VIRTUES AND VICES OF THE PALEOMAGNETIC METHOD AS APPLIED TO MARINE SEDIMENTARY CORES

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ABSTRACT

The geomagnetic polarity has changed irregularly at least twenty times during the last five million years. These polarity changes are world-wide synchronous events and are readily recorded by most sediments of fine silt or smaller size. For reasons which are not clearly understood, polarity and faunal changes sometimes occurred simultaneously. It follows that the paleomagnetic method is a very powerful technique for resolution of Plio-Pleistocene stratigraphic problems, such as exist in the sediments of the Gulf of Mexico.

It will be shown that, like many new techniques, the method is dangerously susceptible to misapplication. This misapplication may result from lack of consideration of: a) variable deposition rates; b) disconformities and unconformities; c) faunal redeposition; d) magnetic recording lag of consolidating sediment; e) an imperfectly defined polarity history; f) limitations of unoriented cores in low latitudes; g) experimental difficulties. Examples of resulting difficulties will be illustrated by presentation of results from continuing studies of deep-sea sedimentary cores from the South Pacific.

It is concluded that the study of paleomagnetism in marine sedimentary cores parallels the earliest conventional stratigraphic methods, in that integration of several disciplines is required for efficient and reliable exploitation of the technique.

RELATIONSHIPS BETWEEN GLOBOROTALIA TRUNCATULINOIDES AND G. TOSAENSIS IN A PLIOCENE-PLEISTOCENE DEEP-SEA CORE FROM THE SOUTH PACIFIC

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ABSTRACT

Based on nannofossils a carbonate core from the South Pacific (Eltanin 21-5; 36°41′S; 93°38′W; length 480 cm; depth 3121 m.) is Upper Pliocene to Lower Pleistocene in age. The Pliocene-Pleistocene boundary (325cm) is placed at the last appearance of most discoaster species in the core including *D. pentaradiatus* and *D. surculus*. *Discoaster brouweri* extends higher, to 225 cm where it also becomes extinct. Above the top of the Pliocene, the presence of *D. brouweri* and absence of *Gephyrocapsa oceanica* indicates a lower Pleistocene age, with the middle Pleistocene and much of the Upper Pleistocene missing in unconformity near the core top.

This core, which lies south of the tropics, is significant in showing alternations of dominantly keeled and dominantly non-keeled populations of the *Globorotalia truncatulinoides–G. tosaensis* plexus. The lower (425-480 cm) and upper (0-130 cm) core sections contain populations dominated (>78%) by keeled forms referable to *G. truncatulinoides*, while intermediate intervals between 198 and 400 cm contain populations dominated (>80%) by non-keeled forms which agree well with topotypes of *G. tosaensis*. Transitional populations occur between 145 and 180 cm.

Globorotalia truncatulinoides is associated in the core only with marginal tropical foraminiferal faunas including *Globorotalia menardii*, *Globigerinoides conglobatus* and *"Globigerina" dutertrei* while *G. tosaensis* is associated with a cooler-water planktonic foraminiferal assemblage lacking these species and with higher frequencies of *Globorotalia inflata* and right coiling *Globigerina pachyderma*. Likewise, the warm-water coccolith *Umbilicosphaera leptopora* exhibits marked increases in frequency in the upper and lower core sections containing *G. truncatulinoides*.

Although not decisive, this sequence suggests that during the Upper Pliocene to Lower Pleistocene, at least in this area, *G. truncatulinoides* and *G. tosaensis* were either phenotypic variants or separate subspecies or species with distinct environmental preferences. It also provokes speculation as to whether the *G. tosaensis* to *G. truncatulinoides* evolutionary bioseries reported by a number of workers near the Pliocene-Pleistocene boundary in tropical deep-sea areas, including the Gulf of Mexico, is instead the result of ecological or oceanographic change.