

seems reasonable to propose, as do Fodor and his colleagues, that the rise originated as a series of volcanic islands and/or seamounts which underwent magmatic differentiation and subsided as the South Atlantic opened. The evidence for subsidence is that the Rio Grande sediment contains shallow-water fossils incompatible with its present depth. Those same sediments also contain little or no volcanic material, suggesting that the igneous activity represented by the dredge samples must have occurred early in the South Atlantic's history.

However, the question of how the volcanic islands formed is still unsolved. They appear to be consistent with generation at a hotspot, although volcanic activity along fracture zones cannot be ruled out. The origin of the Walvis ridge is similarly uncertain.

## European tree-trunks reveal post-glacial changes

from J. M. Fletcher

A symposium on Dendrochronology was held on 19 August, 1977, as part of the X INQUA Congress at Birmingham.

DENDROCHRONOLOGY, the dating of wood remains by the number and pattern of tree-rings has been extensively used to date wooden artefacts and timber structures from prehistoric to relatively modern times (see *News and Views* 268, 402; 1977). Some of the research reported at the symposium demonstrated that the type of tree-ring analysis involved is also revealing and dating major changes in palaeogeography over the past 10,000 years and calibrating radiocarbon ages with greater accuracy than hitherto.

In Europe, Bruno Huber (1899–1969) established German preeminence in this subject and this position is being maintained by the work of his pupils, in particular by that of B. Becker (University of Hohenheim, Stuttgart). From his comprehensive study of the subfossil tree trunks that lie at various depths in the sediments occupying former river channels in central Europe Becker has been able to trace and date with precision changes in fluvial activity and in climate from 9,600 BP (in

Preboreal time) to 780 AD, after which few trunks were deposited in the drainage systems studied.

The information on climatic changes has been derived from the changes in species present in the immediate post-glacial period and from the dating by dendrochronology of 2,000 oak tree-trunks in association with the variations in their average ring-widths (that is growth rates) at different times in the Holocene.

Periods at which depositions ceased simultaneously occurred in several river systems, for example the Danube, Rhine, Main and Werra. At other periods, for example 6,700 to 4,500 BC, the ring-widths and associated remains from peat indicate a slow rate of growth due to wet sites with a high ground water level.

The dates of major changes in the drainage system are pin-pointed by these results. For example, in late Atlantic times there was renewal of trunk accumulation due to high fluvial activity from 4,300 to 3,100 BC. Becker interprets his results for the Late Holocene as providing evidence not only for the activity of the rivers, but, from changes in the widths of the annual rings, for the clearance of forests by man with the production of deep alluvial soils.

A paper of particular interest to those concerned with the calibration of radiocarbon dates dealt with results at Queen's University, Belfast on large samples (175–200 g), each covering 20 years growth, of the sub-fossil oaks already dated in the same department by tree-ring analysis. After a lengthy period of critical examination of the human and other errors that can arise in radiocarbon analysis, G. Pearson has achieved an accuracy in which the uncertainty on each of many results is as little as  $\pm 25$  yr. The importance of this accuracy, which is comparable to that (about  $\pm 20$  yr), now achieved at Seattle by M. Stuiver on comparable samples of recent wood, lies in the reliability of the information for the first period to be examined systematically, namely from 3,600 to 4,600 BP. Whereas previous results from US laboratories a decade or so ago were interpreted as showing distinct 'wiggles' in that part of the calibration curve, the Belfast results virtually conclusively demonstrate their absence.

Two papers in the session dealt with conifers at the timberline in the Alps. Françoise Serre (Laboratory for Palaeobotany and Palynology, Marseilles) has discovered what may well be some of Europe's longest-lived trees. Most of the 38 larches sampled at an altitude of 2,100 m in the Maritime Alps (France) are over 1,000 years old. About 20% of their ring-width sequen-

ces have been cross dated and the 'signature' years compared with climatic variations. The research extends to about 500 km, the distance in the Alps over which ring-width features for this species are common to particular years.

For the eastern Alps, the High Tavern of Austria, H. W. Posamentier (Department of Geosciences, Rider College, New Jersey) described how narrow and wide rings of stone pine and larch at the timberline are related to records of glacier advance or retreat. For stone-pine, the correlation coefficient ( $r$ ) is  $-0.69$  for the years 1891–1969. The tree-ring record implies 10 or 11 periods of glacier advance since 1585: these include the years 1627–28 and 1815–22 when ring-widths were at their lowest values. □

## Snow geese, lizards and sunbirds

from John Krebs

The 15th International Ethological Conference was held at Bielefeld, FRG on 25–31 August, 1977.

THERE are two genetically distinct colour phases of the lesser snow goose, *Anser caerulescens* breeding in Northern Canada. At the Eastern end of Hudson's Bay the large La Pérouse Bay colony contains 25–30% 'blue' and 70–75% 'white' morphs. At the conference, F. Cooke (Queens University, Ontario) described a remarkable long term study of the mating preferences of the two colour morphs. At La Pérouse Bay, most birds choose a mate of their own colour: only 16% of all pairs are mixed, compared with an expected 40% if birds had been choosing mates at random. In a series of experiments with captive geese, Cooke was able to show that the bird's preference for a mate of its own colour comes about through imprinting (learning during early life). The field observations and experiments established the following facts. Birds of mixed parentage choose mates at random with respect to colour, so that own colour has no direct effect on mate choice. In order for a clear preference to be established, a young bird has to grow up with parents and siblings of the same colour. Birds reared with parents and siblings of different colours showed no clear mating colour preferences, although they did avoid mating within

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J. M. Fletcher holds a Leverhulme Trust Fellowship granted through the University of Oxford to the Research Laboratory for Archaeology and History of Art.