Viking Age Wood Conservation & Cultural Heritage:
Project Semester with KHM Saving Oseberg Forskningsprosjekt

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NOR4900 Nordisk prosjektsemester

Autumn 2018

PART I

Project Semester Overview – Saving Oseberg, Kulturhistorisk Museum

The study of wood use and wooden artifacts forms the thematic focus of this project report regarding my project semester with the Saving Oseberg project (Saving Oseberg Forskningsprosjekt) at the Museum of Cultural History, University of Oslo (Kulturhistorisk museum (KHM), UIO) in Oslo, Norway. During the period of mid-August 2018 to mid-December 2018, I participated in several tasks of the main project, all of which provided direct relevant training and access to sources for my master's thesis in Viking and Medieval Studies. This thesis focuses upon the cross examination and referencing of wood and wood crafting in the Viking Age between the archaeological record and the literary history of the period by comparing material culture to textual evidence and philological analysis, and how wood formed an important part of the cultural identity of the Viking Age. I aim to argue how wooden objects have an informed and complex social biography around the use of the material and its capacity as a metaphor in the literary tradition to inform upon cultural practices, and thus is a medium through which much of what we know about the Viking Age has been acquired. Using the Oseberg burial, and in particular the wagon, as my focus for examining this wider scope of the role of wood in the Viking age, Saving Oseberg provided the ideal environment to acquire new perspectives and more insight into the various parts of my thesis that I wish to explore.

The Saving Oseberg project is a project situated within KHM that seeks to investigate conservation methods for the retreatment of the wooden objects from the Oseberg burial find of 1904 (Brøgger et al. 1917; Brøgger 1945; Rosenqvist 1959a; Roseqvist 1959b). The research conducted within this project examines the different processes involved in the original treatment of the wooden objects and their interaction with materials used in later conservation, preservation, and restoration methods that have led to the current deteriorated state of the objects (Braovac and Kutzke 2012, S203). The researchers involved with the project examine many aspects of the conservation process involved with the artifacts from the discovery of the Oseberg burial, and aim to assess the best form(s) of active or passive retreatment to aid in the slowing of the deterioration of the wooden objects (ibid). For example, different projects monitor the current physical and chemical states of each of the objects, and examine factors such as climate, display environment, and impact of tourists upon the condition of the objects. Others focus on the testing of wood samples for the retreatment of the alum-treated Oseberg wood. The most recent projects also explore new

methodologies involving 3D technology to further examine the details of the Oseberg wooden objects, the effects of the original preservation treatments, and the retreatments.

For this project semester, I was involved in several specific projects that dealt with different areas of research pertaining to Saving Oseberg. Each project offered not only access and information to the archaeological theory and methodology required for the interdisciplinary approach to my thesis, but also connected this to important aspects of conservation and cultural heritage preservation that inform the importance of preserving objects such as those in the Oseberg burial. The projects I was involved in focused upon 1) database uploading of current retreatment test data and hands-on help with the retreatment tests of the alum-treated wood samples from Oseberg, 2) a project involving the cleaning of mold-infested medieval wood samples and investigatory work cross-referencing archival material and hand-written artifact documentation, 3) creating profiles of the hull of the Gokstad ship for future projects involving the monitoring of weight shifting and climate impact upon the condition of the ships, and 4) photogrammetry of the Oseberg alum-treated wood samples. Each of these projects will be a large focus of this report, and will be expounded upon later.

For this project semester, I aimed to fulfill several competency goals with regards to my thesis as I completed the project tasks for Saving Oseberg. The first goal included a specific objective for my thesis to learn more specifically about the Oseberg wooden objects, with the specific outcome of finding the best fit and case study object for my interdisciplinary focused thesis on the intertwining of textual analysis and material culture. In addition, with the Oseberg burial as my main subject of study and the material I would be working with during my time with Saving Oseberg, I wanted to learn more conservation of these objects and of archaeological wood in general. From this, I wanted to explore a large part of my thesis about the understanding of wood use and craft in the Viking age and discover relevant literature. Lastly, I aimed to learn more about the importance of conservation of archaeological objects, pertaining specifically to how objects can convey meaning and knowledge through our study of their materiality, and how this can be connected to the Viking age and medieval textual sources to give us a better view of Viking age social practices. In this regard, discovering more about the material culture side of this thesis, as well as applicable theory to explore this material culture, formed a large part of my goal. In order to organize these competency goals, I organized my goals into four specific project objectives, described below.

Project Semester Learning Objectives

Prior to and during the first weeks of this project semester, I formed several objectives I wished to address during my time with Saving Oseberg. The objectives intended to not only fulfill the needs of the project but also to explore competencies related to my thesis topic pertaining to the importance of wood and wood craft in the Viking age. I will briefly describe the general objective categories for my project semester, as well as the specific outcomes and learning experiences I wished to address during my participation in the project tasks. These objectives and questions blended both my own research in preparation for my thesis as well as the research of Saving Oseberg and my contributions to the project. This proved to be very effective in not only providing me with an abundance of resources and guidance for my thesis topic, but it also offered me with other perspectives to consider with regards to theoretical framework and methodologies when considering research into Viking Age wood artifacts. The competency aims of this semester consisted of many different goals and questions to investigate throughout the semester, and are summarized below.

The first objective directly correlated to my thesis topic and focused upon exploring the use of wood as a crafting and construction material and the connections to their functions and practices in the Viking age. This particular objective, within the scope of Saving Oseberg, focused upon the material culture portion of my thesis. Since this objective forms a core part of my thesis topic, this objective was explored throughout the semester with regards to the tasks performed for Saving Oseberg, as well as through supplementary research into the earliest sources written about the Oseberg burial, its archaeological contents, and conservation. I aimed to learn more about the types of wood used in Norway in the Viking Age, and to explore the different types of objects made from wood, in particular those in the Oseberg burial and other iconic structures such as stave churches (Espedal 2017, 991). This particular point will be addressed in my forthcoming thesis. I also wanted to learn more about how and why different types of wood were used for the crafting of different types of objects, and the reasoning behind these decisions. In addition, I sought to explore more deeply the motivations behind why wood is much more prevalent a building material in Norway.

