Scientific Committee:
Henk Kars, Vrije Universiteit Amsterdam
Ian Panter, York Archaeological Trust
Jane Sidell, English Heritage
Mark Pollard, University of Oxford
Mike Corfield, Stafford, UK
Taryn Nixon, Museum of London
Vicky Richards, Western Australian Museum
David Gregory, National Museum of Denmark
Henning Matthiesen, National Museum of Denmark

Organising Committee:
Karen Brynjolf Pedersen
Henning Matthiesen
David Gregory
Mads Chr. Christensen
Welcome!

Welcome to Copenhagen and to the 4th conference on Preserving Archaeological Remains In Situ PARIS4 hosted by the National Museum of Denmark.

The key aim of PARIS4 is to gather together researchers and managers from both archaeology and other disciplines in a forum where problems and solutions, policies and strategies from many regions can be shared and discussed.

PARIS4 takes up the thread from the three previous PARIS conferences, in four different sessions where different key questions are addressed:

1. Degradation of archaeological remains. Can we quantify degradation rates and what rates are acceptable?

2. Monitoring and mitigation case studies – with special focus on long term projects. How, and how long, should sites be monitored?

3. Protocols, standards and legislation for monitoring and management. Is it realistic to make multinational standards when the sites and national legislations are so variable?

4. Preserving Archaeological Remains in situ. Can we document the effectiveness of in situ preservation after nearly 2 decades of research?

The programme includes 46 presentations from 15 different countries which will address these questions. A round table discussion at the end of the conference will try to summarize the results and the way forward.

We are extremely grateful to the institutions and individuals who assisted in making this symposium possible. In particular we would like to thank the Farumgaard Foundation, The National Cultural Heritage Agency of Denmark, English Heritage, the Vikingship Museum in Roskilde, the Palaces and Properties Agency, and Museum of Copenhagen for financial and practical support.

On behalf of the organizing and scientific committees

David Gregory & Henning Matthiesen
National Museum of Denmark
MAIN PROGRAMME

Sunday, May 22nd, 2011
18:00-21:00  Registration and reception at the National Museum

Monday, May 23rd, 2011
08:00-09:00  Registration
09:00-16:40  Symposium at the National Museum, Sessions 1 and 2
17:00-19:00  Visit to Metro Excavations or Ruins under Christiansborg.

Tuesday, May 24th, 2011
09:00-16:00  Symposium at the National Museum, Sessions 2 (continued) and 3
18:30-21:30  Conference dinner at Tivoli.

Wednesday, May 25th, 2011
09:30-16:00  Symposium at the National Museum, Session 4 and round table discussion

Thursday, May 26th, 2011
08:30-17:30  Excursion to Roskilde.

Friday, May 27th, 2011
09:00-12:00  For those interested, it is possible to have an informal, guided tour of the Conservation Department (14 km north of Copenhagen).
Practical details
The main conference venue is the National Museum of Denmark where conference staff will be present at all times. Entrance to the museum from Ny Vestergade 10.

Conference hosts will also be present at all other arrangements during PARIS4. The organisers can be contacted on the following numbers:
Henning Matthiesen: +45 22974642
David Gregory: +45 20713522
Karen Brynjolf Pedersen: +45 50760551

Time and place:

- Registration for the symposium takes place in the hall of the National Museum. Entrance from Ny Vestergade 10.

- Visit to Metro Excavations or Ruins under Christiansborg takes place Monday 17:00-19:00. There is room for approximately 50 people on each tour, so please tell us which tour you prefer during Sunday or Monday. We walk together from the National Museum to these venues right after the last presentation on Monday.

- The conference dinner takes place at Restaurant Grøften in Tivoli. There is an entrance ticket to Tivoli in the conference bag for those who have registered for the dinner. Meeting point: at the main entrance of Tivoli, Vesterbrogade 3 Tuesday at 18:30.

- The excursion to Roskilde takes place Thursday 8:30-17:30. The excursion includes a 1½ hour boat trip in a Viking ship replica, so please bring water/wind proof clothing. Meeting point: Outside the main entrance of The National Museum, Ny Vestergade 10. The bus leaves at 08:30 so please be there before.

- The informal guided tour to the Conservation Department, IC Modewegsvej 1, 2800 Lyngby (14 km north of Copenhagen) takes place Friday 09:00-12:00. Please tell us during the week whether you are interested in participating. Meeting point: Brede Station, 2800 Lyngby at 08:50. Exact travel instructions may be found at www.rejseplanen.dk, but in brief you can take the S-train, Line B towards Holte, get off at Jægersborg station, change platform and take the local train to Brede station. For those staying in central Copenhagen one of our colleagues can meet you on The central Station platform 9-10, where you will take the S-train line B at 08:17.
Metro excavation
Ruins under Christiansborg
National Museum
Tivoli, Main entrance
Central station
Programme for the PARIS4 conference

(O) Oral presentation, (P) Poster, short presentation

Sunday, May 22nd, 2011

18:00 - 21:00 Registration and reception at the National Museum

Monday, May 23rd, 2011

08:00 - 09:00 Registration at the National Museum

09:00 - 09:10 Welcome
David Gregory and Henning Matthiesen

09:10 - 09:15 Welcome
Per Kristian Madsen, Director of National Museum of Denmark

09:15 - 09:30 Opening speech
Anne Mette Rahbæk, Head of National Cultural Heritage Agency in Denmark

Theme 1: Degradation of archaeological remains
Chairmen: Jim Williams & Mark Pollard

09:30 - 09:50 (O) Jana Gelbrich, E. I. Kretschmar, Norbert Lamersdorf, Holger Militz
Laboratory experiments as support for development of in situ conservation methods.

An analytical methodology for the study of the corrosion of ferrous archaeological remains in soils.

10:10 - 10:30 (O) Sandra Ricci, Barbara Davidde
Some aspects of the bioerosion of stone artefacts found underwater: significant case studies

10:30 - 11:00 Coffee break

11:00 - 11:20 (O) Vicki Richards, David Gregory, Ian MacLeod, Henning Matthiesen, Michael Verrall
Reburial and Analyses of Archaeological Remains in the Marine Environment - Investigations into the Effects on Metals

11:20 - 11:40 (O) Marion Heumüller
Erosion and archaeological heritage protection in Lake Constance and Lake Zürich

11:40 - 12:00 (O) Michel Vorenhout
Monitoring projects in the Netherlands: can we predict preservation ?
12:00 - 12:20 (O) D.J. Huisman
Deep impact: what happens when archaeological sites are built over?

12:20 - 13:20 Lunch

Research on conservation state and preservation conditions in unsaturated archaeological deposits in Oslo

13:40 - 14:00 (O) Steve Bodecker
Preserved or destroyed? Quantification methods for the urban areas of the Lower Geman Limes

14:00 - 14:20 (O) Brian Durham, Robert van de Noort, Vibeke Vandrup Martens, Michel Vorenhout
Organic loss in drained wetland monuments: managing the carbon footprint.

14:20 - 14:25 (P) Theresa Mercer, Robert Smith, Malcolm Lillie
Changes in the physico-chemical and microbial nature of wetlands from the leaching of copper, chromium and arsenic (CCA)-treated wood.

14:25 - 14:30 (P) M.M. van den Berg
Hydrology, water-management and in situ preservation of archaeological sites; towards a risk assessment system.

14:30 - 14:45 Summary of Theme 1 by chairmen

14:45 - 15:15 Coffee break

Theme 2: Monitoring and mitigation case studies
Chairmen: Jane Sidell & Hans Huisman

15:15 - 15:35 (O) Louise Jones, Martin Bell
In Situ Preservation of Wetland Heritage: Hydrological and Chemical Change in the Burial environment of the Somerset Levels, UK.

Lowland floodplain responses to extreme flood events: long-term studies and short-term microbial community response to water environment impacts.

15:55 - 16:15 (O) Anna Tjelldén, Søren M. Kristiansen, Knud B. Botfeldt
In situ preservation of the weapon sacrifice in Illerup Ådal - An estimation of the preservation conditions in the northern part of the sacrificial bog in 2009.

16:15 - 16:35 (O) Jørgen Hollesen, Jan Bruun Jensen, Henning Matthiesen, Bo Elberling, Hans Lange, Morten Meldgaard
Kitchen-middens and climate change - the preservation of permafrozen sites in a warm future.

17:00 - 19:00 Visit at Metro excavations or Ruins under Christiansborg
### Theme 2: Monitoring and mitigation case studies (continued)
Chairmen: Jane Sidell & Hans Huisman

