stefan Nilsson said it most likely will be held digitally and in English again, and he hoped to see all participants at next year's forum.