The second objective aimed to examine the connections between wooden objects and the knowledge of cultural heritage, social practices, and history conveyed through the aspect of their materiality. This objective contributed to understanding the contextualization of wooden objects in their social framework, and how their functionality, composition, decoration, and physical characteristics contribute to our understanding of Viking age culture. In other words, this particular objective aimed to learn how wooden objects contribute to and

inform our understanding of Viking Age cultural heritage and what we know of Viking age history. This objective influenced my selection of the Oseberg wagon as a case study for my thesis, as well as showing me new perspectives and information with regards to social biography theory and the theoretical frameworks that have been used before to explore the connections between material culture and cultural heritage (Fridstrøm 1984, Fuglesang 1984, Gerritsen & Riello 2014). This particular objective will form a core part of my thesis work, especially with regards to the methodology and theoretical framework I plan to undertake in my investigations of wood crafting and wooden objects in the Viking Age.

The third objective highlighted the conservation of archaeological wood artifacts, with particular attention to the objectives of Saving Oseberg and their studies of the conservation techniques of the wooden objects in the Oseberg find from 1904. This included the original processes of conservation of the Oseberg burial goods, and the current efforts to retreat the wooden objects to prevent further deterioration and ensure future preservation. This part of the project semester focused upon investigating and learning more details regarding the original preservation techniques with alum and linseed oil that conservators undertook in the early 1900s following the excavation and storage of the goods from the Oseberg burial site (Brøgger 1945; Rosenqvist 1959a; Roseqvist 1959b). In conjunction with these tasks, I explored different modern and current techniques for the preservation of archaeological wood, including alum-treated wood and waterlogged archaeological wood, as well as the specific conservation research currently being done by Saving Oseberg for their alum-treated wood samples (Braovac & Kutzke 2012; McQueen et al. 2017; McQueen et al. 2018). An important aspect of learning about Saving Oseberg's conservation efforts focused upon the condition of the Oseberg objects at various points in the conservation process, from excavation to storage to preservation treatments to retreatment and the long-term consequences, deterioration, and loss. Learning about these treatments was integral to my understanding of the current aspects of the Saving Oseberg project and was crucial to succeed successfully with my tasks with the project. Learning more about the conservation of wood also showed me the connections between the original processes of conservation of the burial objects, the current retreatment plans and their projections, and the importance of connecting these past and present processes in the preservation of cultural heritage.

The final objective category focused upon the intellectual importance of conserving wooden archaeological material, the role of conservation in preserving memory and history, and the future directions of conservation of Viking age material, with particular regards to the Saving Oseberg project. My aim with this particular objective was to learn more about the

modern importance of studying wooden objects from the Viking age, and how their preservation is crucial to preserving historical knowledge, continued study, national identity, and the symbolism such objects garner for Norwegian collective memory. This objective included some of the current discussions to emerge regarding the preservation of the Oseberg collection and the media discussion surrounding the importance of this material to Norwegian cultural heritage, though this will not be of focus in this current report.

PART II

In this section I will briefly describe the various projects and tasks in which I participated during my project semester with Saving Oseberg. Many of these tasks were ongoing throughout the semester, involving different components or phases, while one (the storage unit project at Brobekk) was a temporary task. The descriptions of these project tasks include the overall aim of the project or task, my individual contributions, and the results achieved from my participation, which will also be explored further in this report.

Alum-Treated Wood Retreatment Tests

The first task of the Saving Oseberg project I joined focused upon database updates of retreatment tests of the Oseberg test archaeological material in conjunction with later participation in polyethyleneglycol (PEG) retreatment tests of Oseberg wood fragments. These retreatment tests form a core purpose of the Saving Oseberg project with the objective of finding the best way to retreat the wooden artifacts currently housed in the Viking Ship Museum (VSH) at Bygdøy. Retreatment solutions include the removal of alum, the substance used to first treat the Oseberg artifacts back in 1904 (Brøgger et al. 1917; Brøgger 1945; Rosenqvist 1959a; Rosenqvist 1959b), and subsequent reintroduction of new consolidants (or fillers) to re-preserve the wood. My tasks for this particular project included updating the KHM museum artifact database MUSIT with retreatment test data, including notes, images, 3D scans, and X-rays, from previous stages of the retreatment testing phases. It also included hands-on participation in the next phases of consolidant impregnation of wood test fragments of the Oseberg collection.

Many of the wooden objects from the Oseberg burial, such as the wagon, animal heads, and sledges, were treated with the product alum (*potassium aluminium sulfate*) according to the current preservation techniques of the time in the early 20th century (Hocker et al. 2012, S176). In addition, linseed oil was another common type of preservative and was the particular method used for preservation of the Oseberg ship (ibid). In the case of the preservation of wood with alum, particularly with the wooden objects of the Oseberg burial, this method proved to have destructive consequences. Alum treatments over time, due to

chemical reactions with internal wood chemistry and other elements present in the treatment tanks, caused high acidity (sulfuric acid), weakened wood structural integrity, and the gradual breakdown of wood lignin which resulted in exceptionally fragile wooden objects (Braovac and Kutzke 2012; Hocker et al. 2012). Additional fragility of the wooden objects resulted from mechanical stresses due to climate influence and humidity causing the repeated dissolution and recrystallization of the alum salt (Hocker et al. 2012, S176-S177). Slowly, this has caused the alum-treated objects of the Oseberg find to weaken severely or in some cases, internally dissolve (ibid).

Current retreatment tests with the Saving Oseberg project focus upon identifying the processes of deterioration of the Oseberg wood and removing the alum salts to prevent further degradation of the wooden objects. It also includes finding a replacement reconservation solution, with as little further damage to the objects as possible (Braovac and Kutzke 2012: S203). The current retreatment tests in which I was able to take an active part involve the next phases of PEG impregnation, begun in earlier phases of the Saving Oseberg project, of waterlogged test Oseberg wood fragments. During this project semester, I was able to document on several occasions the current status of the wood fragments (acidity levels, conductivity), wash, photograph, and resubmerge the fragments in 10% and 25% PEG solutions.