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<thead>
<tr>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
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<tr>
<td>09:00 - 09:20</td>
<td>Vicki Richards</td>
<td>In-situ Preservation and Monitoring of the James Matthews Shipwreck Site.</td>
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<td>09:20 - 09:40</td>
<td>Daniel Pascoe</td>
<td>Samuel Pepys’s Navy preserved in-situ?</td>
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<td>09:40 - 10:00</td>
<td>Roberto Petriaggi, Barbara Davidde</td>
<td>The ISCR Project &quot;Restoring Underwater&quot;: an evaluation of the results after ten years from the beginning.</td>
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<td>10:00 - 10:20</td>
<td>Charlotte Gjelstrup Björdal, David Gregory, Martijn Manders, Zyad al-Hamdani, Christin Appelqvist, Jørgen Dencker</td>
<td>Strategies for protection of wooden underwater cultural heritage in the Baltic Sea against marine borers. The EU-project “WreckProtect”.</td>
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<td>10:20 - 10:50</td>
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<td>Coffee break</td>
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<tr>
<td>10:50 - 11:10</td>
<td>Hans de Beer, Henning Matthiesen, Ann Christensson</td>
<td>Quantification and visualisation of degradation at WHS Bryggen in Bergen, Norway</td>
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<td>11:10 - 11:30</td>
<td>Anna Petersén, Ove Bergersen</td>
<td>An assessment of the status and condition of archaeological remains preserved in situ in the medieval town of Trondheim based on archaeochemical investigations conducted during the period 2004-2010.</td>
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<td>11:30 - 11:35</td>
<td>Christina Dal Ri, Susanna Fruet</td>
<td>Preserving archaeological remains in situ: three case studies in Trentino – Italy</td>
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<td>11:35 - 11:40</td>
<td>Dana Goodburn-Brown</td>
<td>Preservation In-Situ for Tourism: An early Christian monastery and church on Sir Bani Yas Island, Western Abu Dhabi, UAE</td>
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<td>11:40 - 11:45</td>
<td>Lu Bai</td>
<td>Sheltering archaeological sites in China: approaches to preventative conservation and the public display of earthen archaeology</td>
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<td>11:45 - 11:50</td>
<td>Daniela De Mattia</td>
<td>Integrated design of conservation of the archaeological heritage.</td>
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<td>11:50 - 11:55</td>
<td>G. De Lange, M. Bakr, J. Gunnink, D.J. Huismann</td>
<td>A predictive map of compression-sensitivity of the Dutch soil archive</td>
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<td>11:55 - 12:00</td>
<td>Michel Vorenhout</td>
<td>Current techniques in monitoring</td>
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<td>12:00 - 12:15</td>
<td>Summary of Theme 2 by chairmen</td>
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<td>12:15 - 13:15</td>
<td>Lunch</td>
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<td><strong>Theme 3: Protocols, standards and legislation</strong></td>
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<td>Chairmen: Jens Rytter &amp; Henk Kars</td>
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<td>13:15 - 13:35</td>
<td>(O) Anke Loska, Ann Christensson</td>
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<td><em>Take the right decision everybody</em></td>
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<td><em>In situ preservation of ancient floor mosaics in Turkey.</em></td>
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<td>13:55 - 14:15</td>
<td>(O) Tajana Plese</td>
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<td><em>Results of cultural management through economical cost effectiveness of Croatian archaeological heritage: the example of Roman civitas lovia (Ludbreg).</em></td>
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<td>14:15 - 14:35</td>
<td>(O) Jonas Van Looveren</td>
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<td><em>Sense or Nonsense of International Standards for Archaeological Advisory Commissions: The case of Flanders (Belgium).</em></td>
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<td>14:35 - 15:05</td>
<td>Coffee break</td>
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<td>15:05 - 15:25</td>
<td>(O) B.J.H. van Os, J.W. de Kort, D.J. Huismann</td>
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<td><em>A qualitative approach for assessment of the burial environment by interpreting soil characteristics. A necessity for archaeological monitoring.</em></td>
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<td>15:25 – 15:45</td>
<td>(O) Jesper Stub Johnsen</td>
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<td><em>Conservation of cultural heritage – specifications, guidelines, procedures</em></td>
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<td>15:45 - 15:50</td>
<td>(P) Nele Goeminne</td>
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<td><em>Development of an “Archaeological Monumentenwacht” in Flanders.</em></td>
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<td>15:50 - 15:55</td>
<td>(P) Pearce Paul Creasman</td>
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<td>15:55 - 16:10</td>
<td>Summary of Theme 3 by chairmen</td>
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<td>18:30 - 21:30</td>
<td>Conference dinner at Tivoli</td>
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**Wednesday, May 25th, 2011**

**Theme 4: Preserving archaeological remains in situ - can we document it works?**
Chairmen: Mike Corfield & Vicky Richards

09:00 - 09:20 (O) I. Nyström Godfrey, T. Bergstrand
*The RAAR project - heritage management aspects on reburial after 10 years of work.*

09:20 - 09:40 (O) Jane Sidell
*PARIS; London. One hundred and fifty years of site preservation.*

09:40 - 10:00 (O) Mike Corfield
*The Rose Theatre: the final challenge.*

10:00 - 10:20 (O) Richard Brunning
*Partial solutions to partially understood problems – the experience of in situ monitoring and preservation in Somerset’s peatlands.*

10:20 - 10:50 Coffee break

10:50 - 11:10 (O) D.J. Huisman, G. Mauro, R. M. van Heeringen
*The never-ending story? What can we learn from 15 years of archaeological monitoring on the former island Schokland.*

11:10 - 11:30 (O) Ian Panter, Tim Malim
*Is preservation in situ a sham? Can monitoring prove the continued preservation of waterlogged deposits?*

11:30 - 11:50 (O) Jim Williams
*20+ years of monitoring in England - what have we learnt?*

11:50 - 11:55 (P) Tracy Ireland
*Conservation in situ of colonial archaeological remains in Australia and New Zealand: Methods, meanings and community benefits.*

11:55 - 12:00 (P) Sorna Khakzad
*The complications and effectiveness of in situ preservation methods for underwater cultural heritage sites.*

12:00 - 12:05 (P) David Gregory, Henning Matthiesen
*Nydam - in situ preservation at work.*

12:05 - 12:20 Summary of Theme 4 by chairman

12:20 - 13:20 Lunch

13:20 - 14:50 Round table discussion. Chairman: David Gregory & Henning Matthiesen

14:50 - 15:20 Coffee break

15:20 - 15:50 Closing address, next conference
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<th>Date</th>
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<tr>
<td>Thursday, May 26th</td>
<td>8:30 - 17:30</td>
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<tr>
<td>Friday, May 27th</td>
<td>09:00 - 12:00</td>
<td>Informal guided tour of the Conservation Department</td>
<td>14 km North of Copenhagen</td>
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Theme 1: Degradation of archaeological remains

Laboratory experiments as support for development of *in situ* conservation methods

Jana Gelbrich 1,*, E. I Kretschmar 2, Norbert Lamersdorf 3, Holger Miltitz 4

1German Maritime Museum, Hans-Scharoun-Platz 1, 27568 Bremerhaven, Germany
2Section Biocides IV1.2, Federal Environment Agency, Germany;
3Department of Soil Science of Temperate and Boreal Ecosystems, University of Goettingen, Germany;
4Department of Wood Biology and Wood Products, University of Goettingen, Germany
*Presenting author: gelbrich@dsm.museum

Archaeological wood, stored in water saturated conditions, must be well preserved as cultural heritage. The main enzymatic wood degraders in such near or completely anoxic conditions are erosion bacteria (EB) and up to now it is not possible to prevent this kind of wood degradation in *in situ* or reburial conservations completely.

For development of preservation strategies fundamental knowledge about the living conditions of the EB is needed. Therefore, microcosm experiments were established which simulate the natural waterlogged conditions of wood in order to establish wood decay with naturally occurring bacteria, to monitor and manipulate the wood degradation process by EB under controlled laboratory conditions.

The establishment of bacterial wood degradation in laboratory microcosm experiments was successful and in this study the role of oxygen and chemical composition of the sediment was investigated. Therefore, the microcosms were subjected to different gassing treatments and the free dissolved oxygen was measured in different depths of the microcosms by special oxygen sensors (optodes). In further experiments the chemical composition of the sediment was verified to investigate the influence of different nutrient concentrations to the degradation process by EB.

From the findings it can be concluded that bacterial wood decay can proceed without free oxygen present but that it is more intense if oxygen is available. A water flow like streams in the sea simulated by vertical water circulation, seem to stimulate the degradation activity and the degradation of wood by EB seem to be a result of low nutrient levels of the surrounding.

All these results can be used directly as basics for improvements of *in situ* or reburial conservation strategies. Further laboratory research is necessary for more detailed knowledge of the living conditions of EB as base for best possible preservation strategies to preserve archaeological wet wood *in situ* as cultural heritage.
An analytical methodology for the study of the corrosion of ferrous archaeological remains in soils

Mandana Saheb1,2, Delphine Neff1, Michael Descostes, Henning Matthiesen3, J.P. Gallien1, Philippe Dillmann1,4
1SIS2M/LAPA, CEA/CNRS UMR3299, 91191 Gif-sur-Yvette Cedex, France
2AREVA NC - Business Group Mines, Research and Development Department (DR&D), France
3Department of Conservation, National Museum of Denmark, IC Modewegsvej, 2800 Lyngby, Denmark
4Institut de recherche sur les Archéomatériaux, UMR 5060 CNRS, France
* Presenting author: mandana.saheb@cea.fr

In the context of the in-situ preservation of archaeological remains, the corrosion mechanisms of ferrous artefacts in soils are studied. On some archaeological sites where in-situ preservation is performed, the environment is watersaturated and anoxic. However, an oxidizing perturbation during the burial cannot be totally excluded. Such perturbation may occur for instance when excavations are performed near the site. This fluctuation of the redox conditions could influence the corrosion processes. In both cases, anoxic or aerated, it is necessary to correlate the environmental conditions to the corrosion processes occurring on archaeological remains.

For this purpose, a special methodology was developed in order to characterize the corrosion system constituted of the environment and the ferrous object. The experiments were particularly developed on the archaeological site of Glinet, an old ironmaking from the 16th C. (France, Normandy).

On the one hand, the environmental conditions are characterized. The site was instrumented in order to follow the evolution of porewater chemistry, and more particularly the key-parameters in iron corrosion (redox potential, pH, O2 concentration, alkalinity, total iron, major cations and anions concentration). On the other hand, the corrosion layer formed on archaeological remains that had been exposed to several environmental conditions during their burial was characterized using microbeam techniques. Corrosion products were detected and identified on transverse sections. To determine the location of the different phases, composition and structure are determined using complementary microbeam techniques (Raman microspectroscopy, X-ray microdiffraction, X-ray microfluorescence, scanning electron microscopy and energy dispersive spectroscopy). Then, in order to correlate the corrosion products formed on the archaeological artefacts and the environmental conditions, thermodynamic modelling is performed.

This study presents a complete characterisation of the corrosion system, from the environment to the object, in order to understand the corrosion mechanisms in soils.

Some aspects of the bioerosion of stone artefact found underwater: significant case studies

1Sandra Ricci*, 2Barbara Davidde
1,2 Istituto Superiore per la Conservazione ed il Restauro (ISCR). Via Di San Michele 23 00153, Rome, Italy
* Presenting author: sandra.ricci@beniculturali.it

Within the framework of the project Restoring underwater started in 2001, the ISCR Marine Biology sector with the ISCR Underwater Archaeology Operation Unit has begun a study of the deterioration of stone artefacts exposed to marine environments (Torre Astura – Nettuno; Baia – Naples). These studies have allowed to better understanding the factor of degradation by biological, mineralogical and petrographic analyses and to develop measures for the protection in situ of cultural heritage. Based on what was recorded, usually the bioerosion presents various degrees of gravity: limited and sporadic damage or very serious alterations. Depending on their chemical composition, the artefacts proved to be particularly susceptible to the action of corrosion exercised by perforating animal and plant organisms.

