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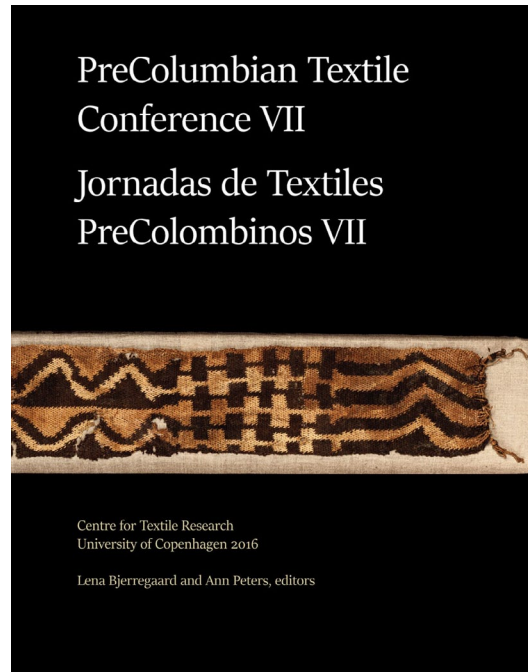
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## Analysis of Paracas fibre material from the Gothenburg Collection

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### Abstract

Gothenburg City has in its collection, 2000-year-old textiles from the Paracas peninsula in Peru. After the exhibition "A Stolen World" at the National Museums of World Culture in 2008, Peru asked for a repatriation of the collection. Following negotiations between the City of Gothenburg and the Ministry of Culture in Peru it was decided that the ownership of the textiles would be returned to Peru. In June 2014, the first four textiles were returned to the National Museum of Archaeology, Anthropology, and History (MNAHP) in Lima as a start of the repatriation. This was also the beginning of a collaboration with the shared objectives to learn more about physical conditions of the Paracas textiles collections in Peru and Sweden. In September 2015, the textile conservator returned to MNAHP to examine the physical condition of the textiles after more than a year of acclimatization to the new museum environment. The investigations into the condition of the collection were undertaken by the textile conservator, as a visiting fellow, at the Heritage Laboratory of the Swedish National Heritage Board along with chemist Kaj Thuresson. Several analytical techniques were employed for the study: fibre documentation, optical microscopy, SEM, compression testing and pH measurements.

### Análisis del material de fibra de Paracas de la colección de Gotemburgo

#### Resumen

La Ciudad de Gothenburg tiene en su colección un grupo de textiles de 2000 años de antigüedad, procedentes de la península de Paracas en Perú. Después de realizarse la exhibición "Un Mundo Robado" en los Museo Nacionales de la Cultura Mundial en 2008, Perú pidió la repatriación de la colección. Luego de las negociaciones entre la Ciudad de Gothenburg y el Ministerio de Cultura del Perú, se decidió entregar los textiles al estado peruano. En Junio de 2014, los primeros cuatro textiles fueron enviados al Museo Nacional de Arqueología, Antropología e Historia del Perú (MNAHP) en Lima, dando inicio al proceso de repatriación. También se inició una colaboración con el objetivo compartido de aprender más acerca de las condiciones físicas de las colecciones de textiles de Paracas en el Perú y en la Suecia. En setiembre de 2015, la conservadora textil volvió al MNAHP para examinar la condición física de los textiles después de más de un año de ajuste al nuevo ambiente museológico. Las investigaciones acerca de la condición de la colección fueron realizados por esta conservadora textil, como investigadora visitante en el Laboratorio de Patrimonio del Patronato de Patrimonio Nacional de Suecia, junto con el químico Kaj Thuresson. Varias técnicas analíticas fueron empleados en el estudio: documentación de fibras, microscopía óptica, microscopía electrónica SEM, prueba de resistencia a la compresión y medición del pH.

Degradation is a natural part of life for all organic material, including textiles. However, there are factors that intensify degradation. It may be light, heat, humidity or pests, but also improper handling. At first glance the Paracas textiles, despite their advanced age, look very well preserved.