Washing Oseberg test fragments prior to PEG tests, October 2018. Photo credit: Susan Braovac.

As a significant part of the Saving Oseberg project aims and a greater objective in the conservation of the Viking age materials at VSH and KHM, the hands-on research dedicated to alum-treated wood retreatment is an exceptional experience in which I could participate.

This part of the project semester involved me in several aspects of the conservation process with regards to delicate and valuable archaeological material. The retreatment and reconservation of the Oseberg collection has lasting consequences not only upon the preservation of the material itself for the observation and enjoyment of museum visitors, but also for future conservation efforts here and abroad. In addition, the preservation of the Oseberg collection is invaluable in the maintaining of intangible heritage in Norway, wherein this ship and the burial goods form a strong presence of national identity upon the collective memory. While working with the database information and the chemical analyses provided valuable chemistry and investigative experience, the hands-on aspect of this project added a further dimension to my larger aims of learning more integrated methodologies that impact the preservation of cultural heritage, both tangibly and intangibly.

Brobekk Storage Project and Identifying Medieval Wood

The second major task in conjunction with KHM during the middle of October 2018 constituted a week-long maintenance and investigatory project involving the cleaning, cataloguing, and recording of medieval archaeological wood that had been moved from a previous storage location to one of KHM's main storage units, at Brobekk.

Each day consisted of sorting through boxes of medieval wood which had been in storage in Trondheim, Norway, and contained boxes of medieval wood pieces in varying states of mold infestation. The wood pieces themselves ranged in size from small fragments to large cut pieces with 30 cm diameters. The goal of this week-long project was to clear the specimens of the mold, investigate and record any identifying data for artifacts, and later cross-reference the gathered documentation with archival material (letters, emails, conservation records) and current KHM identification information (C-numbers, in particular). This was to identify the objects as something more than just *medieval wood from houses and boats*. This task of the project involved recording all information presented with the artifacts, including all information written on identification tags, on accompanying bags or notes, and on the artifacts themselves. The information collected from the wood samples, based upon the documentation found in the boxes and attached to the artifacts, generally consisted of a designated identification number (a D-number), the storage location, the date of documentation, information about the purpose of the artifact (in this case, dendroprøve), and in some cases, the initials of the conservator, curator, or archaeologist responsible for the records. In addition to the task of recording the information accompanying the wood samples, cleaning the artifacts and their containers formed a large part of the first phase of the project, in order to prepare the artifacts for continued storage and possible use in the future provided

their connection to the museum database was established (a task still in progress at the time of writing). The wood itself had varying degrees of mold infestation and existed in varying states of stability. Those pieces that had readily identified documentation and were in a stabilized state of preservation (either solid, taped together, or in a clean plastic bag) were placed back into their original storage boxes and set aside for further storage. Unidentified pieces or loose fragments that could not be connected to larger pieces were discarded. This last part of the tasks formed a key component of the overall purpose and takeaway from this project as it focused mainly upon the best practices, techniques, and importance of proper documentation with museum objects.

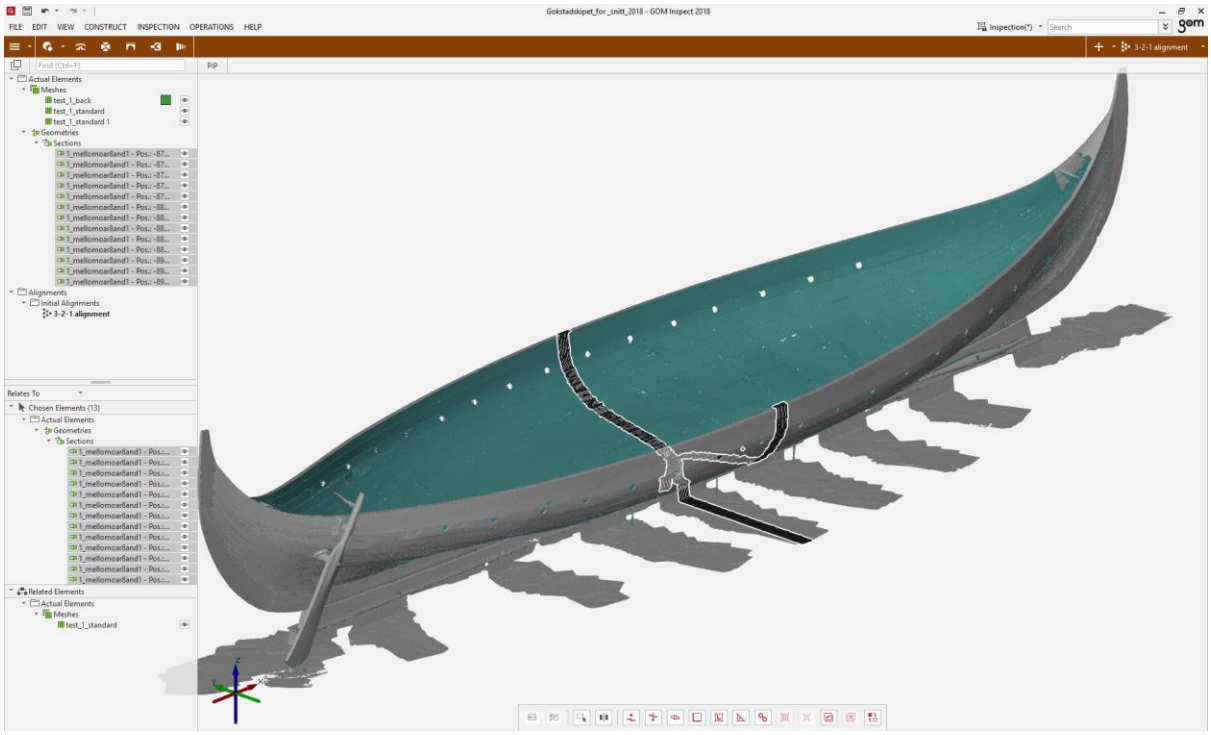
Observing and working with different practices and techniques of the documentation process of artifacts at museums arose as a core aspect of these project tasks, and gaining the hands-on experience working with others' documentation practices proved valuable to understand the importance of these processes. One of the key messages I learned from this experience included the importance of being as clear as possible when documenting artifacts or writing information about museum pieces. This is because the word choice, shorthand, and documentary choices made by one curator may make sense to them, but it may be difficult to decipher for others who work the materials, whether at the same time or in the future. This was especially apparent in our task to record all of the documentation material attached to the artifacts, and many interesting challenges ensued as we tried to decipher more information about our materials. Many of the tags were written with pencil, which, over time and in the presence of dirty and crumbling wood artifacts, either became smudged beyond recognition or faded away from wear. Much of the documentation on the tags was missing, sometimes only including a date of storage or the storage place name. Crucial information such as identification numbers (coinciding with the museum's database) were either missing, mislabeled, or unattached to artifacts. Another important aspect of the actual writing of information on tags included the difficulty in handwriting, where often the words were difficult to read. Another challenge included the documentation of tags and other archival material in a variety of languages other than Norwegian (such as Swedish and Danish) and by museum workers from different nationalities, each with their own forms, procedures, and shorthand for the documentation process. While not necessarily a problem, it presented a challenge when understanding how different groups of artifacts linked together. In addition to the time dedicated to uncovering and deciphering these challenges to the documentation, one of the key aspects of this part of the project taught us the consequences of improper storage procedures and the repercussions of losing information connected to stored artifacts, both for

