The dating of Wreck 2, the Longship, from Skuldelev, Denmark. A preliminary announcement
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Dendrochronology is a very precise scientific dating method in archaeology. The basis for the method is the study of the variations in the width of tree-rings and the knowledge that trees living under the same conditions will grow in the same way; that is to say, in a good year (for example) all the oak-trees in a region will produce a broad tree-ring and in a bad year they will produce a narrow ring. It is thus possible to construct a standard- or master-chronology for the variations in the tree-ring width, and with the help of such a chronology, tree-ring curves from a tree or piece of timber can be dated.

An important factor for dendrochronological dating is thus the existence of a master-chronology covering the region where the analysis is to be carried out.

This problem is even more pronounced when it comes to dendrochronological investigations of ancient shipwrecks; here the question of the provenance of the timber used in the ship is crucial. A ship might have been built of wood deriving from an area that lies far away from the place where it was found and perhaps excavated. Some idea of its origin can be gained by analysing building-techniques and the species of timber that have been used. Even then one can't be sure; the ship might have been built of imported wood, reused timber or repaired several times before it ended up on the bottom of the sea. That is why a dendrochronological analysis of a shipwreck is more complicated than that of a roof construction in a building. A successful dendrochronological dating of a shipwreck presupposes that all the aspects of the wreck have been carefully registered: material (species of timber), splitting technique, repairs etc.

Thanks to a close co-operation between the dendrochronological laboratories at The National Museum in Copenhagen, The University of Lund (Sweden) and The University of Hamburg, the region around the eastern part of the Baltic Sea is covered by oak-chronologies extending from the Iron Age to the present day. This is the basis for dating historical shipwrecks from southern Scandinavia with the help of dendrochronology at present.

In addition to other projects that have produced good results in this respect, wreck 2 from the famous Skuldelev find in Denmark has recently been investigated. The ship is a 30 meter long clinker-built warship with originally approximately 60 oars. It is built in oak, Quercus sp., in the fashion that was normal for "vikingships" in Scandinavia around 1000 AD, although it contain details not seen in any nordic ship finds, especially the cross sections of the keel and the ribs. Similar details have been registered in ship finds from England and Ireland.

Eighteen samples were cut from the preserved planks, which were all radially cleaved, along with a sample from the keel and one from the keelson.

It was possible to correlate the tree-ring curves from twelve planks and the keel and construct a chronology which spanned 248 years, representing the building-
Fig. 1: Master-chronologies for Denmark and surrounding countries. Labs.: 1) Alf Bråthen, Trollhättan (Sweden), 2) University of Lund (Sweden), 3) The Danish National Museum, Copenhagen (Denmark), 4) Skalk, Aarhus (Denmark), 5) University of Hamburg (West Germany), 6) Academy for Science, Berlin (German Democratic Republic), Academy of Fine Arts, Warsaw (Poland).

Fig. 2: Reconstruction of wreck 2 from Skuldelev. The Danish National Museum.

phase for the ship. Unfortunately, none of the correlated samples had sapwood present, so it was not possible to give a precise felling date for the timber and thus date the building of the ship exactly. It was however possible to make a fairly close estimate.

It was impossible to date this chronology with the help of any of the master-chronologies for oak from the Baltic area, Denmark, Southern Sweden, Northern Germany or the coastal area of Poland. Due to the shape of the cross section of the keel mentioned above, we then started to look at reference chronologies from England and Ireland. Thanks to the fine publication-policy of our colleagues working with dendrochronology in Ireland and England we had access to medieval chronologies from Belfast, Dublin, Exeter, London and the East Midlands as well as one master-chronology for England and one for South Central Scotland.

The results were surprising. The Skuldelev-chronology fitted perfectly with all the chronologies except the one for Belfast, which, as it turned out, did not cover the dating-range for our curve. The Dublin-chronology in particular produced extremely good results. With the help of this chronology we got a correlation value that normally occurs when curves deriving from trees from the same forest are compared.

<table>
<thead>
<tr>
<th>Correlation values, &quot;P&quot; for the comparison of the chronology for Skuldelev 2 and oak chronologies from Ireland and England.</th>
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<tbody>
<tr>
<td>Belfast 1001-1970 AD</td>
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<tr>
<td>overlap to short</td>
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<tr>
<td>Dublin 851-1326 AD</td>
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<td>Exeter 799-1216 AD</td>
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<td>East Midlands 882-1891 AD</td>
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<td>London etc. 790-1195 AD</td>
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<td>England 401-1981 AD</td>
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<td>S U Scotland 954-1975</td>
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The latest preserved tree-ring in the chronology was produced in 1025 AD. If we use the sapwood estimation for Irish and English oak-trees we have to add at least approximately 30 tree-rings to this date if the missing sapwood is taken in to consideration. That gives a felling date lying between 1060 and 1090 AD.

Based on these results we can conclude that the longship excavated in Denmark was built in the region of the Irish Sea, most likely in Dublin, in the second half of the 11th century.
The dendrochronological laboratories in Belfast and Copenhagen are carrying out further investigations to confirm the determination of the provenance of the building site and to see whether it will be possible to produce a more precise date.

References


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**Working Group on Wet Organic Archaeological Materials Newsletter.**

This twice-yearly newsletter is edited by Tom Daley, c/o Historic Resource conservation Branch, 1550 Liverpool Court, Ottawa, K1A 0H3, Canada. The newsletter has information about current conservation debates, methods and results, and notices of conferences and publications.