This phenomenon becomes more significant in the case in which the artefacts remain exposed and in the same position for a long period of time. It is possible to confirm that the combined action of attack from clionides (sponges) and bivalves can lead, over time, to the total destruction of portions of the artefact (macroboring). As well as these more macroscopic types of damage there was evidence of the widespread presence of microscopic bioerosion (microboring), caused by autotrophic and heterotrophic microorganisms, visible only through SEM observations, which despite not creating large chambers, progressively undermine the resistance of the stone and facilitate the development of other biodeteriogens. This paper will be focused on the characterization of the bioerosion observed on different artefacts: the roman statues discovered underwater in the Grotta Azzurra, Capri and in the Campi Flegrei area (Naples –Italy), and the marble sarcophagi that are still on the seabed of San Pietro in Bevagna (Taranto- Italy).
Reburial and Analyses of Archaeological Remains in the Marine Environment – Investigations into the Effects on Metals

Vicki Richards¹*, David Gregory², Ian MacLeod³, Henning Matthiesen², Michael Verrall⁴
¹Department of Materials Conservation, Western Australian Museum, Shipwreck Galleries, 45-47 Cliff St, Fremantle, WA 6160, Australia
²Conservation Department, National Museum of Denmark, Denmark
³Collection Management & Conservation, Western Australian Museum, Australia
⁴Australian Resources Research Centre (ARRC), Australia
*Presenting author: vicki.richards@museum.wa.gov.au

The treatment and long-term storage of recovered cultural material from underwater heritage sites is becoming less cost effective and reburial of archaeological sites and the associated artefacts in the marine environment is becoming increasingly common practice in managing the submerged cultural resource. Following recent large-scale underwater archaeological excavations in Marstrand harbour, Sweden the majority of recovered finds were reburied in defined trenches in the harbour sediment. Subsequently, the Studio of the Western Sweden Conservators in conjunction with the Bohus County Museum initiated a 50 year research project to evaluate reburial as an appropriate method of preserving waterlogged archaeological artefacts in the long-term. The research project, entitled ‘Reburial and Analyses of Archaeological Remains’ was launched in 2002 and consists of six sub-projects. The main aims of these sub-projects are to analyse the extent of deterioration of the most common material types found on underwater archaeological sites, assess the stability of packing and marking materials used in archaeological documentation and monitor the reburial environment.

The aim of the metals sub-project is to investigate the short to long-term corrosion behaviour of metals buried in the marine environment by examining the deterioration of reburied and exposed modern metal coupons and compare these results to the analysis of actual shipwreck artefacts. The environmental monitoring sub-project is designed to complement the other sub-projects by assessing the physico-chemical changes occurring in the reburial environment over time and the effect on the deterioration of the different reburied material types. In comparing the results obtained over the past seven years from both the metals and monitoring sub-projects, it should be possible to more accurately evaluate the effectiveness of reburial as a long-term in situ preservation strategy for metallic archaeological remains.
Erosion and archaeological heritage protection in Lake Constance and Lake Zürich

Dr. Marion Heumüller
Regierungspräsidium Stuttgart, Landesamt für Denkmalpflege Baden-Württemberg, Fischersteig 9, 78343 Gaienhofen, Germany
* Presenting author: marion.heumueller@rps.bwl.de

The shore zones of the pre-Alpine lakes conceal pile dwelling sites of international standing, many of which are acutely threatened by destruction through erosion. The precise mechanisms of the erosion processes have, up until now, hardly been examined. Changes in water levels, construction along the shorelines and shipping traffic as well as damage to protective aquatic plant and reed bed reserves are all possible triggers to the destruction processes. Archaeologists and lake researchers have joined together for an international, interdisciplinary project on "Erosion and archaeological heritage protection in Lake Constance and Lake Zürich" (Erosion und Denkmalschutz am Bodensee und Zürichsee), in order to investigate erosion processes more precisely, to test ecologically compatible protective measures against erosion and to prepare a better, long-term surveillance of the cultural assets under water. The project is co-financed by funds from the European Union within the framework of the Interreg IV programme “Alpenrhine-Bodensee-Hochrhein” (Alpine Rhine, Lake Constance, Upper Rhine). For this purpose 1.8 million euros have been allotted for Germany, Austria and the Lake Constance region of Switzerland. The responsible bodies for the project are the State Office for the Preservation of Monuments in the Regional Council in Stuttgart, the Office of Archaeology of the Canton of Thurgau, Canton Archaeology Zürich, the Institute of Lake Research of Baden-Württemberg and the Voralberg State Museum. The Limnological Institute of Constance University and the Water Research Institute of Eidgenössischen Technical Collages are co-operation partners.

The current state of destruction will be documented on the basis of a select and representative number of sites on Lake Constance and Lake Zürich. An important objective of the project is setting up monitoring for the long-term control of underwater sites using standardized methods. The mapping of the sites by research divers, documentation by remote sensing and bathymetric documentation of the lakebed all play an important role. A number of different measuring techniques for registering erosion and accumulation processes will be tested. Lake researchers will examine the mechanisms of wave dynamics and the redistribution of sediment. In addition experiments on installing erosion protection systems will be carried out, e.g. in the form of extensive and grid arrayed gravel coatings. The respective effectiveness will be tested and the effect of the measures on the lakebed as a biotope documented. The aim of the research is to optimize erosion protection measures and operational procedures while at the same time maintaining the ecological diversity of shallow waters.

The project gains particular importance against the background of the international initiative for the nomination of the lake dwellings as a UNESCO world heritage site, spearheaded by Switzerland, with Germany and Austria and also the alpine countries of France, Italy and Slovenia participating.
Monitoring projects in the Netherlands: Can we predict preservation?

Michel Vorenhout
MVH Consult, Beukenrode 19, 2317 BD Leiden, The Netherlands
*Corresponding author: m.vorenhout@mvhconsult.nl

Monitoring of in situ preservation is becoming more accepted in the Netherlands. Last years have shown an increase in the number of projects carried out in both the commercial as the academic world. There is still no strong standardization on methods, but a package of tools should be available soon considering the work put into standardization by the VU University Amsterdam and MVH Consult. The monitoring is used in various cases, all with their own focus. Besides the simple baseline study, several long term monitoring projects have started in 2009-2010.

One of the largest monitoring projects in the Netherlands is the monitoring of 15 random peatmounds in the nature development area the ‘Onlanden’, in the North of the Netherlands. This monitoring is the basis for a long term monitoring of effects of the reintroduction of water into a currently dry wetland area on the archaeological values in peatmounds. Another large project involves the monitoring of six ship wrecks and an experimental coverage of an archaeological site with 1.5 meters of sand. The raising is used to compensate the loss of soil height in time.

These larger projects will be discussed and can serve as examples to answer the important question: can we predict the preservation of a site based on the monitoring of that site? It is the authors opinion that we can, if we will invest in more long term studies that include the actual degradation of archaeological materials in conjunction with the monitoring of that site. The burial of bone in a coverage experiment, in which also environmental parameters are under monitoring, serves as an example of experimental work that will help in understanding the link between the burial environment and the preservation in the long run.
Deep impact: what happens when archaeological sites are built over?

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One of the most well-known effects of the introduction of the Malta-convention is the obligation for developers to fund excavation of archaeological sites that they will disturb. The costs of excavations makes it appealing to find ways to preserve archaeological remains while still developing and building on sites. Moreover, preservation \textit{in situ} is the preferred option in the Malta convention. More and more often, developers search for ways to build on archaeological sites while and preserving the remains underneath the construction. Some adverse effects for the archaeological sites are inevitable, but may be acceptable. Deciding what effects are acceptable, and when excavations (preservation \textit{ex situ}) is difficult however. Not only because of the uncertainties of the archaeological remains present in an unexcavated site. A bigger problem is the lack of knowledge on the impacts of construction on archaeological sites. Such impacts include:

- Disturbance by digging
- Disturbance by piling
- Compression
- Degradation through changes in burial environment
- Soil colour change affecting visibility of soil features through changes in burial environment
- Non-physical effects like inaccessibility for monitoring and research

The main question in all these cases is to what extent the site is damaged, or future archaeological research is hampered in other ways. In this presentation, I will give an overview of the present state of knowledge on the various ways in which building affects archaeological sites. Special attention will be given to results of recent and ongoing research. This includes micromorphological research into the impact of piling on archaeological sites, and results from research into the visibility of soil features. Also, new research plans will be presented to research the impact of loading and compression.
Research on conservation state and preservation conditions in unsaturated archaeological deposits in Oslo

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Within the last few years, a large number of augured boreholes have penetrated the archaeological deposits of the protected heritage sites of the medieval town of Oslo, Norway, mostly as a result of large development projects. The archaeological observations and geochemical samples analyzed from these investigations constitute the basic research material for evaluations of conservation state and preservation conditions. The data has been collected in collaboration between NIKU and Bioforsk. This paper presents the observed state of conservation of the archaeological deposits, ground water levels, and assesses the future preservation conditions. It discusses how much of the protected heritage site is in the unsaturated zone and in the fluctuation zone, the apparently most vulnerable deposit types. Research has so far focused on the saturated zone, so this paper advocates research on tools for measuring preservation conditions directly in soil, and an evaluation of which parameters give the most relevant information for evaluation of the state of conservation as well as preservation conditions. It considers to which threats the deposits in the unsaturated and fluctuation zones are exposed, and how high a rate of degradation is to be expected. It also includes an evaluation of 3D models of the deposits and water levels as tools for research and dissemination.
A new archaeological cadastre for the Lower German Limes allows new sight on the preservation of roman remains in the urban areas of the Rhineland. The Rhineland is one of Germanys most densely populated and most developing areas. At the same time, most of it's towns a found in roman times and offer a rich archeological potential. The precise mapping and quantification of preservation and destruction leads to new perspectives in managing the archeological heritage for the urban areas of the Rhineland.
Organic loss in drained wetland monuments: managing the carbon footprint

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The recent installation of land drains at Star Carr, Yorkshire, UK, has been followed by loss of preservation quality in this important Mesolithic buried landscape. This paper will review a range of other wetland sites where drainage has had this effect, thereby challenging the PARIS principle.