the artifacts in hand and for the future archives of other archaeological materials. This project, while brief in execution and with a small list of tasks and outcomes, provided insight into the larger challenges faced by museums in the preservation, storage, and conservation of not only materials but information from the past.

Conservation and Climate Effects – Weighing Gokstad

The third task encompassed several different projects and learning situations that currently focus upon the long-term environmental effects of wooden objects displayed in a museum setting, including factors such as humidity, stability, temperature, and vibration. In particular, these projects focused upon the use of different technologies and engineering to aid in the monitoring of the climate environment upon the artifacts in the Viking Ship Museum (VSH). One of the specific pieces of this research focused upon monitoring the climate data, including temperature, humidity, and dew point of the display cases in the museum. This type of monitoring is important with regards to understanding the effects of these factors upon the state of preservation of the wood. This type of data, in conjunction with the effects observed upon the artifacts themselves, is important when considering the effectiveness of current display cases, and how to change these in the future while still making the artifacts accessible to the public. It is also important especially in the future designs of the new Viking Ship Museum when considering the monitoring and display of objects that are in storage and might also be in a much more fragile state.

The specific task in which I had active participation focused upon the use of 3D scanning and engineering to create paper profiles of the outer hull of the Gokstad Viking ship. The purpose of this project was to create wooden support structures to surround Gokstad and prevent the ship from tipping while it was raised for the placement of weight monitoring devices around its perimeter. A similar project had been undertaken earlier in 2018 for the Oseberg ship. The aims of this project and the overall purpose of monitoring the weight distribution of the ships contributes to ongoing research that monitors the impact of the museum environment upon the structural health of the ships with respect to the wood's stability and preservation. My work involved on this project consisted of the creation of twenty stencils or profiles that followed the outline of the outer hull of Gokstad. The profiles were traced from a previously made 3D scan of the entire ship within the 3D scanning and measuring program GOM Inspect 2018, which allowed for precise placement and point-by-point tracing of the outer hull into a stencil of the ship.



Gokstadskipet in GOM Inspect, November 2018. Photo credit: Erin Kristine Pevan.

These profiles created in GOM will then be exported and manipulated in another software printing program called Rhino, from which they can be printed onto paper and traced onto the wooden supports, which will be completed in early 2019. From this methodology, each of the twenty supports has a custom profile that matches the part of the hull under which they will be fitted. The supports, currently in design at the end of the project semester, will be used in the next phase of the project when weight monitoring scales are placed beneath Gokstad to monitor ship movement and weight distribution in a manner similar to the Oseberg ship.

The importance of these projects and the data they acquire has direct consequences for the future management of the Viking Ship Museum's displays and the artifacts within them. The data can be used to present the mechanical consequences of the support structures and vibrations from tourists upon the ships, which manifest in the forms of uneven weight distribution, stress upon different parts of the ship, and visible damage (such as cracks) that have formed over the years (Hocker et al. 2012; McQueen et al. 2017). This has resulted in, for example, the increased fragility of the Oseberg ship and the need for additional support wires to stabilize the constant daily movement of the ship. Similar consequences are expected upon the Gokstad ship as well. With regards to the effects of the climate controlled environments upon the wooden objects, examining the data gathered from the climate sensors in climate controlled displays in conjunction with the visual and chemical data gathered from

the artifacts in these displays, as well as the climate data from the uncontrolled environment of the ships, has demonstrated the importance of studying the impact, over time, of climate conditions upon the stability and fitness of the artifacts. This data is very important to current conservation projects of the alum-treated artifacts of the ship burials in the museum, as well as the continued research and work dedicated to stabilizing and minimizing further damage to the ships.

