Is Earth's Magnetic Field Reversing?

Catherine Constable
Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography
University of California at San Diego
La Jolla, CA920930225
USA
cconstable@ucsd.edu

Monika Korte
GeoForschungsZentrum Potsdam
Telegrafenberg
14473 Postdam
Germany
monika@gfzpotsdam.de

Abstract

Earth's dipole field has been diminishing in strength since the first systematic observations of field intensity were made in the mid nineteenth century. This has led to speculation that the geomagnetic field might now be in the early stages of a reversal. When placed in the longer term context of paleomagnetic observations it is seen that the current value remains high compared with the average throughout the ongoing 0.78 Myr Brunhes polarity interval; the present rate of change in Earth's dipole strength is not anomalous compared with rates of change for the past 7 kyr; the Brunhes is not improbably long when compared with the current reversal rate and expected statistical variability in polarity interval length; furthermore there is evidence that the field has been stronger on average during the Brunhes than for the past 160 Ma, and that high average field values are associated with longer polarity chrons. The paleomagnetic evidence does not support the idea that the field is entering a polarity transition, although it remains a reasonable supposition that the magnetic field will eventually reverse even though the time scale is unpredictable. A more immediate concern is that ongoing secular variation in the magnetic field may be expected to moderate the current high dipole strength on centennial to millennial time scales: it would not be surprising if it dropped substantially, returning closer to the average without necessarily reversing. This could have important consequences for space weather, and also highlights the need for improved understanding of the impact of geomagnetic field strength on the production rates of cosmogenic isotopes that are used to estimate past solar variability.