Distribution of high quality Plio-Pleistocene magnetostratigraphic records

Brad L. Clement, Florida International University

The development of hydraulic piston coring techniques by the Deep Sea Drilling Project and the Ocean Drilling Program has revolutionized the paleomagnetic study of deep-sea sediments. These coring methods are capable of recovering thick sequences of relatively undisturbed sediment. As a result, it has been possible to document the polarity history over long intervals of time, and obtain high-resolution records of geomagnetic field behavior from sequences of rapidly accumulating sediment. The high-resolution records of polarity reversal transitions obtained from cores taken by the DSDP and the ODP were the basis for the still controversial interpretation that the virtual geomagnetic poles tend to fall along two, nearly antipodal, longitudinal paths during reversals. If true, this means that the lowermost mantle of the Earth must influence the geodynamo in the generation of the field as it reverses. In order to test this hypothesis it is necessary to extend the geographical coverage of transition records. Because two-thirds of Earth's surface is covered by the oceans, it is clear that deep sea sediment records are the most important potential source for these records. An important objective for future drilling is to widen the geographical coverage of high quality transition records. The distribution of DSDP, ODP and Lamont-Doherty Earth Observatory sites which produced the best quality, Plio-Pleistocene magnetostratigraphic records are plotted in the figure on a satellite image of photosynthesis in the ocean's surface. There is a strong coincidence between the distribution of high quality magnetic records and surface water productivity. However, the distribution of high quality, magnetostratigraphic records also shows a strong correlation with the distribution of detrital sediment. These apparent correlations present a conundrum, suggesting that either some factor related to biological productivity (possibly biogenic magnetite, or processes associated with changing oxidation-reduction conditions), or simply detrital input, is the most important critical factor that governs the fidelity of the paleomagnetic record. How this will be resolved by ODP is not obvious but is important for predicting where suitable high-resolution records may be obtained in future drilling.

References:

Clement, B. M., D.V. Kent, and N. D. Opdyke, A synthesis of magnetostratigraphic results from Plio-Pleistocene sediments cored using the hydraulic piston corer, *Paleoceanography, 11,* 299-308, 1996.