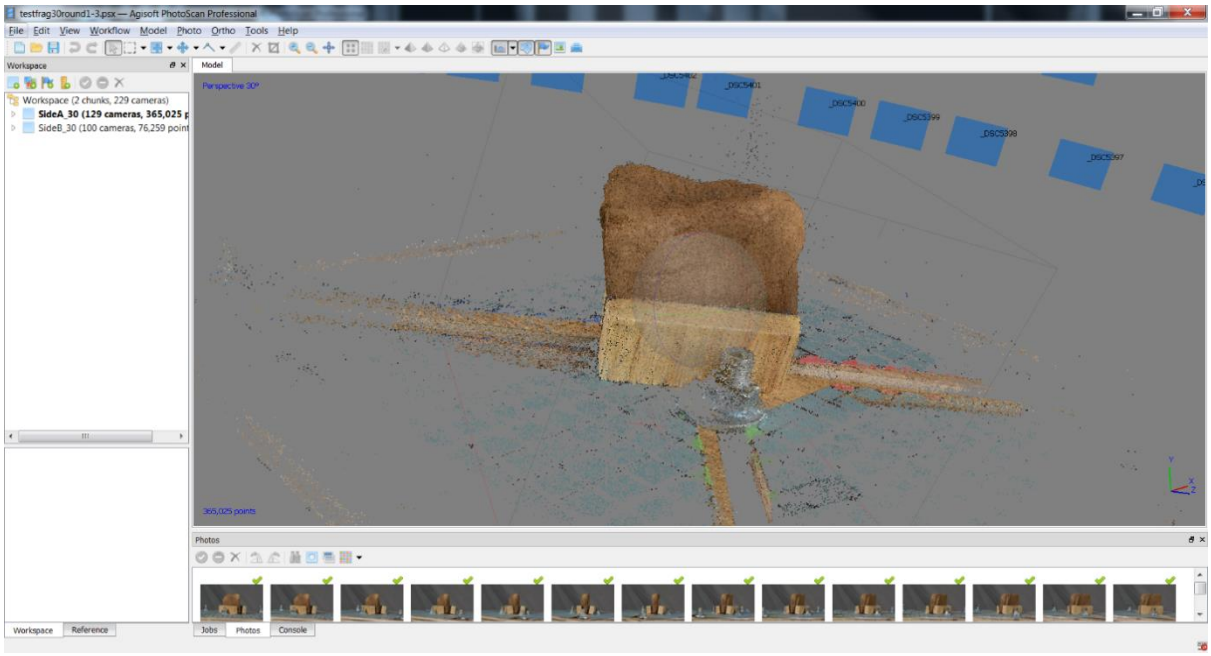
Why is this research important? These data from all the climate and engineering projects with Saving Oseberg has the immediate potential to impact the design decisions of the new Viking Ship Museum, particularly impacting parts of the design pertaining to new display cases and the need for a better climate control system. But equally important are the measures taken as a result of this data to prevent further deterioration of the archaeological material and the ensuing effects of the potential loss of these materials should no action be taken regarding the impact of climate. Not only would the physical loss of these artifacts impact tourism and research opportunities, but an even more devastating loss occurs with regards to the Norwegian people and their association of these objects with Norwegian national identity and cultural heritage symbolism.

Wood Conservation and Photogrammetry

The fourth task of this project semester focused upon the use of digital documentation methods for examining and documenting archaeological material, specifically the use of photogrammetry. The methodology of photogrammetry aims to produce a three dimensional model representation of an object from photographs of the object. In the most basic methodology, overlapping photographs are taken in concentric rings around the entire object or the part that is the focus of three-dimensional reproduction, either in situ or in a lab setting with artificial lighting (AL-Ruzouq 2012, 97). The photographs are then processed in photogrammetry software, such as Agisoft Photoscan, to produce a digital three dimensional representation of the original object, complete with the original surface details and textures in the desired resolution. My specific tasks at the time of writing included learning new techniques in the photogrammetry methodological process, the photography portion of the process, and test 3D renderings of the test samples of wood from the Oseberg burial that are being used for the retreatment tests of alum-treated materials. The rendering of the final models from these current photography phases will happen at a later stage in another project phase.

The use of photogrammetry to recreate three dimensional digital models has many benefits in the museum setting, and is a possible methodology for future research with the

Saving Oseberg project. One of the paths of investigation for Saving Oseberg is to study the current state of the wooden artifacts of the burial, particularly those that are scheduled for retreatment such as the alum-treated artifacts. This is important to assess the current stability and possible detrimental effects that changes in the material composition would occur due to retreatment. Equally important is the study of the objects and their condition after retreatment, in order to assess the success of the treatment and how it will affect the condition of the objects over time. While visual observation works, the intricacies of photogrammetry to produce high-resolution models with respect to the surface details (which is important to consider when dealing with objects that will be on display in a museum) allows for closer inspection and measurements of changes that are unable to be seen or detected by the human eye (Bitelli et al. 2007). This is especially important for Saving Oseberg as they are conducting experiments with different types of retreatment plans for the alum-treated artifacts, and the use of photogrammetry is a valuable way of assessing the different retreatment plans through the comparison of before-and-after results of three dimensional generated models.



Oseberg Test Sample 30 in Agisoft Photoscan, November 2018. Photo credit: Erin Kristine Pevan.

By creating models of the wood samples both before and after retreatment, much more intricate analysis can be done to compare the process of retreatment, especially when the original state of the wood sample is gone due to retreatment. It also helps lower margins of error in analyzing the retreatment process, as the existence of a permanent three dimensional version of the original sample and retreatment tests allows for continuous comparison even throughout different phases of retreatment. It helps lessen human error in

observation as well as assisting the researcher to supplement their visual observations to make decisions about the effectiveness of the retreatment plan. Models created with photogrammetry can be used to generate much more precise and detailed measurements in the software, and can even be compared to other forms of digital documentation (such as 3D laser scans) in order to get a more composite form of the object for comparative analyses.

PART III

Assessment of Learning Objectives

While the project tasks in which I participated were varied and covered a variety of areas within conservation, Viking age materials, and archaeology, each one was successful in applying information or relevance to one or more of the general objectives defined at the outset of the semester. Through the active participation in the projects and the supplemental reading/research required for the project tasks, I was able to not only acquire knowledge and practice that contributed to the successful completion of my Saving Oseberg project objectives and their goals, but also acquire much relevant literature, future directions, and a much more solid projection of my thesis and my desired outcomes for this thesis. In summary, I will discuss the ways in which I felt the objectives of my project semester were met, and the future directions of this research into the thesis semester.