The colours are bright and they are embroidered in intricate patterns. It is only when you study them closely and analyse fibres that you realize that this is not the case at all. After many years above ground, since excavations on the Paracas peninsula in Peru during the 1930s<sup>1</sup> the textiles bare clear

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1. Paul, Anne. 1979. *Paracas Textiles: Selected from the Museum's Collection*, Gothenburg, The Ethnographic Museum Gothenburg. Etnologiska Studier nr 34.

signs of degradation. The fibres are brittle and pulverise on handling. In many cases the weaves and embroidery today stay together out of old habit.

Out of the total collection in Gothenburg, 89 textiles are formally owned by the City of Gothenburg, the so called Gothenburg Collection. They are kept in the Museum of World Culture, alongside other objects from the Paracas culture. The Museum is responsible for their care and preservation and for making them accessible to research and the general public in and outside of Sweden. During the last twenty years fibre material from the collection have been analysed as a long-term project to understand the degradation processes and condition of the Paracas textiles in Gothenburg. This work intensified as Peru in 2008 asked for repatriation of the collection.

Between 1991 and 1993 fibres from textiles in the Gothenburg collection were analysed. The pH of the fibres was measured and the surface of the fibres were studied in a scanning electron microscope. The pH of the camelid fibres was 3.0 which is on the acid side and it was suggested that this was an indication of degradation products. In an attempt to reduce the rate of degradation display cases were constructed in which oxygen was substituted with ammonium gas to raise the pH of the fibres. The gas was then replaced with neutral nitrogen gas to prevent further degradation<sup>2</sup>. During the 1990s, forty Paracas textiles were exhibited in Gothenburg Ethnographic Museum. The rest of the collection was stored on Kapa plates, cardboard sheets with polyurethane core.

Again in 2001 analysis of fibres in the Gothenburg collection was carried out. The pH of the fibres was measured and the surface of the fibres were studied in a scanning electron microscope. Fibres were sampled by the textile conservator, from the same textiles as in 1992, textiles that had been on display and subjected to the ammonia and nitrogen treatment. Fibres from textiles in the collection that had not been on display and thus had not been subjected to the ammonium gas treatment, were also sampled. The pH of the treated fibres were now 5.9 and of the untreated fibres, 3.5<sup>3</sup>. The textiles not on display seemed to be relatively unaffected by eight years in storage. Ammonium treatment appears to have had a positive impact on the camelid fibre, while the cellulose in the cotton fibre were too degraded to be analysed. The result was disturbing since the cotton fabric acts as support for the embroideries.



1935.32.188

Photo 1. Paracas textile from the Gothenburg Collection 1935.32.0188/ RT-38074. Photo: The National Museums of World Culture, Sweden (CC-BY)