Historically-captured organic carbon, including organic artefacts, is being converted to soluble organic compounds and less soluble carbon gases. At the same time sulphur and nitrogen compounds are oxidised to species that are chemically destructive of artifacts and ecofacts. Two of the carbon products, CO₂ and methane, are ‘greenhouse gases’ whose environmental impact is amenable to a well-tried valuation process in terms of carbon equivalents, while the loss of cultural information can be evaluated in terms of what its communal audience might pay for its preservation. Jointly the two impacts can be set against an assessment of the gain in agricultural productivity of the land arising from drainage, at Star Carr being the improved yield of livestock.

The paper will review available data on hydrological change, information-loss and deposit shrinkage at Star Carr and elsewhere, and will match these against carbon budgets from ecologically-sensitive Scottish and Scandinavian wetland sites, including examples with both negative and positive values for carbon capture. The objective is a provisional post-drainage carbon economy for Star Carr in the light of a ‘decay reaction kinetics’ approach to preservation, and recommendations for monitoring techniques that could substantiate this.

On the assumption that the recent decay process at Star Carr could be slowed by restoring the historic hydrology, evidence of wetland carbon capture in a Scottish bog will be invoked as a way by which the Star Carr farmers might propose to switch the specially sensitive land from livestock to a ‘peat crop’ and thereby claim carbon credits.
Changes in the physico-chemical and microbial nature of wetlands from the leaching of copper, chromium and arsenic (CCA)-treated wood

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Microbial activities are responsible for reducing the harmful effects of pollutants in different burial environments. Within wetlands in particular, microorganisms play an important role in the transformation of heavy metals and metalloids via direct or indirect oxidation / reduction. In turn, these microbial transformations can lead to the detoxification of pollutant elements such as copper, chromium and arsenic (CCA) that comprise CCA-treated wood.

CCA was the most commonly used wood preservative in the UK (up until its partial ban in 2004). CCA prolongs the service life of wood by 20-50 years by making it resistant to microbiological attack. As such, it has been regularly used in the construction of platforms and boardwalks in wetlands. However, recent concerns over the impact of the chemical constituents of this treatment on both the environment and human health have prompted the introduction of legislation in order to ensure that this type of treated wood is disposed of in accordance with the relevant health and safety guidelines.

In light of this information, it is important to assess changes in the physico-chemical and microbial nature of wetlands associated with the leaching of CCA from wooden structures. The results will not only provide a greater scope for understanding the implications associated with the in situ preservation of the archaeological resource contained within these environments, but also highlight the potential ramifications for wetland ecosystem dynamics.
Hydrology, water-management and in situ preservation of archaeological sites; to a risk assessment system

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Most anthropogenic remains in the soil are thermodynamically instable under many of the common environmental circumstances, and hence subject to physical decay processes. Specific environmental circumstances, however, inhibit the transport of the necessary chemical ingredients for decay reactions to take place; preservation of archaeological sites and assets within buried landscapes, as commonly found in the Netherlands, are the result.

My research aims to analyze the degradation of archaeological materials in the soil as a function of the environmental flux (e.g. oxygen, nutrients) to and from an archaeological site. Different types and rates of environmental flux leads to different types and rates of decay. The flux is highly correlated to water management and to the physical characteristics (geological, geomorphological, hydrogeological) of the landscape on a regional and local scale.

The first step of my research is to semi-quantify the various pathways a function of environmental flux and is based on literature study. The second step is to carry out a geographical analysis that differentiates a specific area into ‘statistically homogeneous sub-areas’. It is expected that the flux within these sub-areas is statistically homogeneous and hence the type of decay of materials. The third step is to identify changes in water management and land-use. The last step, and main goal of the study, is to contribute to a risk assessment system for heritage managers that identifies and evaluates the threats induced by changing water management in terms of changing pathways of decay.
Theme 2 Monitoring and mitigation case studies

**In Situ Preservation of Wetland Heritage: Hydrological and Chemical Change in the Burial environment of the Somerset Levels, UK.**

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**In situ** preservation is a core strategy for the conservation and management of waterlogged remains at wetland sites. Inorganic and organic remains can however quickly become degraded, or lost entirely from the archaeological record, as a result of chemical or hydrological changes within the burial environment. Monitoring these parameters is therefore crucial in identifying baseline data for a site, the extent of spatial and or temporal variability, and to evaluate the potential impacts of these variables on current and future **in situ** preservation potential.

Since August 2009, monthly monitoring has taken place at two internationally important sites in the Somerset Levels, UK, the Iron Age site of Glastonbury Lake Village, and the nearby southern section of the Neolithic Sweet Track bordering the Shapwick Burtle. This research aimed to identify whether a spatial, stratigraphic and analytical approach to the analysis of sediment horizons, and monitoring of groundwater chemistry, redox potential, water table depth and soil moisture (using TDR), could be used to characterise the burial environment at these two sites more fully, and therefore inform on current and future **in situ** preservation potential. Central to this strategy was the identification of the extent of spatial and temporal variability within these parameters. The water samples have been analysed using ICP-OES and anion chromatography, and the sediment samples, using particle size analysis, XRD, XRF and loss on ignition. This collaborative, interdisciplinary doctoral research project is funded by the Science and Heritage Programme, (AHRC/EPSRC) with English Heritage as case partners, and additional support from Somerset County Council and Natural England.

Observations, results and interpretations for all parameters are presented here, including a discussion on possible future directions for management and monitoring at these sites. It is also hoped that as a result, this research will also contribute towards **in situ** preservation research more widely.
Lowland floodplain responses to extreme flood events: long-term studies and short-term microbial community response to water environment impacts

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Long-term studies of waterlogged burial environments allow researchers to gain holistic insights into the physico-chemical and biological condition of wetlands. Recent research has shown that microbial community diversity and functioning are intimately linked to physical and chemical parameters, such that environmental perturbations may have the potential to enhance the effectiveness of microbial communities in the degradation process. Our studies have shown that, as a consequence of the 2007 floods which impacted upon many British lowland areas, a rapid response to environmental perturbations can be demonstrated within the wetland deposits being monitored. As such, a quantification of the latent functionality of microbial wood degraders in a soil profile may be of fundamental importance for our understanding of potential \textit{in situ} degradation processes; and as a consequence, the likelihood for the biodegradation of sensitive archaeo-organic remains; a factor which is of primary importance for both on-going and future mitigation strategies, and attempts at managing the cultural resource of wetlands.

This paper will consider the effectiveness of a long-term research project in a lowland wetland at Newington, Nottinghamshire, England, between 2004 and 2008; and evaluate the efficacy of this study in relation to the significant impacts that occurred as a result of the severe floods in 2007. We conclude that the data generated after the floods necessitated a total re-evaluation of the first three years of environmental monitoring, and that the impacts of the flood event continued for some time after the initial impact phase. These observations have far-reaching implications for \textit{in situ} monitoring into the future as disruptions to weather patterns influence the various environmental impacts on the wetland resource.
In situ preservation of the weapon sacrifice in Illerup Ådal - An estimation of the preservation conditions in the northern part of the sacrificial bog in 2009

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At the excavations in 1950-56 and 1975-85 of the southern part of the sacrificial bog in Illerup Ådal between Skanderborg and Århus, Denmark, approximately 15,000 items, including weapons, equipment and personal belongings from 200 AC were recovered. 60% of the area was left unexcavated for future generations and in the northern part of the bog thousands of objects are now preserved in situ.

In November 2008 one year of in situ monitoring in the northern part of the bog in Illerup Ådal was started. The monitoring project included measurements of the water table, analyses of the water quality in the field and at the laboratory, investigations of the vegetation in the area and high precision GPS measurements of points of references and the water table pipes. Data were compared to the preservation environment in 1975-85 and the measurements carried out by Hedeselskabet in 1984-85.

Measurements of the water table show that the artifacts in general are situated in a waterlogged and anaerobic environment. The water table could, however, be higher in the northeastern part of the bog. The analysis of the water quality shows a near neutral pH and an extremely reduced environment. In one of the water pipes the conductivity and the chloride amount was much higher than average. This may be due to contamination of salts from the nearby located highway basin in the southeastern part of the bog. Investigations of the vegetation showed no sign of marsh horsetail and water horsetail, but grey willow grows on an area where artifacts are in situ preserved, which is not recommended.

Future changes in the area must consider the location of the four points of reference used for the excavation plotting from 1975-85. A continued in situ monitoring is necessary in order to document and control environmental development and to improve methods for measuring and analyzing. Further the project represents low cost measurements and analysis for the use of monitoring a supposedly waterlogged preservation environment.
Kitchen-middens and climate change – the preservation of permafrozen sites in a warm future

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Archaeological material may be extraordinary well preserved in Arctic areas, where permanently frozen conditions in the ground slows down the decay of materials such as for instance wood, bone, flesh, hair and DNA. However, the mean annual air temperature in the Arctic is expected to increase with 2.5 – 7.5 °C by the end of the 21st century. This may have a significant warming effect on the soil and could lead to permafrost thaw and degradation of currently frozen archaeological remains.

Here we present a four year monitoring and research project taking place at Qajaa in the Disko Bay area in West Greenland. Qajaa is a large kitchen-midden, containing permafrozen remains from 4500 years of inhabitation, from the first Palaeo-Eskimos entered Greenland, until the site was abandoned in the 18th century. The purpose of the project is to investigate current preservation conditions through field and laboratory measurements, to evaluate future conditions by using computer models, and if necessary to propose remediation actions that ensure future preservation.

Preliminary results show that the archaeological material at Qajaa is still very well preserved, but some microbial decay is observed in the most exposed wooden artefacts that thaw every summer. Summer temperatures are above 0 °C in the upper 40-50 cm of the midden and between 0 and -2 °C further down. Thereby the permafrost may be vulnerable to quite small increases in summer air temperatures. Moreover, laboratory measurements show that organic material in the midden produces heat when decomposed, which may have an additional warming effect on the midden. At the moment the water or ice content within the midden is high limiting the subsurface oxygen availability. Threats to the future preservation are related to further thawing followed by drainage, increased oxygen availability, and microbial decay of the organic material. Furthermore the site may be threatened by coastal erosion if the sealevel rises.
Over the past few decades, the archaeological community has been moving away from the more traditional methods of excavation and recovery of underwater cultural heritage towards a less intrusive management approach, essentially involving the preservation of sites in-situ. The recently ratified UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001 states that “The preservation in-situ of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage”. Over the years, a number of different remediation strategies have been utilised in order to protect underwater cultural heritage sites in-situ and most of the techniques or combinations thereof, involve reburial of sites. Reburial may be an appropriate means of stabilizing and decreasing the deterioration rate of a site, however, there needs to be a holistic approach to the study of the environment, before and after reburial to gain a full understanding of the changes that are occurring on the site and determine the effectiveness of the technique.

