MAGNETIC SOURCE SEPARATION IN THE OUTER CORE: INTRODUCING THE SCOR-FIELD

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We present evidence that the primary source of Earth's axial dipole (AD) is physically distinct from souces responsible for the rest of the geomagnetic field. Support for this claim comes from correlations between the structure of the historic non-axial dipole (NAD) field and transitional paleomagnetic behavior recorded in lavas during the early Brunhes Chron. 40Ar/39Ar age determinations of lavas from West Eifel, Germany, indicate the recording of five excursions spanning ~200 kyr, including the Big Lost Event (~580 ka). Transitional lavas from Tahiti also record the Big Lost as well as the Matuyama-Brunhes reversal. Virtual geomagnetic poles (VGPs) recorded at West Eifel are spread across Eurasia, while those recorded on Tahiti during the two events are associated with the same tightly clustered location west of Australia – the site of the most intense NAD flux feature since direct field measurements started some 400 years ago. The differing locations and amounts of spread of transitional VGPs match – at both sites – virtual poles determined for the historic NAD-field. We contend that (1) the field generated by deep convective columns near the tangent cylinder is the primary source for the AD; and (2) the field arising from flux concentrations held and controlled by lower mantle conditions is the primary source for the NAD. Since there most certainly is a small contribution to the AD term (g_1^0) associated with mantle-held sources, we define this field as the Shallow-Core-Generated (SCOR) field. Paleomagnetic data from Tahiti and Australia strongly suggest that the Australasian flux feature is long-lived, regionally dominating the field when the strength of the main AD had significantly weakened or vanished. We argue that recurrence of transitional VGPs observed over geologic time indicates that (1) the entire field does not reverse as a single unit, and (2) field sources exist in the core that are sufficiently separated to be in "poor communication." It follows that subsequent work on spherical harmonic-based field descriptions may now incorporate an understanding of a dichotomy of spatial-temporal dynamo processes.

Reversals, Dynamo, Core

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