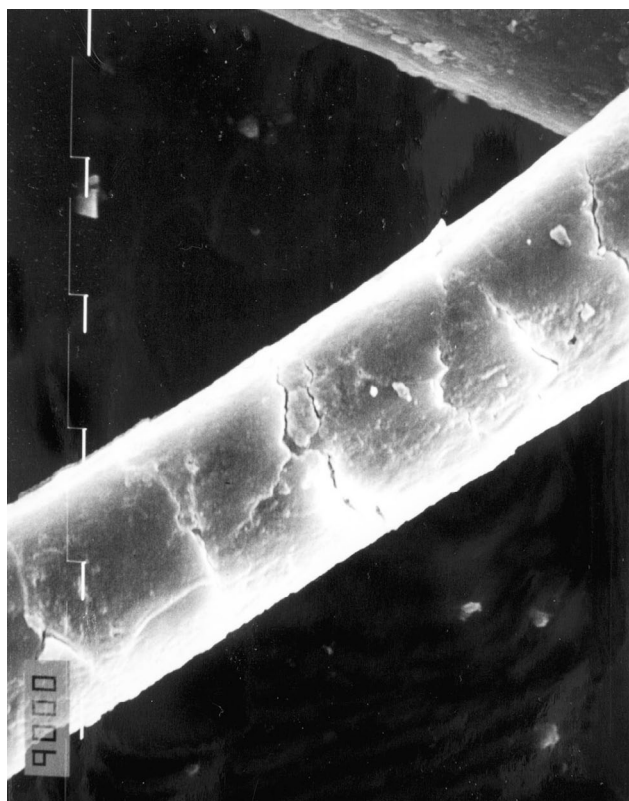


Photo 2. Scanning electron microscope image of a red camelid fibre from the embroidery of the Calendar Mantle under two thousand times magnification. The analysis and Scanning Electron Microscope (SEM) photographs were carried out in 1993 by Harald Åsnes at TEFO, the Swedish institute for textile research and the results are presented in an unpublished report available from TEFO. Photo: TEFO (CC-BY)

2. The analysis of the fibres and the research of ammonium gas treatment were carried out in 1991-1993 by Harald Åsnes at TEFO, The Swedish Institute for Textile Research.
3. The analysis and Scanning Electron Microscope (SEM) photographs were carried out in 2001 by Jörgen Ohlsson, M. Sc., Manager of the Fibre Department at IFP Research AB in Sweden and the results are presented in an unpublished report available from IFP Research AB.



Photo 3. The Gothenburg collection on display in the exhibition “A Stolen World”. Photo: The National Museums of World Culture, Sweden (CC-BY)

In 2001 the collection was packed carefully and moved to the new storage facilities at the Museum of World Culture in Gothenburg<sup>4</sup>. The textiles rest on a support of plain polyester weave stretched over an aluminium frame. This system has been developed locally and is based on a similar system constructed under the guidance of Vuka Rousakis, textile conservator at the Natural History Museum in New York<sup>5</sup>. It has proven to be a well-functioning system, lightweight and volume saving for the fragile archaeological textiles. The textiles were stored for seven years and in 2008 it was time to display them in the exhibition “A Stolen World” at the Museum of World Culture.

Textiles from Paracas have been taken out of Peru illegally almost since they were first discovered. Today there is more knowledge and awareness about the problems associated with looted objects and illicit trade. Even today weapons, drugs and objects travel the same routes. The textiles

in the exhibition are believed to come from the funerary complex Necrópolis de Wari Kayan. Exactly which tombs they come from is not known, since they were looted and have not been properly documented. The exhibition *A Stolen World* aimed to raise general awareness of the consequences when objects are being looted and thereby lose their original context<sup>6</sup>.

In connection with the exhibition, in 2008, Peru asked for a repatriation of the collection. Following negotiations between the City of Gothenburg and the Ministry of Culture in Peru it was decided by the municipal councillor that the ownership of the textiles would be returned to Peru during the years 2014 to 2021<sup>7</sup>. In June 2014 the first four textiles were returned to the Museo Nacional de Antropología, Arqueología y Historia (MNAHP) in Lima, Peru as a start of the repatriation.

In 2013 the conservator, as a visiting fellow at the

4. Javér, Anna. 2012. Om och om igen – att flytta 2000 år gamla textilier från Paracas, Peru. In: *Moving Collection – Processes and consequences* IIC Nordic Group conference, Oslo, October 15-17 2012.

5. Roussakis, Vuka. 1986. “Storage renovation and mounting techniques for the Andean Textile Collection at the American Museum of Natural History”, in *Textile Treatments Revisited. The Harper Ferry Regional Textile Group 8<sup>th</sup> Textile Preservation Meeting*. Washington, 7 November 1986.