With regards to the first objective, in which I wanted to learn more about wood use and wood craft in the Viking age, I was able to build a list of secondary literature that addressed various in-depth topics about this area of study, which will be furthered elaborated upon in the thesis. Pertaining particularly to the topic at hand, that of Viking age wood craft and wood as a commonly used resource, Hunt (2012) asserts that because of the availability of wood in Norway and it's much more flexible mechanical properties compared to stone (strength, bendability, and tensile properties) made it much more common and favored building material (S11-S12). Wood is also quite adaptable to different types of structures of many different sizes, from homes to fences to weapons to utensils. Pertaining specifically to wood species used in Norway, Lang (1998) describes several different tree species and examples of their use in the Viking age. Lang describes alder used for animal head chair terminals and the beech wood chair from the Oseberg burial, as well as maple, oak (the Oseberg ship), sweet chestnut, and willow. While much of the source material for this particular assessment of Viking age wood considers a wider geographic scope (including the British Isles, Ireland, and Scandinavia), Lang (1998) does describe several iconic wooden objects from Norway, the most important with regards to this thesis is the Oseberg burial. In addition, sources considering the craft of woodcarving highlight the complexity of this

practice, particularly the detailed relief of such works as in the Oseberg burial (Holan 1990; Ingstad 1995; Magerøy and Karlsson 1993, 725). Carved designs into wooden objects and the differences in styles (reliefs, sculptured, incised, and openwork) are of particular interest as they can be used as benchmarks for establishing chronology, storytelling, connecting objects to particular areas, and can show how far stylistic influences have spread (Graham-Campbell 2013). We can then use these benchmarks to examine the Viking age from frameworks including the aesthetic, historical, and archaeological, and can learn cultural, technological, and scientific information from the physicality of the objects themselves and the images they convey. It is within the many physical characteristics of the wooden objects that communicate information that holds much significance.

The close examination of wooden objects with regards to the values they express through their material substance and the manipulation of that substance formed the second objective of this project semester. For this I aimed to learn more about the cultural heritage value of wooden objects and the means (theoretical frameworks) by which we can interpret and contextualize the cultural knowledge gained from wooden objects and why it is important. As I aimed to focus upon Viking age wooden objects, I used the resources at hand through the Saving Oseberg project to select a case study through which to examine the connections between material culture and cultural heritage. The first part of this objective, where I am aimed to find a particular case study within the Oseberg burial cache of objects, manifested in the focus of my thesis centering upon the wagon and its materiality, carvings, and posited purpose in the context of the burial and inferred use prior to burial. The second outcome of this objective formed a core part of building the theoretical framework in which I will analyze the contributions of wooden objects (with the wagon as my case study) to our cultural knowledge of the Viking age. It also includes interpreting the more comprehensive values wooden objects convey through their materiality, especially when cross referenced with literary and textual evidence of the same materials and objects. In this respect, the theory of social biography forms a large part of the framework in which I will examine the wagon as my case study for the contribution of wood to Viking age knowledge. Social biography is described as the identity and intangible qualities an artifact acquires throughout its "social life" as it is used and connected to social practices, relationships, roles, and human agency (Appadurai 1986; Gosden & Marshall 1999; Jerome 2008; Klevnäs 2016; Kopytoff 1986; Lund 2017; Naguib 2013; Sørensen 2009). The challenge with this thesis is to understand and explain how wooden objects contribute to cultural heritage through their social biography, with specific respect to Viking age history and cultural heritage. Through my experience in

this project semester I have learned the struggle of justifying the importance of cultural heritage from the side of conservation and archaeological value. It is through the theoretical framework of social biography, coupled with the textual representation (philology) of wooden objects, that more evidence presents itself to better explain the cultural heritage value of wooden objects for Viking age historical analysis (Clunies Ross & Gade 2012, 202).

The main focus of this project semester comes forth through the outcomes of my third objective which aimed to learn more about the methodology and importance of conservation archaeology of wooden artifacts, and to learn more specifically about the conservation efforts for the Oseberg burial objects in the Saving Oseberg project. As discussed earlier, the Saving Oseberg project researches the best preventive techniques to reduce the deterioration of the alum-treated wooden objects from the Oseberg burial, and to find the best methods of retreating the objects, or to determine if retreatment is too invasive or damaging to the continued preservation of the objects (Braovac & Kutzke 2012; McQueen et al. 2017; McQueen et al. 2018).

Oseberg test fragments in PEG solution, October 2018. Photo credit: Susan Braovac.

The original preservation technique of the Oseberg burial's most deteriorated objects, as described by Brøgger (1945) and Rosenqvist (1959), consisted of immersing the wooden objects into 90 degree Celsius solutions of the alum salts for 2-36 hours (Braovac & Kutzke 2012, S204). The intention was for the alum salt to fill in and stabilize the wood, and to replace the clay-infused water that had previously accumulated within the wood cells as the objects were interred in the burial site in Vestfold (Björdal 2012, S118). The recrystallization

of the alum salts in the water helped provide support where the wooden cell walls were either destroyed or weakened, and upon drying, did not change the shape or structure of the wood. This technique appeared to be ideal at the time as it allowed the reconstruction of the objects as they had originally been constructed (Braovac & Kutzke 2012, S204). Afterwards, the alum-treated objects, along with the Oseberg ship, were covered in linseed oil, fitted together with items such as screws, pins, modern wood, and adhesives, and lastly covered in resin (ibid.). As the objects sat on display throughout the twentieth and early twenty-first centuries, research and observation realized that the alum salt technique resulted in further, albeit slower, deterioration of the objects due to chemical reactions within the wood creating sulfuric acid (Hocker et al. 2012, S176). Over time, this chemical reaction slowly disintegrated the alum-treated wooden objects from the inside out. In addition, the climate environment of the Viking Ship Museum, the display techniques, and the presence of the public caused gradual wear and tear upon the ships, leading to a weakened mechanical state for those objects and the early signs of breakage from these factors (Hocker et al. 2012; McQueen et al. 2017). My participation with Saving Oseberg exposed me to the different types of methodologies being currently used to measure the state of the wooden objects of the Oseberg burial, particularly those including the chemical retreatment of the Oseberg burial objects, those involving the effects of the museum climate upon the objects, and the 3D technology being used to assess the retreatment tests of the alum-treated objects. These methodologies are particularly useful for further consideration in my thesis regarding the close examination of the wagon and its importance for cultural heritage, especially when considering the knowledge aspect that these wooden objects provide regarding the cultural practices of the Viking age. In particular, I am most interested in the use of 3D scanning and photogrammetry of the Oseberg wagon, as these methodologies are scheduled to be commenced in the near future, and may provide additional insight into the carvings, imagery, and composition of the wagon either not examined before, or from another perspective.