In early 2000, the James Matthews, a copper sheathed, wooden hulled vessel wrecked in 1841 south of Fremantle, Western Australia, was identified as being under considerable threat from increased site exposure due to a combination of natural near-shore sedimentary processes and industrial activity in the immediate area. An extensive on-site conservation survey was carried out to establish the state of preservation of the wreck and provide information regarding the physico-chemical and biological nature of the environment prior to the implementation of any mitigation strategy. In 2003 it was confirmed that further exposure of the site was occurring at an alarming rate and devising a management plan was of paramount importance.

Since this time a number of different reburial techniques have been trialled on the site and these include sand bags of differing material composition, polymeric shade cloth or debris netting, artificial sea grass mats made from polyvinyl chloride bunting and the use of interlocking medium density polyethylene ‘crash barrier’ units in a cofferdam arrangement to confine deposited sand. The geological, physico-chemical and microbiological changes in the burial environments have also been monitored over this time. Furthermore, the broader scale, near-shore sedimentary processes affecting the site are being assessed in order to establish the reasons behind the continuing sediment loss. In situ preservation of the iron fittings by cathodic protection has also been included in these field trials. The results from these experiments will be discussed and this information used to finalise the design of the full scale in-situ preservation strategy for the James Matthews site and assist in establishing a post-reburial monitoring programme that will measure the success of the adopted remediation technique.
Samuel Pepys’s Navy preserved in-situ?

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In 1979 a Third Rate Man of War sailed once more into our midst as the Goodwin Sands gifted us a unique opportunity to travel back in time. What was originally an archaeologist’s dream turned into a heritage management nightmare. Limited time, funds, knowledge and calls for the ships conservation were only relieved by the reburial of the ship a year later. Two decades on the Stirling Castle revealed itself again, this time for a longer period. Unfortunately a lack of planning during the proceeding years meant this was a lost opportunity to learn about a restoration warship. This highlights the limitations of preservation in-situ without a pro active mitigation strategy.

Despite this lost opportunity it would appear some lessons have been learned as seen in the more open minded approach taken on the wrecks of the Colossus, Swash Channel and Hazardous. On these sites the value of recently exposed material has been realised and thus recovered before it degraded in-situ to the point of no return. The ephemeral nature of archaeological evidence has to be recognised if preservation in-situ is to be a successful management strategy.

At present the Stirling Castle is reaching equilibrium within its surrounding environment offering us another chance to plan for future investigations if the site uncovers again. This paper will discuss the lessons learned in attempting to manage such a highly complex and almost complete ship in-situ and offer a strategy for its future management.
The ISCR Project “Restoring Underwater”: an evaluation of the results after ten years from the beginning

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The project “Restoring Underwater” launched by the Underwater Archaeology Operation Unit of the Istituto Superiore per la Conservazione ed il Restauro (ISCR, Rome- Italy)” is aimed at the study and the experimentation of instruments, materials, methodologies and techniques for the restoration, conservation and in situ display of ancient submerged artefacts. Set up in 2001 with the restoration of the vivaria of the Roman villa of Torre Astura (Nettuno-Rome), since 2003 the main subject of researches has been the submerged archaeological site of Baia (Naples, Italy), where, over the years, the restoration of sectors of certain buildings in the protected marine area has been carried out: the Villa con ingresso a Protiro, the Villa dei Pisoni, the Via Herculanea and the Building with porticoed courtyard near Portus Iulius. In 2007, in 2009 and in 2010 three new archaeological targets have been added to the research: a group of nine cast iron cannons discovered offshore the coast of the Marettimo Island (Sicily- Italy), the roman wreck carrying a load of sarcophagi discovered off the coast of San Pietro in Bevagna (Taranto - Italy) and the traditional fishing boat recently discovered off the coast of Martana Island (Bolsena Lake-Italy).

The purpose of this paper is to evaluate the work in progress and the results of these ten years of the project. The paper will shows as the conservation and museum display in situ of underwater heritage must not just be considered an opportune choice but may in itself provide a strong stimulus for experimenting new materials and technologies as well as representing a factor in the socio-economic development of the communities concerned, as shown by the example of Baia.
Strategies for protection of wooden underwater cultural heritage in the Baltic Sea against marine borers. The EU project “WreckProtect”

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Marine borers constitute a great danger to historical shipwreck in marine environments as they are able to decompose wood material in just a few years. Recently there have been indications that marine borers *Teredo navalis* are spreading into the brackish Baltic sea, where about 100,000 of wrecks for centuries have had unique preservation conditions due to the absence of the saline depending borers. A European project within the EC-7th framework programme started in 2009 and focus on the potential biological decay of wood in the Baltic Sea, with a special emphasis on the spread of marine borers. The name of the project is “Strategies for the protection of shipwrecks in the Baltic Sea against forthcoming attack by wood degrading marine borers. A synthesis and information project based on the effects of climatic changes” and the acronym is WreckProtect. The environmental parameters for decay are evaluated by literature study and provide basis for development of a mathematic GIS model, that describe the Baltic sea and areas with risk of attack from marine borers. Parallel to this work, an evaluation of existing methods for in situ preservation of shipwrecks is carried out. It is based on experience from all over the world and international publications. The ongoing, gradually microbial degradation by fungi and bacteria and its consequences on wood structures are also discussed.

Strategies to manage a future invasion and the evaluation of present methods for protection the wrecks in situ, are the main objectives of WreckProtect. Two guidelines for stakeholder are developed; one for predictions on “hot spots” areas, where future decay will take place, and a second for efficient methods for in situ protection. This will ensure that shipwrecks of unique historical importance can be saved for future generations in time – before an invasion takes place. The project involves a cross disciplinary research team, including wood scientist, biologists, geo-physicist and marine archaeologists.

The project will be presented, and results given.
Since 2001, an intensive monitoring scheme at the World Heritage site of Bryggen in Bergen, western Norway, has shown damaging settling rates caused by deterioration of underlying cultural deposits. Monitoring is focused on both chemistry and quantity of groundwater and soil moisture content in the saturated and unsaturated zone. Continuous logging of piezometric head, oxygen and soil moisture content and chemical analyses of water and soil samples are key elements. The monitoring includes registration of movement rates for both buildings and soil surface, field measurements and archaeological recording in small excavations, as well as studies of archaeological and modern materials in the subsoil. The results have given good insights into the preservation conditions, with focus on deterioration rates. Groundwater monitoring and chemical analyses reveal a dynamic flow regime under the thick, organic cultural deposits of the site. The flow regime is controlled by interaction of tidal fluctuations, urban drainage systems, natural and urban stratigraphy and bedrock hydraulic features. The documented preservation conditions within the cultural deposits as well as oxygen and moisture content fluctuations in the unsaturated zone have a significant correlation with the different groundwater flow dynamics found throughout the site. It is demonstrated that groundwater and soil moisture monitoring, combined with 3D hydrological and geochemical modelling are potentially effective routines to improve the understanding and quantification of degradation processes in complex archaeological surroundings. It is also shown that available easy-to-use 3D object orientated modelling software is able to visually combine the results of geological, archaeological, geochemical and hydrological investigations as well as modelling results. This opens up for improved multidisciplinary understanding of preservation conditions among stakeholders and the general public, and thus contributes to an improved protection of archaeological deposits in situ.
An assessment of the status and condition of archaeological remains preserved in situ in the medieval town of Trondheim based on archaeochemical investigations conducted during the period 2004 - 2010

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Trondheim in Mid Norway is located on a river plain by the mouth of the river Nid which where it enters the Trondheim Fiord. The legally protected archaeological site of medieval Trondheim covers an extensive part of the modern town. Within this area the thickness of the medieval deposits varies greatly from more than 4 m to less than 0.5 m. The archaeological remains overlie well-drained alluvial sands and gravels and the entire area lies almost completely within a non-saturated zone.

In recent years systematic archaeochemical investigations in the medieval town of Trondheim have provided the heritage management authorities with a rich and complex set of data concerning the status and condition of the urban deposits. The collected data raises important questions for the long-time management of in situ preservation for archaeological material in non-saturated zones. In this paper we present the standardized scientific methods used in these archaeochemical investigations. We examine the results from several sites in the town and discuss on the challenges facing modern heritage management in its efforts to protect a complex body of archaeological material in the non-saturated zone.
Preserving archaeological remains in situ: three case studies in Trentino - Italy

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Beneath the historic centre of Trento lies the ancient Roman city of Tridentum, the splendidum Municipium, as it was described by the Emperor Claudius in 46 AD. Symbolic of Tridentum is the S.A.S.S. (Spazio Archeologico Sotterraneo del Sas), the result of the archaeological excavations carried out during work on the restoration of the Teatro Sociale in the 1990s. The area, which was opened to the public in 2001, is extensive, comprising both public and private areas and buildings. Archaeological remains were restored and the environment was air-conditioned. This poster presents the conservation data after 10 years of public use not only as an archaeological area, but also as a place which hosts meetings, conferences, educational activities, exhibitions and performances.

The archaeological site of Monte San Martino is located at 850 metres above sea-level on the north side of Lake Garda. The first archaeological excavations carried out in the 1970s brought to light the ruins of a Roman sanctuary. In 1996 the resumption of the excavations explored a large settlement which dates back to the Second Iron Age and was used through Roman time until the Medieval Period. The archaeological remains lie in the open air with no covering structure. The climate is characterized by cold and snowy winters and by warm summers. Since 1970 many different conservation works have been carried out. We present the data of 30 years of preserving works.

Fiavè Carera lake-dwelling is located in the Giudicarie Esteriori Valley, not far from Lake Garda, at 646 metres above sea-level. It lies in a peat bog which occupied an ancient lake of glacial origin. The first discoveries made during peat extraction work date back to 1854. From 1969 until today the zone has been systematically explored. The oldest stable human occupation dates back to the Late Neolithic-Copper Age. The settlement was characterised by different types of lake-dwellings which continued until the Recent Bronze Age. This year, in order to create an archaeological public park, we started a project on wood piles conservation with the partnership of C.N.R. IVALSA - National Research Centre of Sesto Fiorentino (Firenze). This poster presents the first results of our research work.
Preservation In-Situ for Tourism: An early Christian monastery and church on Sir Bani Yas Island, Western Abu Dhabi, UAE

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This poster reports on the programme being developed in order to preserve the remains of a Christian monastic complex on Sir Bani Yas Island, believed to have been settled around 600 AD by a community of 30 to 40 monks of the Church of the East (also known as the Nestorian Church).

