

Long-term Phanerozoic Octupole Fields

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The assumption that the ancient geomagnetic was purely dipolar is fundamental to paleomagnetism. However, one sign that something may be amiss is that observed inclinations at mid-latitudes are often lower than expected. A zonal octupole field in the late Paleozoic, Mesozoic and Early Tertiary was revealed by comparing the observed paleomagnetic paleolatitude distributions for Laurussia (North America, Greenland, and Europe) with those predicted from the mean paleopoles. When only volcanics are analyzed, the pattern remains unchanged, indicating that inclination error in sediments is not the culprit. Estimates of the magnitude of the octupole/dipole field ratio center around 0.1, which could cause errors in conventional paleopoles of about 7.5 degrees; because of the antisymmetry of octupole fields a comparison of paleomagnetic poles from mid-northern and mid-southern hemisphere locations could thus be off by as much as 15 degrees. The well-known misfit between the paleomagnetic results from the Laurentia-European and Gondwana continents in a classical Pangea A configuration could be explained by such errors due to octupole fields. This explanation would negate the need to seek tectonic (Pangea B type) solutions for the misfit. Another misfit based on too-low inclinations is seen in a comparison of Central Asian poles with those for the Eurasian reference path, and here as well do octupole fields provide a possible solution, although sedimentary inclination shallowing is another possibility. When including Pre-Permian poles for Gondwana in a similar test for non-dipole fields, an increase in the percentage octupole contribution is suggested for older times. Undoubtedly, the octupole field contributions have varied in magnitude over shorter time scales as well.

1. Chapman conference on Timescales of the Geomagnetic Field 2. Invited by J. E. T. Channell 3. (a) Rob Van der Voo Dept. Geological Sciences, University of Michigan, Ann Arbor, MI. 48109-1063 (b) 734-764-8322 (c) 734-763-4690 (d) voo@umich.edu 4. No