The final objective of this project semester focused upon the importance of the conservation of wooden material to cultural heritage, and the kinds of knowledge we can gather from wooden archaeological objects to contribute to memory and history as well as the future directions of preserving archaeological wood. In consideration of the different project tasks performed for this semester, the procedures and techniques followed in these endeavors impacts not only the materials in the present but the preservation of heritage and their memories for those future researchers. While the consequences may not be apparent at the time of conservation, even these projects illustrate the impacts of the seemingly simple

mistakes in the processes and procedures of conservation, display, and storage. The most apparent consequences of improper or incomplete conservation is the discarding of material too damaged for further study, and of material that cannot be properly identified with current museum archival records. Without knowing the specific identification of this material, its contributions to further narrative histories is difficult, if not impossible. As a result, the stories and histories this material could have told is now lost. The importance of conservation procedures and correct identification techniques also impacts those materials available for museum collections and those materials available for researchers. As with any cascading effect, this in turn impacts the information we can learn from the materials and the contexts in which they existed or were used. Learning from these mistakes in conservation procedures does not have to result in only negative consequences, however. In light of the challenges that ensued for these projects, it teaches one to strategize better storage options, especially for delicate, damage prone, or decay-susceptible materials. It also provides opportunities to learn more about how to better manage museum displays and storage spaces, particularly for museum collections in which such space is very limited and new materials or discoveries demanding this space are uncovered.

The most important aspect to take from this project experience is the amount of effort that goes into conservation of archaeological materials, and the importance of preserving not only the physical, tangible material itself, but the intangible information, histories, and knowledge preserved within their physicality. It is these latter intangible pieces of information that will be explored in the archaeological part of my thesis, and will be informed by the philological analysis.

What forms can this intangible information take, particularly from archaeological objects? Wooden objects, more specifically relating to their composition, can provide abundant information regarding the evolution of technology, favored wood species for crafting, and can even connect pieces to certain areas through the origin of the wood and the ways in which it was handled (Fridstrøm 1984, 87; Klaasen & Creemers 2012, S124). We can learn the types of aesthetic qualities favored by the people of the time, such as color and texture, and the different types and their preferred use for different types of objects such as ships, tools, or buildings (Nilsson & Rowell 2012, S5; Monaco et al. 2018, 161). Wooden objects can also act as an "archive" of past climate events, containing information about changes in climate or natural disasters within their ring structure which can be extracted through dendrochronology or isotope analysis (Bonde 1995, Espedal 2017, 986; Klaasen & Creemers 2012, S125). This type of information can be interesting when cross referenced

with other historical sources and objects regarding major events, climatic or otherwise, which coincide with the information found within the structure of the wooden objects and can be used to establish cultural contexts and relationships between objects, events, and location (Adams 2001, 296).

With regards to cultural practices, evidence of wood crafting skills, techniques, tradition, and time period of construction exhibits itself through the carvings, imagery style, and construction of wooden objects (Fridstrøm 1984, 92; Balletti et al. 2017, 77; Monaco et al. 2018, 162). Conservation aims to preserve all aspects of the features within wooden objects, from the whole material itself to the smallest minute details in carvings and other ornamentation which describe the character and identity of the object. Maintaining the objects to as near its authentic original state constitutes an important motivation in conservation and preservation. It is this aspect of objects, authenticity, which provides an interesting framework through which to view Viking age wooden objects, and their legitimacy as works worth preserving because of the historical knowledge embedded within their physicality (Espedal 2017, Jerome 2008). This is important for passing on this information to future generations once these objects have been excavated, as well as for the valorization of these objects, in which some cases these objects become symbols of national identity. By examining wooden objects and considering not only their material composition and archaeological context but also the wider context of their social biography and symbolic meaning through valorization within historical knowledge, we can make more informed and integrative interpretations about the cultural practices of the Viking age.

References

Adams, J., 2001. Ships and boats as archaeological source material. *World Archaeology* 32(3), 292-310.

AL-Ruzouq, R., 2012. Photogrammetry for Archaeological Documentation and Cultural Heritage Conservation *Special Applications of Photogrammetry*, 97-110.

Appadurai, A., 1986. Introduction. Commodities and the politics of value. In *The social life of things. Commodities in cultural perspective*, ed. A. Appadurai. Cambridge, 3-63.

Balletti, F., C. Pelosi, & A. L. Monaco, 2017. The Conservation of Wood Historical Works of Art: Technological Evaluation, Diagnosis, and Valorisation. *9th European Symposium on Religious Art, Restoration & Conservation Iași, 18th-20th May 2017*, 77-81.

Bitelli, G., V. Girelli, F. Remondino, L. Vittuari, 2007. The potential of 3D techniques for Cultural Heritage object documentation. *Proceedings of SPIE – The International Society for Optical Engineering*, 2-9.

Bonde, N., 1995. Dendrochronological Dating of the Viking Age Ship Burials at Oseberg, Gokstad, and Tune, Norway. In *Anthropological Science 1995. Proceedings of a conference of the scientific techniques to the study of archaeology*, eds. Anthony Sinclair, Elizabeth Slater, and John Gowlett. Oxford: Oxbow Monograph 64 1997, Oxbow Books, 195-200.

