Monumental effort to save the threatened Viking treasures of Oseberg

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The wood fibers of the richly decorated ceremonial wagon are disintegrated because of the preservation method. Credit: © Museum of Cultural History, University of Oslo / Eirik Irgens Johnsen

Researchers from the Museum of Cultural History in Oslo, working closely with Helmholtz-Zentrum Berlin, have been studying ancient wooden Viking artefacts at the synchrotron radiation source BESSY II. The conservators expect this non-destructive method will yield crucial insights into the degradation of these unique works of art. The wooden artefacts come from a Viking grave found in 1904 at Oseberg near the Oslo fjords.

The Oseberg finding is considered one of the most important testimonies of the Viking Age and is one of the most frequently visited sights in Norway. Yet, they are now in serious danger of collapse because the

wood fibres in the artefacts are disintegrating. The reason is the preservation method widely used a hundred years ago in Scandinavia, by which the artefacts were treated. Now, chemists and conservators of the project Saving Oseberg, which is receiving international support, are trying to save these national treasures of Norway.

By performing tests at the synchrotron radiation source BESSY II at HZB, the conservators from Oslo have examined the condition of the wood to figure out what strategies will work to preserve them in future. "In order to halt the degradation process of the cultural treasures, we have to analyze the chemical processes the preservative has caused in the wood very precisely," says Dr. Hartmut Kutzke who, as chemist at the Museum of Cultural History in Oslo, is leading the conservation project.

The Norwegian scientists used the infrared beamline IRIS for their studies. Employing very high resolution infrared spectroscopy, the researchers have discerned what chemical changes the material has undergone as well as the composition of the overlapping layers of lacquer that have been applied over its hundred-year history of restoration. "The method works completely non-destructively.

The wood fibres of the richly decorated ceremonial wagon are disintegrated because of the preservation method.

The most famous archaeological trove of Oseberg is a well preserved and richly decorated Viking ship, in which two ladies from high social rank have been buried. The ship was not treated with alum. Credit: © Museum of Cultural History, University of Oslo / Eirik Irgens Johnsen

With the brilliant synchrotron radiation from BESSY II, we can study with pinpoint accuracy the tiniest samples hardly visible to the eye," Dr. Ulrich Schade of Helmholtz-Zentrum Berlin describes the advantages of the infrared method.

Alongside the near-complete Viking ship, the burial ground discovered at the Oseberg farm on the Oslofjord contained numerous works of art. This finding from the 9th century counts among the most important testimonies of the Viking Age. At the time of their excavation, some of the the objects were heavily fragmented. At the beginning of the 20th century, restorers preserved the individual pieces of wood, including four ceremonial sleds and one wagon, using a solution of alum (potassium aluminium sulfate). The alum crystallized in the wood,

thereby stabilizing the wood structure. Following this treatment, the fragments were assembled using metal pins and screws and finally given a coat of lacquer.

Over the last twenty years, the researchers have seen these valuable wooden Viking artefacts become increasingly brittle. Tests have revealed that the treated wood is exhibiting strongly acidic reactions. The alum, originally used to strengthen the wood, has led to the complete destruction of the cellulose fibres – a main structural component of the wood. "Some of the Viking treasures of Oseberg are in very bad condition. Some are only held together by the outermost layers of lacquer," Hartmut Kutzke explains.

The researchers have now done infrared studies to see whether the alum has also changed the composition of another important component of the wood – its lignin. Even the metal pins and nails used to hold the wooden pieces together may have triggered catalytic processes in the valuable artefacts and caused unknown interactions with the alum and other materials used in their preservation. Initial results confirm so far that there is no cellulose left in the affected Oseberg artefacts and that the lignin has been strongly modified. At the microscale, the researchers have detected significant differences from other archaeological wood not treated with alum.

Working from these results, the conservators intend to develop new preservation materials for archaeological wood so that they can preserve the Oseberg Viking treasures once again – this time for good. "Our aim is to develop an artificial wood. This could be a type of lignin that will form a new wood structure inside," project leader Kutzke says. These novel materials could then be employed for preserving wooden cultural treasures all around the world.

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