The archaeological site was initially excavated between 1993 and 1996 by the Abu Dhabi Islands Archaeological Survey (ADIAS) under the patronage of Sheikh Zayed, the founder of the UAE, who used Sir Bani Yas Island as a retreat. The site was then reburied until 2009 when Sheikh Mohammed bin Zayed, the Crown Prince of Abu Dhabi, ordered excavations to resume, under the aegis of the Tourism Development and Investment Company, TDIC. The church and part of the monastic living quarters, which stand to a height of up to 1m in places, were re-opened for public viewing in December 2010, and it is hoped that more of the monastic buildings will be uncovered in the future. One key objective is to include the site, a planned display centre and a ‘heritage trail’ as part of a wide range of nature and sport activities being developed for visitors to the island by TDIC.

Given the extremes of heat and humidity and the effects of wind experienced on the site, there is an urgent need to develop systems for the monastery’s protection. Very little work of this kind has as yet been done in the UAE. Observations on the effectiveness of the reburial system between 1996 and 2010, and the measures which are presently being undertaken to preserve the plaster floors and faced standing truncated walls, while opening the site to visitors, are presented.
Sheltering archaeological sites in China: approaches to preventative conservation and the public display of earthen archaeology

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The archaeological site of Jinsha, in Sichuan Province, China, was excavated in 2001, revealing extensive evidence of a substantial 3,000 years old settlement. The site was subsequently sheltered and in 2007 an on-site museum was constructed. A gold sun bird foil found during the excavations now symbolizes Chinese cultural heritage and has been adopted by Chengdu, the provincial capital. The site is now on the World Heritage tentative list and is regarded as one of the most important sites in southwest China.

However, as with many other sites in China, after sheltering the site has suffered various problems, such as fissures and the growth of mosses. My current doctoral research examines this site and a range of other sheltered archaeological site case-studies across China, exploring the approaches to scientific and material-based conservation and the role of the conservator in the planning and design of such shelters. It is vital that Chinese conservators should participate more fully in museum and shelter decision-making, not just act as a passive service or to fire-fight when problems have emerge.
Integrated design of conservation of the archaeological heritage

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This presentation connects the following points of Valetta treaty:
- Identification of the heritage and Measures for protection;
- Collection and dissemination of scientific information.

Will be shown the research carried out at the of the Roman Temple of the Asklepieion in Kos, during my PhD, which led to a project of anastylosis developed concurrently with the design of a data base of three-dimensional models of individual architectural elements of the Temple and a model CAD / CAM of the project to rebuild the Temple.

The project of anastylosis was developed by integrating the findings made at the beginning of the twentieth century by German researchers R. Herzog e P. Schazmann, and examining and correcting a project of anastylosis of by the Italian architect M. Paolini, started in the 1938 and never finished. The research conducted thus compared three types of intervention for the conservation of archaeological heritage in situ and its musealization and public presentation.

The database and the model CAD / CAM, represent two innovative ways that help to preserve data for scientific research in full. The database can store three-dimensional data, in addition to twodimensional, allowing to create a catalog full of great utility for future researches, but it is also an important document for the creation of architectural integration and maintenance of the originals parts.

The scale model CAD / CAM is a verification of the reconstruction project at the same time a possibility of a museum model of archaeological material in a perfect copy, the current evolution of the traditional models stored in the Glyptotek in the early twentieth century, including precisely the Glyptotek in Copenhagen with the scale model of the facade of the Temple of Aegina.

The proposed research could help to show three major methods of preservation of archaeological heritage fully integrated and developed in sync with each other, and could help to highlight how to preserve in situ as well as overcome the absence of the originals from the museum or research laboratories.
A predictive map of compression – sensitivity of the Dutch soil archive

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Weak soils like unconsolidated clay and peat may deform and compress considerably under surcharge loading, e.g. by sand bodies for roads, railways and building developments. Archaeological sites within such easily compressible soil layers may therefore be heavily affected by different kinds of construction works. The vulnerability of archaeological sites to compression is largely dependent on soil properties like lithology, grain-size and previous loading history. This may therefore differ considerably. Predicting the compression sensitivity is of great value for planners, since they can estimate in which areas in situ protection of archaeological sites may be feasible and where it would require (costly) technical measures or plan adaptations.

As part of the Cultural Heritage Agency’s research programme on construction and archaeology, we made a predictive map of the compression sensitivity of the subsurface sediments in the Netherlands for 1 m depth intervals from 0 to 20 m depth.

The map was made using a true 3D voxel model of the subsurface. This is a geostatistically derived representation of the most likely lithology distribution, based on borehole information in the national subsurface database DINO. The model was subjected by a uniform load equivalent to 2 m of dry sand fill and the compaction in each 1 m thick layer calculated with a consolidation formula. A uniform consolidation time of 30 years was used, which is considered sufficient to dissipate excess pore water pressures due to the surcharge load.

In combination with the Indicative Map of Archaeological Values (IKAW) that is already available, these maps can be used to better estimating the technical measures needed and costs involved for in situ protection of archaeological sites in the planning phase of construction projects.
There is no true preservation in situ without monitoring. Without monitoring, a site is in an unknown state of quality, and will stay in such a state. This can be considered bad practise. An efficient monitoring program focuses on those parameters that are most important for the preservation potential of the site. This poster presents the current techniques in use in Dutch monitoring projects to determine and follow the preservation potential of the burial environment. Continuous measurements on ground water table, soil moisture content, redox potential and temperature are possible with current techniques. Discontinuous measurements on pH and organic content are favoured in several projects.

The data analysis of the continuously measured parameters is the new challenge in archaeological monitoring. The large amount of generated data needs simple mathematical tools to be interpreted and scaled. These tools need international scientific cooperation.
Theme 3 Protocols, standards and legislation

Take the right decision everybody

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Riksantikvaren (The Directorate for Cultural Heritage) is part of the national environmental management, and answers to the Ministry of the Environment. It is responsible for

- the management of all archaeological and architectural monuments and sites and cultural environments in accordance with the relevant legislation,
- ensuring that cultural heritage considerations are taken into account in all planning processes,
- ensuring that a representative selection of monuments and sites of all periods is preserved for present and future generations.

All aspects of cultural heritage have to be treated as finite and non-renewable resources, because once destroyed, they can never be replaced.

The archaeological deposits in medieval towns are among the most important and distinctive heritage monuments in Norway. The modern settlement has developed on top of medieval and younger deposits which means that not only are they an irreplaceable depository of historical information, but also form a significant part of the modern town’s physical foundation.

Since 2002 Riksantikvaren has been funding systematic monitoring of archaeological deposits of the World Heritage Site Bryggen in Bergen. The monitoring programme consists of several approaches: Archaeological assessment of the deposits state of preservation, biochemical investigation of preservation conditions within the deposits, hydrogeological mapping of the watertable, water flow and other given parameters. The knowledge and methods developed through monitoring activity has been the basis for a monitoring manual and an official norwegian standard covering archaeological, biochemical and hydrogeological deposit investigations (Norsk Standard Cultural Property, Requirements on environmental monitoring and investigation of cultural deposits, NS 9451:2009, in norwegian only).

Continuous systematic monitoring by using testable, replicable methods and measures, data and results acquire increased quality and validity. This in turn provides the cultural heritage management with a toolbox for making correct decisions and thereby allow the government’s preservation targets to be attained. But most important, it guarantees the preservation of the “underground archives” and at the same time allows the urban centres to develop.
The researchers involved in the monitoring work are
Rory Dunlop, Norwegian Institute for Cultural Heritage Research
Henning Matthiesen, National Museum of Denmark
Hans de Beer, Geological Survey of Norway
Jann Atle Jensen, Multiconsult AS
Bioforsk, Norwegian Institute for Agricultural and Environmental Research
In situ preservation of ancient floor mosaics in Turkey

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As stated in the Burra Charter (1979), “A building or work should remain in its historical location. The moving of all part of a building or work is unacceptable unless is the sole means of ensuring its survival”. This statement has been neglected for many times and in many cases during the rescue excavations in Turkey (i.e. Zeugma), whereas the destruction of ancient floor mosaics caused by lifting, especially when carried out by incompetent or inexperienced personnel at systematic archaeological excavations has steered the authorities to preserve them in situ. However, due to the lack of conservation professionals and insufficient resources for conservation, it becomes a difficult issue to provide an effective preservation scheme for archaeological excavations. This paper aims to discuss this important issue in terms of the national legislation, preventive and interventive conservation approaches at various sites, exhibition and maintenance of mosaics; as well as the training of conservation technicians in Turkey. Cases of successful and defective attempts to preserve floor mosaics in situ will be presented with illustrations from numerous archaeological sites. Following the current situation of in situ mosaic preservation in Turkey, a comprehensive preservation program for archaeological excavations addressing to the above mentioned issues will be presented and the need for establishing standards in the in situ preservation of mosaics will be emphasized.
This paper will encompass the complex question of mutual influences of urban archaeology, current legislation, valorization, conservation and presentation on the example of excavated part of Roman civitas lovia within present town of Ludbreg. Position of lovia was known through literature and its precise location was confirmed through systematic and long-lasting method of small probe-pits during the early 1970s. Since present town of Ludbreg entirely took over the general layout of Roman settlement, it was very hard (due to existing infrastructure) to begin the excavations on a larger scale. However, knowing that Croatian part of Roman province of Pannonia is poorly excavated due to frequent overlaying of later settlements on Roman ones, it was of great scientific importance to try to continue the research. The most interesting result that came up in probe-pits was two semi-circled pools in a garden of large private property in the very center of present town. When the proprietary problems were finally solved, the new owner became the town authorities. Vigilant for their Roman heritage, they were eager to proceed with the excavations, making the legislation considering archaeological sites very easy to practice. By careful coordination of dual funding (researches were partly financed by Ministry of Culture and partly by local government) and known problems of excavations within present town with active infrastructure, it was possible to achieve great results. During three seasons of excavations a smaller baths and sizeable public building were discovered. Respecting the specific situation of this site, the optimal plan of presentation was made encompassing the scientific and professional demands regarding the conservation in situ combined with requirements for successful cultural management thus resulting with maintaining agreement and positive economical cost effectiveness. By using abovementioned principles that were laid out more as guidelines and not as practical law, it was possible to provide a reliable, statutory secure future for this site.
Sense or Nonsense of International Standards for Archaeological Advisory Commissions: the Case of Flanders (Belgium)

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In 1965 the first members of the Belgian National Commission for Excavations were appointed. This Commission had to provide the competent Minister with advise and suggestions on archaeological heritage and excavations. The Commission was unfortunately not recomposed after its second term ended in 1979. During the eighties, Belgium underwent several state reforms which ultimately resulted in the complete regionalization of archeology (1988-1989). Throughout this period, several drafts for laws pertaining to archaeology were developed. Almost all of them included the reinstallation of an advisory board. The drafts offer interesting differing visions on its raisons d’être since the composition and tasks of this advisory board varied from one project to another. None of these projects made it into law however and the Flemish Region only voted an ‘archaeology decree’ in 1993. It created a new advisory board: the Flemish Archaeological Council. This council existed independently until it was integrated in the Royal Commission for Monuments and Sites in 2004. The Royal Commission now also advises on the preservation and protection of archaeological monuments and zones.