Braovac, S. & H. Kutzke, 2012. The presence of sulfuric acid in alum-conserved wood – Origin and consequences. *Journal of Cultural Heritage* 13S, S203-S208.

Björdal, C. G., 2012. Microbial degradation of waterlogged archaeological wood. *Journal of Cultural Heritage* 13S, S118-S122.

Brøgger, A. W.,H. J. Falk, & H. Schetelig, 1917. *Osebergfundet 1*. Oslo: Universitetets Oldsaksamling.

Brøgger, A.W., 1945. Oseberggraven-Haugbrottet. In *Viking: Tidsskrift for norrøn arkeologi. Bind IX*, ed. A.W. Brøgger. Oslo: Johan Grundt Tanum, Utgitt av Norsk Arkeologisk Selskap, 1-44.

Clunies Ross, M. and K. E. Gade, 2012. Cosmology and Skaldic Poetry. *Journal of English and Germanic Philology* 111(2), 199-207.

Espedal, K. J., 2017. From Stone to Norwegian Wood. *International Journal of Computational Methods and Experimental Measurements* 5(6), 985-996.

Fridstrøm, E., 1984. The Viking Age Wood Carvers. Their Tools and Techniques. In *Festkrift til Thorleif Sjøvold på 70-Års-Dagen*. Oslo: Universitets Oldsaksamling, 87-92.

Fuglesang, S.H., 1984. Wood Carving from Oslo and Trondheim and Some Reflections on Period Styles. In *Festkrift til Thorleif Sjøvold på 70-Års-Dagen*. Oslo: Universitets Oldsaksamling, 93-108.

Gerritsen, A. and G. Riello, 2014. Introduction: Writing Material Culture History. In *Writing Material Culture History*, eds. Anne Gerritsen and Giorgio Riello. London, New Delhi, New York, Sydney: Bloomsbury, 1-13.

Gosden, C., and Y. Marshall, 1999. The cultural biography of things, *World archaeology* 31(2), 169–78.

Graham-Campbell, J., 2013. *Viking Art*. London: Thames & Hudson, Ltd.

Hocker, E, G. Almkvist, & M. Sahlstedt, 2012. The *Vasa* experience with polyethylene glycol: A conservator's perspective. *Journal of Cultural Heritage* 13S, S175-S182.

Holan, J., 1990. Norwegian wood: A tradition of building. New York: Rizzoli International Publications, Inc.

Hunt, D., 2012. Properties of wood in the conservation of historical wooden artifacts. *Journal of Cultural Heritage* 13S, S10-S15.

Ingstad, A. S., 1995. The Interpretation of the Oseberg find. In *The Ship as Symbol in Prehistoric and Medieval Scandinavia: Papers from an International Research Seminar at the Danish National Museum, Copenhagen, 5th-7th May 1994*, eds. Ole Crumlin-Pedersen & Birgitte Munch Thye. Copenhagen: Publications from the National Museum, Studies in Archaeology & History Vol 1., 138-147.

Jerome, P., 2008. An Introduction to Authenticity. *APT Bulletin: The Journal of Preservation Technology* 39(2-3), 3-7.

Klaasen, R. K.W.M. & J. G.M. Creemers, 2012. Wooden foundation piles and its underestimated relevance for cultural heritage. *Journal of Cultural Heritage* 13S, S123-S128.

Klevnäs, A. M., 2016. 'Imbued with the Essence of the Owner': Personhood and Possessions in the Reopening and Reworking of Viking-Age Burials. *European Journal of Archaeology* 19(3), 456-476.

Kopytoff, I., 1986. The cultural biography of things. Commoditization as process. In *The social life of things. Commodities in cultural perspective*, ed. A. Appadurai. Cambridge, 64-91.

Lang, J. T., 1988. Viking Age Decorated Wood, Medieval Dublin Excavations 1962-81 Series B1. Dublin: Royal Irish Academy.

Lund, J., 2017. Connectedness with things. Animated objects of Viking Age Scandinavia and early medieval Europe. *Archaeological Dialogues* 24(1), 89-108.

Magerøy, E.M. and L. Karlsson, 1993. Woodcarving. In *Medieval Scandinavia: An Encyclopedia*, eds. Phillip Pulsiano, et al. New York: Garland Reference Library of the Humanities 934, Garland, 725-737.

Monaco, A.L., F. Balletti, & C. Pelosi, 2018. Wood in Cultural Heritage: Properties and Conservation of Historical Wooden Artefacts. *European Journal of Science and Theology* 14(2), 161-171.

McQueen, C.M.A., D. Tamburini, J.J. Łucejko, S. Braovac, F. Gambineri, F. Modugno, M.P. Colombini, & H. Kutzke, 2017. New insights into the degradation processes and influence of the conservation treatment in alum-treated wood from the Oseberg collection. *Microchemical Journal* 132, 119-129.

McQueen, C.M.A., Tamburini, D., & S. Braovac, 2018. Identification of inorganic compounds in composite alum-treated wooden artefacts from the Oseberg collection. *Scientific Reports* 8 (2901), 1-8.

Naguib, S., 2013. Museums, Diasporas and the Sustainability of Intangible Cultural Heritage. *Sustainability* 5, 2178-2190.

Nilsson, T. & R. Rowell, 2012. Historical wood – structure and properties. *Journal of Cultural Heritage* 13S, S5-S9.

Rosenqvist, A. M., 1959(a). The Stablizing of Wood Found in the Viking Ship of Oseberg: Part I. *Studies in Conservation* 4(1), 13-22.

Rosenqvist, A. M., 1959(b). The Stablizing of Wood Found in the Viking Ship of Oseberg: Part II. *Studies in Conservation* 4(2), 62-72.

Sørensen, M. L. S., 2009. Gender, Material Culture, and Identity in the Viking Diaspora. *Viking and Medieval Scandinavia* 5, 253-269.