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Paleomagnetic reconstruction of the global geomagnetic field during the Matuyama/Brunhes transition

R. Leonhardt and K. Fabian

Department für Geo- und Umweltwissenschaften, Ludwig-Maximilians-Universität, 80333 München, Germany

The Earth's magnetic field changed its polarity from the last reversed into today's normal state approximately 780 000 years ago. While before and after this so called Matuyama/Brunhes reversal, the Earth magnetic field was essentially an axial dipole, the details of its transitional structure are still largely unknown. Here, a Bayesian inversion method is developed to reconstruct the spherical harmonic expansion of this transitional field from paleomagnetic data. This is achieved by minimizing the total energy variation at the core-mantle boundary during the transition under paleomagnetic constraints. By the proposed method several high quality paleomagnetic reversal records are iteratively combined into a single geometric reversal scenario without assuming an *a priori* common age model. After inverting only four geographically distributed paleomagnetic records of the Matuyama/Brunhes reversal, the obtained spatio-temporal reversal scenario successfully predicts most independent transitional records. The obtained reconstruction invites to compare the inferred transitional field structure with results from numerical geodynamo models regarding the morphology of the transitional field. It also offers new answers to the long standing problems of existence of preferred longitudinal bands during the transition and reversal duration. Our model of the last reversal indicates a non-dipolar dominance during the transition. Thus, the character and information of surface geomagnetic field records is strongly site dependent. Different directional variations of the surface geomagnetic field, continuous or abrupt, are found during the transition. Two preferred longitudinal bands along the Americas and East Asia are not observed for uniformly distributed sampling locations on the globe. The paleomagnetic duration of reversals shows not only a latitudinal, but also a longitudinal variation. Even the paleomagnetically determined age of the reversal varies significantly between different sites on the globe.