This paper will try to investigate if international standards can support institutions in their task or quest to preserve archaeological heritage in situ. The short histories of the Belgian and Flemish advisory commissions, and its roles in the protection and in situ preservation of the archaeological heritage, will therefore be discussed. Furthermore, the impact of the lack of such institutions on the archaeological patrimony will be handled. The sequence of existence, absence and reinstallation of the Belgian and Flemish Commissions and their functioning also offer a good case to explore whether the setting up of an advisory commission should be recommended in multinational standards on preserving archaeological remains in situ.
A qualitative approach for assessment of the burial environment by interpreting soil characteristics. A necessity for archaeological monitoring

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Modern day archaeological monitoring is often hampered by lack of money, lack of time, inadequate measuring equipment and lack of insight in the conservation potential of a site.

Although in modern archeological excavations soil characteristics are noted (colour, texture, ground water level and sometimes mineralogy), these characteristics are mainly used for the interpretation of a site. However, by looking to these characteristics from a conservational view eventually combined with the conservation status of the archeological objects, much can be learned about the burial environment. This is essential for optimizing archaeological monitoring.

Degradation processes result from the change of reactive phases in the soil or the site. Reactive phases are soil components such as organic matter, sulfides, iron(hydr)oxides and carbonates (chalk, shells) and if present, components in the ground or interstitial water such as hydrogen ions and sulfate. The presence of these phases can easily be established by the archeologist or soil scientist in the field.

Just by noting, for example, if shells or other carbonates are present, the pH can be estimated to be higher than 7.5. If monitoring of such a site is foreseen, measuring of the pH is not necessary. The presence of shells makes it likely that the site was never acid, and will not be in the future if conditions do not change.

From the presence of organic matter and sulfides in combination with a sulfide odor, it is obvious that sulfate reducing conditions are present. In such a case redox measurements will only tell the obvious. The same is true for the presence of an iron oxide layer followed by a blue or grey sand or clay layer, which indicates suboxic conditions (absence of oxygen and ferrous iron present). These characteristics can easily be observed and interpreted. In addition, these characteristics can be predicted beforehand by looking at the site soil, hydrological and geological maps.

We propose a simple field based method for assessing degradation processes essential for in situ preservation and monitoring.
Conservation of cultural heritage – specifications, guidelines, procedures
European Standard, Norme Européenne, Europäische norm

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New publications, standards, procedures and guidelines are published to improve the quality of the materials and procedures used for conservation-restoration of cultural heritage. These publications are often based on sound research and knowledge and written by skilled and respectable authors or highly regarded organisations. For the end user, however, it can be difficult to get an overview and evaluate the validity and usability of these documents.

Since 2003 a Technical Committee (TC 346) within the frame of CEN (European Committee for Standardization) has been established. The objective for TC 346 is to develop and draft standards on conservation-restoration of movable and immovable cultural heritage. The drafted standards are written by nominated experts from all over Europe and should present the recent research and awareness within each subject. Moreover, the drafted documents are commented by experts from the CEN member states before publication and should be reviewed every five years.

The presentation will introduce key elements from the CEN TC 346 business plan as well as the work in progress and gives examples on drafted standards. Also the effect on the conservation-restoration in Europe in the future will be discussed. The Technical Committee has created five Working Groups covering all aspects of conservation-restoration of cultural property from developing common terminology and surveying methods to create methodologies for evaluation of materials and methods used in conservation-restoration, developing standards for the environment for both movable and immovable heritage which could include preserving archaeological remains in situ?
Development of an “Archaeological Monumentenwacht” in Flanders

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Monumentenwacht prescribes a preventive approach and aims to stimulate the conservation of valuable cultural heritage in Flanders by offering a systematic inspection system focused on regular maintenance. Monumentenwacht is not a state-run body but a group of six non-profit making organisations, established under private law, at the service of the owner or administrator of valuable cultural heritage. The membership of Monumentenwacht is voluntary based. Parallel to the immediate action in the field, the association plays an important role in raising awareness among many owners.

Monumentenwacht prescribes an integral approach and was founded initially in 1992 at the service of owners – administrators of valuable built heritage. Gradually the services were broadened to interiors (1997) and boats (2008). Since august 2009 a similar service for archaeological heritage is set up. The concept of an “archaeological” service is inspired by foreign organisations as the Archaeological Monument Watch (AMW) from the Netherlands and the Historic Environment Field Advisers (HEFA’s) from English Heritage.

With this new service Monumentenwacht aims to contribute to the conservation and maintenance of archaeological heritage in situ, as is aspired by the Valletta treaty (art. 4 § 2). Particularly, the intention of the new service is to support owners – administrators (or clients) in the maintenance and conservation of their archaeological heritage by offering recurrent and preventive monitoring services and independent advice. The monitoring in field is based on visual observations and results in a status report containing a condition and risk assessment together with indications concerning measures to be carried out in the (immediate / medium / longterm) future. With this new service Monumentenwacht aims also to contribute to the raising of public awareness of the value of archaeological heritage (Valletta treaty art. 9 § 1).

Obviously, the new service of the “Archaeological Monumentenwacht” is confronted with the present-day challenges of the archaeological heritage sector in Flanders. We would be keen to give a, preferably oral, presentation concerning the development of this new service and its added value in reference to the Flemish and international context.
Long-term Preservation of Dendroarchaeological Specimens: Problems and Practical Solutions

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Dendrochronology, by the very definition of the term, is multidisciplinary and the nature of the field offers a unique opportunity to address the long-term conservation and maintenance needs of its specimens. For example, the Laboratory of Tree-Ring Research at the University of Arizona (USA) has served as a national scientific wood repository for over 70 years and contains approximately 2,000,000 specimens (including approximately 500,000 archaeological specimens). These collections have been obtained from thousands of historic buildings, ancient forests, and archaeological sites. The specimens have proven critically important in recent studies of climate change, historical assessments of river flows and water supplies, and especially historical human/environment interactions.

The subfield of dendroarchaeology is often compared to the assembly of a jigsaw puzzle. The pieces are assembled over a period of years and collected from a wide variety of independent sources. Long-term preservation and continued access to specimens is crucial, as an individual sample may prove to be significant only decades after its collection when sufficient other samples have been obtained for comparison, allowing completion of the “puzzle.” Despite this necessarily far-sighted scope, practitioners and stakeholders alike have yet to develop a comprehensive solution for the long-term needs of the expanding collections. This paper outlines pressing problems for these collections and suggests practical solutions in light of the necessities of such research and international calls for a higher standard of care for archaeological heritage.
The RAAR project – heritage management aspects on reburial after 10 years of work

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The international reburial project, Reburial and Analyses of Archaeological Remains (RAAR) has been ongoing for more than ten years. The idea of a reburial research site in Marstrand was initiated during extensive marine archaeological excavations in the harbour of Marstrand on the Swedish west coast in 1998-99. The initial research group met in 2001. The general purpose of RAAR is to evaluate reburial as a method for the long-term storage and preservation of waterlogged archaeological remains. Since 2001 material samples have been buried, retrieved, analysed systematically and the results reported.

RAAR has mainly focused on the degradation of materials commonly encountered on archaeological sites and on environmental monitoring techniques in order to determine what type of material can be reburied and for how long. The project has concluded that a heritage institution could provide short- or long-term curation for its archaeological archive by using reburial depots provided they are set up according to guidelines and restrictions given by the RAAR project.

There are practical and legal issues that need to be discussed before each reburial project as well taking into account overall national heritage management considerations. Should reburial depots be managed locally, regionally or nationally? Could the location of a reburial cause property issues and under what laws are the artefacts protected?

The reason to rebury an artefact, or for that matter a ship wreck, is to preserve it so that it can be accessed and used in the future, but how far ahead in the distant future is a reburial depot likely to be remembered and accessed. The RAAR project has discussed the use of time frames for reburial as a way to more actively consider why and what we choose to rebury. The idea of using time limits for storage ties in with what we know from material degradation studies. As the life of an artefact is not endless, even under good preservation conditions, consideration must be given to the fate of a reburial depot after its use-by date.

Another important aspect is that of value. Any treatment of an artefact, be it conservation, reburial or in situ preservation, must be preceded by an assessment of its scientific and/or pedagogic value. With limited resources and increasing archaeological records, choices have to be made as to what should be preserved, but on what grounds do we make these choices and who makes them.

This paper will discuss these issues, their consequences and also highlight possible differences in approaches between the countries involved in the RAAR project.
PARIS; London
One hundred and fifty years of site preservation

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This paper will consider the history of preservation of archaeological remains in London over the last hundred and fifty years.

London has a rich and diverse past ranging from its Prehistoric roots, going back nearly half a million years to pre-Neanderthal days, through the development of extensive farming economies up to the advent of a Roman provincial capital, the imprint of which is still visible in street patterns, place names and surviving historic fabric. This in turn fell, was replaced by several more cities, all building one upon the other until we reach today’s forward- and outward-looking city; firmly placed upon the world stage.

