

REVIEW

Relative Dating of the Fossil Hominids of Europe; by K P OAKLEY. London, 1980. (Bulletin of the British Museum [Natural History] Geology series, volume 34, part 1, approximately £8.00).

This extensive paper describes the methods of relative dating based on analysis of fluorine, uranium, and nitrogen in fossil skeletal material (specifically antler, bone, and teeth), and their application to hominid and other associated mammalian remains from Pleistocene and early post-Pleistocene sites in Europe. The principle upon which these methods of dating are based is that the concentration of fluorine and uranium in buried antler, bone, and teeth increases with time, whilst the nitrogen content decreases. As only small samples are required for the estimation of these elements (fluorine and nitrogen chemically, uranium radiometrically), all three methods are essentially non-destructive, often an important consideration as far as material from museum collections is concerned.

The discovery that fossil bones and teeth may contain a higher concentration of fluorine was made early in the nineteenth century and later, in the 1890's, the principle was successfully used by Adolphe Carnot for relative dating of human bone. The idea fell into oblivion, however, until revived and combined with the uranium and nitrogen methods by Kenneth Oakley of the Sub-Department of Anthropology at the British Museum (Natural History) in the late 1940s.

These three methods are strictly empirical, so that comparison of the concentrations of fluorine, uranium, and nitrogen in fossil bone must be made with those in bone of known age from a similar matrix from the same site. Nevertheless, Dr Oakley was able from the start to apply these methods critically to a large number of specimens from a wide range of sites. Some of the remains he investigated had been known since the early days of systematic palaeontology (for example, the famous 'Red Lady' of Paviland found in 1823) and the dating of some (for example, the human skeletons of modern type found in 1880 in Tertiary deposits at Castenedolo, Italy) had always been highly controversial. This publication is, therefore, a valuable account of the way in which the antiquity of many well-known human remains has been confirmed whilst others, such as those from Castenedolo, have been usefully dismissed from the fossil record. The results of this work have played an important part in the compilation by Oakley and his colleagues of the comprehensive three-volume *Catalogue of Fossil Hominids* (1967-1975) covering Africa, Europe, the Americas, Asia and Australasia, published by the British Museum (Natural History). Dr Oakley's research report is of particular interest also because the investigation of the relative age of many of the remains was followed by confirmatory radiocarbon measurement. Indeed, in some laboratories, analysis of fluorine, uranium, and especially nitrogen, is considered to be mandatory before subjecting human skeletal material to radiocarbon analysis, the known average ratio of carbon to nitrogen in unburnt bone of 2.5:1 being a useful guide to the amount of material required.

Following an introduction in which the history, principles, and applications of these methods are fully discussed, there is a descriptive catalogue of the hominid and other skeletal remains from Europe that were investigated. Of particular interest and importance among these are the remains from Krapina (Yugoslavia), Mauer, Heidelberg (Germany), Swanscombe, Thames Valley (England) and Vértesszöllös (Hungary). The numerical results of the analyses are arranged chronologically by countries in 17 tables and there are 6 text figures. These include graphs showing the fluorine/phosphate ratios of fossil skeletal material in relation to stratigraphic age, electron micrographs of collagen fibrils preserved in ancient bone and ivory, and a chromatogram of the amino-acids obtained from acid hydrolysis of ancient collagen. Finally, there is a valuable bibliography of more than 160 references.

In summary, this work brings together, in the form of an accessible monograph, the results of research conducted by Kenneth Oakley over a period of more than 25 years on the relative dating of fossil hominids and is the most authoritative statement on the subject now available; it will form the model and the base-line for all future studies.

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