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Evidence of possible long-term changes in the pattern of mantle-held magnetic flux from comparison of transitional field records

K.A. Hoffman
Physics Department, Cal Poly State University, San Luis Obispo, California, USA

Findings from studies of the paleomagnetic field since the late Tertiary, and of the historic field to the present day, often indicate a configurational persistence consistent with long-lived mantle influence over flux emanating from Earth's fluid core. For example, many records of polarity transitions possess the common feature of clustering of sequential virtual geomagnetic poles (VGPs), indicating considerable time spent by the field in similar configurations while reversing. One such recurring VGP cluster is found near western Australia. Fundamental to an understanding of such behavior is the question of the spatial-temporal nature of the physical conditions at the base of the mantle that may control the pattern and movement of magnetic flux. With this in mind, we have been investigating paleomagnetic reversal records in eastern Australia, a site presumably closest to the source of flux mainly responsible for this VGP cluster. Australia's Great Dividing Range consists largely of hotspot volcanism spanning the entire Cenozoic. We recently presented an analysis of the transitional field during a mid-Cenozoic (25 Ma) reverse-to-normal (R–N) polarity change recorded in a continuous sequence of lava flows in southeastern Queensland. This record contains a VGP cluster near the west coast of Australia, nearly identical to a number of Plio-Pleistocene transitional field records obtained from other localities. This correlation strongly suggests that the duration over which mantle conditions may remain effectively stationary, retaining an apparently unaltered hold over the pattern of flux at the CMB, is far longer than has previously been observed. Yet, this finding contrasts the detailed R-N transitional field record gleaned from the 35 Ma Liverpool Volcano sequence in nearby New South Wales. In this case alone the VGP cluster is found over New Zealand. Albeit speculative, findings from these two Australian records, having been obtained from indistinguishable sites relative to the CMB, are consistent with a

westward lateral change in the pattern of mantle-held flux beneath Australasia sometime within the intervening 10 Myr between these eruptive sequences. If so, and again speculative, the complex nature of the CMB beneath the Tasman Sea may be responsible. This region lies midway between the two VGP cluster sites and has recently been found to be a pocket of dense, partially molten material as well as a zone of ultralow seismic velocity. Assuming this anomalous region existed in the mid-Cenozoic the question is: could it have facilitated a large bundle of flux to “skip” westward to a location that has remained stationary to the present day?