So how have we, the modern inhabitants of London, protected our heritage? In many periods, the past has been viewed as irrelevant and in the way. Historic buildings have suffered particularly. In part this is owing to fashions in architecture combined with the need for efficient building space, and in part owing to the lack of romance which is not the case with many examples of archaeological remains often linked to the spirits of the dead.

Nevertheless, the selectivity of preservation in London has been highly erratic. Decisions to preserve, before the advent of government guidance in 1991, were taken entirely randomly and largely linked to individual cases and personalities rather than considered thought and policy. Archaeologists are often torn between the desire to excavate and learn more, as well as heeding the responsibility incumbent upon us to preserve the past intact. This has led to a variety of sites surviving, several of which were in fact protected not through the archaeological or scholarly worlds, but as a result of public pressure, an early example being an Anglo-Saxon Barrow cemetery, saved from destruction in 1848.

The Rose Theatre was a pivotal moment: since its discovery and preservation, more thought has gone into what we preserve, how we preserve it, and as importantly whether survival and enjoyment can be guaranteed. This paper will conclude by examining successful recent examples of preservation combined with presentation, including the Spitalfields Charnel House and the Bermondsey Abbey tower base and will also look forward to the possibilities of another Shakespearean Theatre.
The Rose Theatre: The final challenge

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The hydrology of the Rose Theatre has been continuously monitored for the past twenty years creating a vast archive of data that broadly demonstrates that the site environment has been maintained in a condition conducive to the preservation of the theatre remains. The Rose Theatre Trust now has exciting plans for the future of the site but inherent in these is the absolute requirement to maintain the archaeological integrity of the site which is a Scheduled Ancient Monument. This paper will explain how the site will be sealed so that the pre-existing hydrological conditions are re-established. A study of the site hydrological data and the surrounding hydrology will be undertaken to demonstrate that this can be achieved.
Partial solutions to partially understood problems – the experience of in situ monitoring and preservation in Somerset’s peatlands

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The Somerset peatlands contain numerous nationally important monuments that are known to be potentially at risk of destruction, chiefly from peat desiccation and associated peat wastage. Compared to other areas of the UK a considerable amount of time and effort has been spent on assessing the condition of the monuments and monitoring their burial environment. One of these monuments, the early Neolithic Sweet Track, has experienced long periods of monitoring and numerous investigations of its condition.

The methodologies of assessment and monitoring have developed over time and are being further refined by ongoing work (proposed as another paper for the conference by the team from Reading University). This paper will examine what the decades of work in the area have achieved and what crucial questions still need to be answered to enable sustainable preservation in situ to be a realistic proposition.

The burial environment in the peatlands of Somerset is comparatively simple but recent work has generated as many questions as it has produced answers. Preservation is being achieved in some areas and not in others. A combination of coring, radiocarbon dating and LIDAR imagery can show how this variation is operating on a landscape scale as well as on individual sites.

The practical solutions required for achieving site or landscape level preservation are more dependent upon farming economics, than upon legislation, protocols or improved understanding of the complexities of the burial environment. Climate change predictions indicate that the threat to preservation is likely to significantly increase over coming decades, but the shared interests of nature conservation, archaeology, carbon storage and an ageing farming population may combine to enable sustainable preservation for part of the peatland landscape.
The neverending story? What can we learn from 15 years of archaeological monitoring on the former island Schokland

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The former island of Schokland became part of the mainland of the Netherlands when the Noord-Oost polder was drained in the 1940\textsuperscript{ies}. On Schokland in the immediate surroundings Mesolithic camping sites, Neolithic and Bronze age settlements and Medieval living mounds can be found. Schokland, including the associated archaeological sites are now a UNESCO World Heritage site.

The main threat to the former island and the archaeological are caused by drying out of the soil profiles, causing degradation of organic remains. Because of this, on the island and its immediate surroundings the groundwater table is kept high in an especially created hydrological zone.

Schokland was one of the first sites in the Netherlands which was monitored to assess threats to the archaeological record and ongoing degradation processes. Monitoring started in 1999, and subsequent measuring took place in 2001, 2006 and 2009/2010. This included measurements of groundwater tables, water composition, redox, soil moisture and soil chemistry, micromorphology and degradation state of botanical remains and bone. This time - series of measurements makes it possible – first and foremost - to study long-term effects and changes in the Schokland burial environment, and their effects on the archaeology. In addition, the development of monitoring techniques around Schokland may demonstrate how the field of archaeological monitoring has evolved over the years.
Is preservation in situ a sham?
Can monitoring prove the continued preservation of waterlogged deposits?

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This paper will outline the approach taken for monitoring of two waterlogged areas in England: the multi-period deposits beneath the historic town of Nantwich, Cheshire, and the Bronze Age timber platform at Whittlesey, Cambridgeshire. These two examples allow contrast and comparison between urban and rural contexts, and between multiple ownerships and single development. The projects also illustrate how English planning guidance can be variously interpreted dependent on conflicting aims and objectives. The paper will describe the characteristics of the sites, their past history and present threats, and the suggested management strategies for each. The duration, spatial interval, and methods of monitoring (including use of in situ REDOX probes, Time Domain Reflectometry, sediment geochemistry and water level measurement) will be discussed, and how short-term data-gathering is actually what influences decision-making.
20+ years of monitoring in England – what have we learnt?

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This paper will review groundwater monitoring projects carried out in England over the last 20 years or so to assess how practice has evolved during this time. Aside from (attempting to) draw together a list and summary of past and existing monitoring projects, this paper will look at the evolution of our tools and techniques, and identify the current state of our understanding of monitoring on both rural and urban sites. Additionally, it will consider the planning and resource management drivers for water monitoring of archaeological sites and mitigation methods available when monitoring data suggest deterioration in below-ground conditions.
Conservation *in situ* of colonial archaeological remains in Australia and New Zealand: methods, meanings and community benefits

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While there is extensive international literature on the technology and techniques of archaeological conservation and preservation *in situ*, there has been only limited discussion of its perceived cultural effects and the meanings and responses these places might transmit to, or shape in, communities.

Experience in Australia and New Zealand over the past decade suggests that the conservation of colonial archaeological remains is today seen as a more desirable option by the community, whereas previously many would have suggested that this kind of activity was only appropriate in 'old world' places like Greece and Italy; and that the archaeology of the colonial period was not old enough to be of interest. This change of attitude is driven not only by the expanding category of national heritage, the success of the conservation movement and its doctrine, but also by the work of the engineers and architects who expound a vision for how past and present co-exist in the urban landscape. If the practice of conservation *in situ* has been exported from Europe, perhaps uncritically as some have suggested, then how, if at all, has this form been adapted for colonial archaeological remains which occupy contested social space in postcolonial nations? Is the 'aesthetic' of archaeological remains from the recent colonial past conserved *in situ* a device that mimics the historic depth of ancient European cities—does it aim to make the postcolonial world more like Europe by creating evidence of similar historical depth? Or is archaeology being used to provide material evidence of the legitimacy of the nation as a basis for sovereignty? This paper reviews the burgeoning field of conservation *in situ* in Australia and New Zealand, drawing on recent surveys of visitors to colonial archaeological sites and their perceptions about conservation methods and the meaning of these places.
Underwater Cultural Heritage (UCH) as an outstanding division of the cultural heritage of humanity appears to be crucial and complicated when the issues regarding preservation and conservation are raised. The essence of in situ preservation should be equally discussable for any kind of archaeological remains; on-land or underwater.

There is a long history of different methods and concepts of intervening in variety kinds of sub-aquatic archaeological sites; from the shipwrecks to submerged settlements.

This paper intends to present an introduction to different techniques and theories of preservation and conservation of underwater cultural and archaeological sites since this kind of heritage has scientifically been explored and studied. A range of different methodologies of preservation, from transferring in-land totally, partially and preserving under water, will be compared; the advantages and disadvantages of each option will be discussed. Different examples of the best practices in the world will be illustrated and the scientific critics about these projects will be analyzed. Furthermore, there will be a focus on the UNESCO Convention of 2001 on Conservation and Preservation of UCH, where the in situ conservation has been recommended.

Moreover, the technical issue for preservation of UCH sites, either in situ or after displacement, will be explained. The implication of relocation for different sorts of sites and materials will be argued- some sites such as shipwrecks would more easily be displaced comparing with submerged settlements, villages or ports. Also the speed of degradation for different materials is dissimilar in aerobic and anaerobic conditions. The possible damages which each procedure would bring to the sites will be presented.

Finally, by stressing that the quality of “being underwater” made many sites of significance of being considered as UCH, the justification of in situ preservation will be evaluated.
Nydam – in situ preservation at work

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Nydam is a waterlogged archaeological site with several sacrifices of war booty from 2-400 AD preserved in situ. The site has been monitored for 15 years, and results have already been presented at earlier PARIS conferences: At PARIS2 in London in 2001 focus was on environmental monitoring at the site, and the effect of archaeological excavations. At PARIS3 in Amsterdam there were presentations of geophysical methods used to find the extent of the site, and of corrosion mechanisms for metallic artefacts. Over the years more than 20 papers have described the studies and results from Nydam.

Here at the PARIS4 conference in Copenhagen we can conclude that in situ preservation actually works at a site like Nydam: Artefacts from small trial excavations in the recent years are in a good state of preservation. The groundwater level is above the archaeological remains even during a dry summer, and work is ongoing to raise the watertable further to mitigate the effects of a future warmer climate. Physical damage of wooden artefacts by Horsetail (Equisetum Fluviatile) growing at the site is the greatest threat, but the problem has been reduced by covering the site with geotextile - a promising solution even if it requires some maintenance or renewal at intervals. Overall, the physical and chemical conditions in the soil are conducive to the preservation of the archaeological artefacts, and there is no urgent need to "rescue excavate" the whole site.

The detailed and labour intensive monitoring program earlier taking place at Nydam has been replaced by less frequent measurements and automated logging of a few key parameters. Still, the research taking place at Nydam hasn’t stopped: In these years a book series about the archaeological excavations in the 1990s is being published, further mapping of the site is ongoing with new geophysical methods and small trial excavations, and fundamental studies of corrosion and wood degradation still takes place at Nydam. Thus Nydam is used as a research resource, while preserving the site in situ.
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