6. <http://www.varldskulturmuseerna.se/varldskulturmuseet/aktuella-utställningar/utställningsarkiv/en-stulen-varld/> (2016-06-01)

7. [http://www5.goteborg.se/prod/Intraservice/Namndhandlingar/SamrumPortal.nsf/D709C76F3C280ED2C1257A8E004ECA31/\\$File/KF\\_Handling\\_2012\\_nr\\_151.pdf?OpenElement](http://www5.goteborg.se/prod/Intraservice/Namndhandlingar/SamrumPortal.nsf/D709C76F3C280ED2C1257A8E004ECA31/$File/KF_Handling_2012_nr_151.pdf?OpenElement) (2016-06-01)

National Heritage Board in Sweden, was able to do analysis of fibres from the Gothenburg collection. Together with chemist Kaj Thuresson at the National Heritage Board the weight, length and diameter of 23 fiber samples were measured as well as the pH. For every sample, approximately 4 mm of thread was put into a 0.5 ml Eppendorf safe-lock micro centrifuge tube and covered with 50  $\mu$ l deionized water. The samples were left to extract at room temperature for approximately 6 hours. Measurements were taken with a new Horiba LAQUA twin pH meter calibrated with pH 4.0 and pH 7.0 standard buffer solutions. The pH meter probe was rinsed with ample deionized water between each measurement (but not dried in order not to disturb the sensitive probe surfaces). The samples were then measured by VWR Prolabo paper dosatest for pH 0-14 and all the readings recorded.

SEM images were taken with a scanning electron microscope under 500 and 1000 times magnification. Because the fiber samples were too small to be subjected to a tensile test instead a compression test was constructed. The fibre samples were supported on glass microscope slides and sections of 1 mm were cut off each sample whilst ensuring that the yarn's twist and ply were not disturbed. A microscope slide cover glass was placed on the sample and then carefully weighed down with a 200-gram weight. Stereomicroscope images of the test samples were recorded before and after compression and their behaviour was noted, e.g. the subjective feel of how flexible the fibres were or how easily they crushed under the weight.

The Calendar mantle<sup>8</sup> is the most unique object in the collection and perhaps most unique in the world. It was to be included among the first four objects to be repatriated back to Lima. Fibres from different areas of the mantle were analysed. White undyed camelid fibre from the embroidery, was hardly not changed at all. The 2000 year old fibre is still



Photo 4. Anna Javér as a visiting fellow at the National Heritage Board measuring pH of the fibres. Photo: Marei Hacke, Swedish National Heritage Board (CC-BY)

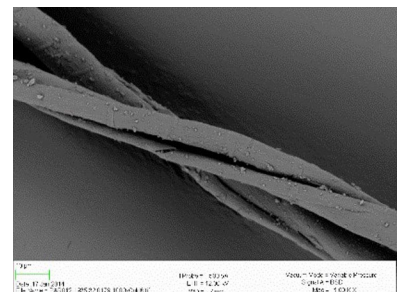
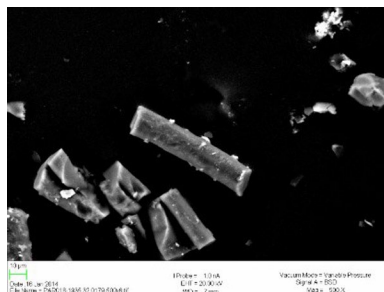
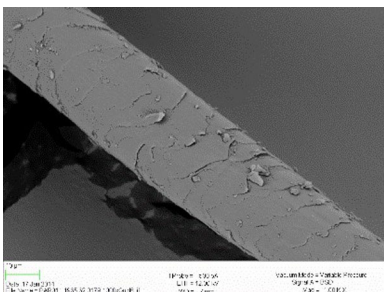


Photo 5 . Scanning electron microscope image of a white camelid fibre (to the left) and a black camelid fibre (in the middle) from the embroidery under magnification. To the left is a cotton fibre from the support weave under magnification. All are from the Calendar Mantle. Photo: Swedish National Heritage Board (CC-BY)

8. <http://collections.smyk.se/carlotta-vkm/web/object/96680> (2016-06-01)



Photo 6 and 6a (detail). The Calander Mantle from the Gothenburg Collection 1935.32.0179/RT-38072 were one can see both the camelid embroidery threads and the cotton support weave. Photo: The National Museums of World Culture, Sweden (CC-BY)



flexible and supple as new. In the scanning electron microscope the white camelid fibre look new with perfect epidermis scales, the lines that characterize wool. Black camelid fibres from the embroidery are in contrast crushed and shatter like glass under the weight. In the dyeing process metal ions have been added in order to get the black colour and with time the metal has accelerated the degradation of the fibre. Today it is very brittle and carbonised<sup>9</sup>. In the scanning electron microscope the black fibre has almost no texture left and breaks into small pieces with sharp ends.

