

Regionally Recurring Transitional Field Structures: Further Evidence of Mantle Control Over the Geodynamo

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The question of whether mantle influence over the reversing geodynamo is observable has been hotly debated over the past several years. Paleomagnetic database studies of late Cenozoic transition records have been inconclusive. Yet, certain recurrent features of reversing fields continue to be reported. Our findings indicate that the apparent inconsistency can be explained through regional rather than global investigations of available data. For example, some Matuyama-Brunhes reversal records contain the common feature of grouped sequential VGPs near and within western Australia. Those that do often are from sites that roughly ring Australasia. Yet detailed Matuyama-Brunhes records from the North Atlantic, for example, do not.

Five reasonably detailed transitional field records from lavas erupted at the Society Island hotspot spanning the past 3 Ma--a Pliocene event (from Huahine), and the Punaruu Event, termination of the Jaramillo, Matuyama-Brunhes, and Big Lost Event (from Tahiti)--all contain some degree of VGP clustering off the western Australian coast. Interestingly, VGPs associated with the modern-day field after removal of the axial dipole term determined for sites that surround Australasia (spanning 90° of longitude and 60° of latitude) are found to cluster about western Australia. Such is also the case for the modern-day non-dipole field. These findings suggest that bundles of concentrated magnetic flux presently emerging from the fluid core beneath Australasia have been held essentially stationary by the mantle over the past several millions of years, and that they regionally dominate the surface field at those times when the axial dipole is weak or non-existent.

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