Testing the dipole throughout geological time

M.E. Evans[1]

[1] Institute for Geophysical Research, University of Alberta

The long-term morphology of the geomagnetic field plays a central role in palaeomagnetic investigations and in geodynamo simulations. But it is very difficult to demonstrate observationally what its dominant morphology has been throughout geological time. One early test was based on the idea that the sum total of palaeomagnetic sampling combined with plate tectonic movements has, over time, provided a random sample of the geomagnetic field. If this is so, then it should be possible to deduce certain broad features of the time-averaged field. This random palaeogeographic test (RPT), as it is now called, initially gave the encouraging result that the field was dipolar throughout the entire Phanerozoic (0-600 Ma). However, there has recently been some discussion concerning the efficacy of the RPT. Different approaches lead to strongly divergent conclusions, all the way from the view that (a) a few hundred million years is enough to furnish a statistically adequate sample to the assertion that (b) a time interval greater than the age of the Earth would be required. In an attempt to shed further light on this conundrum, we have investigated how a spherical cap (representing a super-continent) samples the earth's surface as it executes a random walk at a typical plate velocity. The results strongly favour viewpoint (a) and suggest that there is a high probability that the RPT furnishes a suitable test over intervals of ˜300 Ma.