

GENERAL SCIENCE NOTES

THE AGE DATING OF BIOLOGICAL MATERIALS — SOME INTERESTING PROBLEMS

By Richard D. Tkachuck, Geoscience Research Institute

Two seemingly unrelated papers when juxtaposed provide some interesting insights into the problems of dating biological materials. The paper by Weiner et al.¹ describes an analysis of aspartic acid racemization in collagen removed from the Dead Sea Scrolls. In most of the natural world, L-amino acids are incorporated into proteins. Upon death of the organism, a slow racemization of the L-forms to the D-forms takes place. Finally an equilibrium is reached where an equal abundance of both is observed. Under constant laboratory conditions this racemization takes place at predictable rates. If the assumption that the laboratory conditions approximate field conditions over the long haul is valid, it should be possible to determine the age of an organic sample. This method was used by Bada² to date human fossil remains found in Sunnyvale, California, at 70,000 years. (A few years earlier a sample from Del Mar, California, was dated at 48,000 years by Bada).

In the work of Weiner et al., racemization data was collected from two different sites of the same manuscript. Several different manuscripts were examined in such a manner. An interior site was chosen which showed little morphological change, while the other site which was along the edge showed morphological change in the collagen form. A sharp boundary between the two regions indicated that the edges of samples became wet sometime in the past. In one case, sample areas were only 5 mm apart. When the various samples were examined for the D/L ratios, significant differences were observed between the two portions of the same scroll fragments. It is suspected that water acts on the collagen to change its physical characteristics to that of a gel. In the gel state, it appears that racemization takes place at a much more rapid rate. Thus relatively minor alterations in the environment of the sample can drastically affect its apparent age.

The paper by Bischoff & Rosenbauer³ reexamines the Del Mar and Sunnyvale materials which Bada had dated. The skeletal remains were of modern affinities and the dating by Bada has caused some consternation among anthropologists who feel that this is much too early a date for modern man in the new world. Basing their analysis using uranium series dating age for Del Mar was 11,000 years and Sunnyvale was 8300 years.

In conclusion, it can be seen that there are still unresolved difficulties in the age-dating of fossil materials and that caution is urged before the acceptance of a particular interpretation.

ENDNOTES

1. Weiner S, Kustanovich Z, Gil-Av E, Traub W. 1980. Dead Sea Scroll parchments: unfolding of the collagen molecules and racemization of aspartic acid. *Nature* 287:820-823.
2. Bada JL, Helfman PM. 1975. *World Archaeology* 7:160.
3. Bischoff JL, Rosenbauer RJ. 1981. Uranium series dating of human skeletal remains from the Del Mar and Sunnyvale sites, California. *Science* 213:1003-1005.