Characteristics of the Geomagnetic Field From the Present to the Middle Jurassic: The Perspective From Marine Magnetic Anomalies

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Lineated marine magnetic anomalies generated by sea floor spreading at oceanic ridges are the principal records of geomagnetic polarity reversals for the past 170 Ma. Very generally, the marine record shows two sequences of lineated magnetic anomalies (0-84 Ma and 121 to about 155 Ma) and two magnetic quiet zones where the anomalous fields are very small. Age calibration of the lineated magnetic anomalies suggests magnetic field reversal rates ranging from less than one to about five/m.y. The younger magnetic quiet zone at 84-121 Ma in the mid-Cretaceous is marked by abrupt boundaries in magnetic anomaly amplitudes, although the rate of reversals generally increases from 84 Ma towards the present. This quiet zone almost certainly results from a period of no magnetic reversals for about 37 m.y. called the Cretaceous normal superchron. The older quiet zone has a gradually emergent younger boundary in both rate and amplitude, characterized by gradually increasing anomaly amplitudes and decreasing reversal rate from about 155 Ma towards the present. Detailed marine magnetic surveys within this quiet zone and land-based reversal stratigraphy within the Middle Jurassic both suggest many magnetic reversals. Thus, the Jurassic quiet zone probably results, at least in part, from magnetic polarity transitions spaced so closely together within the seafloor as to attenuate their anomalous fields at the sea surface. The Middle to Late Jurassic probably had a much larger reversal rate than at any subsequent time. If deep mantle convection (plume) activity exerts a control on reversal rate, then an increase in Cretaceous mantle plume activity, as evidenced by oceanic plateaus of that age, might have caused the Cretaceous normal superchron. Very little Jurassic seafloor remains to test the opposite possibility for the Jurassic quiet zone.

1. Chapman Conference on Timescales of the Geomagnetic Field 2. Invited 3. (a) R L Larson, Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882-1197 (b) 401-874-6165 (c) 401-874-6811 (d) rlar@gsosun1.gso.uri.edu 4. No