Archaeology

Scandinavian pine chronologies

from John Fletcher

LYING close to entrances from the Baltic to the Gulfs of Bothnia and Finland, the Åland islands have played the role in the Baltic that Malta has played in the Mediterranean. The massive castle of Kastelholm on the main island was already of strategic importance in the 14th century. Now its importance is more to archaeologists, including those at a recent conference* held in Mariehamn, the main town of the autonomous province of Åland.

The granite promontory on which the castle stands was originally surrounded by a palisade of pine stakes. Most of the stakes that still exist are medieval and so of great interest to dendrochronologists in a region that is beyond the habitat of oak. To form pine chronologies for Åland, L. Löpstrand (Tree-Ring Laboratory, Uppsala) has used not only the palisade stakes but also boards and planks from the castle itself and churches on the islands. Elsewhere in the north and east of Scandinavia, mediaeval excavations at Trondheim, Bergen and Oslo, in Norway, have provided T. Thun (Botanical Institute, Trondheim) with pine samples, while a mean curve for central Sweden formed by T. Bartholin (Institute for Wood Anatomy, Lund) goes back to AD 1078; Bartholin's samples for Lapland go back as far as AD 436.

So far, Scandinavian pine-ring dendochronologists have not attempted to use any long-distance (over 500 km) correlations such as those applied to subalpine conifers and to oak in central Germany and northwest Europe. The almost obsolete concept that each chronology needs to be regional and confined to small areas — it was thought even to the Åland islands themselves — persists in Scandinavia and has delayed progress in dating by dendrochronology. A link between the growth of pine in west Norway and that measured by Schweingruber, Bräker and Schär (*Boreas* **8**, 427; 1979) in northern Scotland is no more unlikely than the link that has been established between the growth of oak in certain periods in southern England and Denmark. For Åland and southern Finland, the medieval pine chronology from AD 884-1462 formed by B.A. Kolchin (*Soviet Archaeology* **1**, 113; 1962)† from multilayers of the mediaeval wooden pavements of Novgorod (2,500 samples in 1961) may prove useful because trees from forests many hundreds of kilometres apart show the same 'thin-ring' characteristics.

Also of considerable interest at the meeting was some information on the diet of prehistoric man derived from stable isotope analysis of bones of Danish skeletons (H. Tauber, National Museum, Copenhagen). For northern latitudes, the decrease in the ratio of ^{13}C to ^{12}C when carbon dioxide enters the ocean is substantially less than when it is assimilated into plants via photosynthesis, so a fish-based diet can be distinguished from a plant-based diet or one that is based on herbivorous animals. Human bones, and those of dogs, examined by Tauber show a local change in subsistence in the long mesolithic period which covers the Maglemose and Ertebolle stone age cultures (~7000–3000 BC, uncalibrated) in Scandinavia. In the earlier Maglemose culture, almost no fish was consumed but subsequently fish played a large part in the diet (so Tauber refers to the 'hunter' and 'fisher' Stone Age periods). Nitrogen isotope ratios ($^{15}N/^{14}N$) confirm the results from carbon isotope analysis. □

*The 3rd Nordic Conference on 'The Application of Scientific Methods to Archaeology', Mariehamn, 8 - 11 October, 1984, was organized by Dr Högne Jungner of the Radiocarbon Dating Laboratory, Helsinki. The Proceedings will form a special issue of ISKOS, published by the Archaeological Society of Finland.

†English translation in Fletcher J.M. & Linnard W. *Russian Papers on Dendrochronology and Dendroclimatology 1962, 1968, 1970, 1972*, 124 (Oxford University, 1977).

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Palaeontology

Ammonoids and extinctions

from Digby J. McLaren

SPECULATION on causes of extinctions in the geological past dates back to the early days of geology when Cuvier's catastrophic model was replaced by Lyell's gradualism, giving rise to Whewell's derisory term ''uniformitarianism'. Today several immediate causes are fielded, both gradual and sudden, and there is a considerble degree of polarization among their protagonists. Because of the nature of the fossil record, most hypotheses are concerned principally with marine faunal extinctions, although they may be generalized to the land and the plant kingdom. They include climatic change[1], anoxic oceanic events[2], eustatic events, either a fall[3] or a rise[4,5] in sea level, and large-body impacts[6,7]. It seems increasingly likely that a variety of mechanisms, acting singly or severally, have caused environmental change leading to extinctions at different times in Earth history. Furthermore, confusion between conflicting hypotheses arises through failure to distinguish between immediate or proximate causes and the three possible ultimate causes: internal terrestrial effects (for example, mantle movements), orbital and solar changes, and random or episodic meteoroid or cometary impacts[8].

On page 17 of this issue, M.R. House has used his knowledge of the Ammonoidea, an extinct subclass of the cephalopods, in an attempt to use evolutionary changes as a 'bioseismograph' to detect events causing environmental change[9]. He considers eight extinctions over a selected period of ~30 Myr from the Lower Devonian to the base of the Carboniferous. He recognizes a sequential pattern in each of these events — a decline in diversity and an inferred reduction in biomass, followed by appearance of new forms, increase in diversity and the re-establishment of normal evolutionary trends. Interestingly, similar patterns have been reported for extinctions of other groups including trilobites in the Cambrian[10], mammal-like reptiles from Carboniferous to Trias[11], and Foraminifera at the beginning of the Paleocene[12], as well as the abrupt extinction and slow subsequent re-establishment and radiation of most corals and brachiopods after the end of the Frasnian[13,14] (which House calls the Kellwasser event).

The eight extinction events differ in degree. Some are now recognizable only by detailed changes in ammonoid development; three are large and known to affect many unrelated groups:

(1) The Taghanic event, which marked the end of the Givetian (according to established general usage — House rightly deplores the changes made by the Devonian Subcommission[15]), was a major extinction, particularly well defined by marked changes in the ammonoids. It represents the beginning of the end of the eastern North American faunal province.

(2) The Kellwasser event (the name of which is, in my opinion, unfortunately chosen for a world-wide extinction at the end of the Frasnian). Space does not allow development of the argument, but Walliser[5] and House[16] himself have shown that euxinic black shale deposition, which marks the beginning of this event in Germany, began before the end of the Frasnian. Typical Frasnian corals and brachiopods flourished in other parts of the world, for example Alberta and northwest Australia, and became extinct at about the end of the *Palmatolepis gigas* conodont zone. The Famennian fauna of the early Stage was depauperate and markedly different, and the Stage saw the slow development of new radiations in several groups that were the precursors of the Carboniferous fauna. Recently an iridium anomaly has been discovered in the Upper Devonian of the Canning Basin, northwest Australia, at the horizon of the late Frasnian extinction event[17]. Although the