A fibre from the same object but from the cotton support weave have the beautiful - clockwise rotations which is characteristic of cotton. But in the scanning electron microscope one can also observe the degradation of the fibre through the cracks and debris on the surface. In the same textile, as here described in the Calendar Mantle, there are parts that are extremely fragile as well as parts that are flexible as new. The risk of vibrations from handling and transport can be very damaging for the textiles.

We consulted with colleagues at the National Museum in Copenhagen<sup>10</sup> and Museum of Ethnography in Berlin<sup>11</sup> on how to safely transport the textiles. Together with the transport company we constructed crates with double inner boxes so that the vibrations were reduced to a minimum in the inner box with the textiles. The vibrations were measured throughout transportation with data loggers of similar type used during space missions by NASA.

The trip went by truck and boat from Gothenburg to Amsterdam and by plane to Lima, Peru. At Cargo the crates were unloaded together with the Deputy Minister of Culture, the National Heritage Board and former Peruvian ambassador to Sweden met the press and ensured that the Gothenburg collection had arrived safely to the country. The crates were then transported to the Museo Nacional de Antropología, Arqueología y Historia and placed in the textile storage over the weekend to acclimatise from air transport.

Three days later the crates were opened in front of the press by Peru's Minister of Culture and The Swedish Ambassador in Chile and Peru. When they left the room, us conservators had a chance to do a thorough survey of the textile's condition after transport. Only a few new breaks in the delicate embroidery was noticed. The method of packing had worked and condition reports could be filled out and signed.

In the afternoon, we packed the crates again since President Humala wanted the repatriation ceremony to take



Photo 7. The conservators at the Museo Nacional de Antropología, Arqueología y Historia inspecting the Calendar Mantle after transport. Photo: The National Museums of World Culture, Sweden (CC-BY)

place in the presidential palace. The textiles were displayed in the gold room which is a replica of the Hall of Mirrors in Versailles. The Municipal Council President of Gothenburg, The Swedish Ambassador, Peru's Minister of Culture and Peru's Minister of Finance together with President Humala signed the agreement of repatriation. When the ceremony was over the textiles were once again packed and transported them back to the museum where Carmen Thays Delgado and her colleagues are now responsible for the preservation of the collection.

The investigation into the condition of the Paracas fibres continue with a comparative study of fiber material

9. As noticed by Ann H. Peters in early Nasca textiles. Peters, Anne H. 2012. "Identity, Innovation and Textile Exchange Practices at the Paracas Necropolis, 2000 BP", in *Textile & Politics. The Textile Society of America 13<sup>th</sup> Biennial Symposium*. Washington DC, September 19-22, 2012.

10. Visit to the National Museum in Brede, Denmark and personal communication to Textile conservator Maj Ringgaard and conservator Barbara Berlowicz in March 2014.

11. Visit by Lena Bjeergaard to the National Museum of World Culture to see the Gothenburg collection in June 2013.



from the Paracas culture in Peru as part of the agreement between Gothenburg and Peru. 10 more fibres from 4 different objects will be analysed together with conservation scientist Marei Hacke and conservation chemist Kaj Thuresson at the National Heritage board<sup>12</sup>. Fibres from the collection at the Museo Nacional de Antropología, Arqueología y Historia were sampled in September 2015 together with Carmen Thays Delgado and Maria Ysabel

Medina Castro in order to see if there are any noticeable differences in the condition of the fibres. Our intentions are to see how dyes and the condition of the Paracas fibers correspond. Hopefully, the results from the analysis will help to broaden the international interest in this unique textile world and its future and perhaps the conservator's knowledge of material can contribute to the ongoing discussion about repatriation issues.

12. <http://www.k-blogg.se/2016/06/22/starka-resor-skora-tradar/> (2016-06-27)