Dipole strength during the Matuyama-Brunhes reversal reconstructed from the deconvolution of magnetic and climatic modulation of 10Be/9Be records

Ramon Egli1, Tatiana Savranskaia2, Jean-Pierre Valet2, Franck Bassinot3, Laure Meynadier2, Quentin Simon4, Didier Bourlès4, and Nicolas Thouveny6

1ZAMG, Wien, Austria (ramon.egli@zamg.ac.at)
2IPGP, Paris, France
3LSCE, Gif-Sur-Yvette, France
4CEREGE, Aix-en-Provence

The global production rate of the cosmogenic isotope 10Be by cosmic ray spallation is modulated by the activity of the sun and the intensity of the far-reaching component of the Earth magnetic field, which is in turn dominated by the dipolar term. Therefore, sedimentary 10Be records can be used to reconstruct past variations of the geomagnetic dipole moment. However, several environmental factors affect the transfer of 10Be atoms from the high atmosphere and soils, where it is produced, to the sediment, introducing a significant climatic modulation that can, in worst cases, completely obscure the paleomagnetic signal. These factors include variations of the continental runoff, oceanic circulation, sediment fluxes, and sediment scavenging efficiency. The latter is largely removed by normalizing the 10Be record with the concentration of authigenic 9Be, which is accumulated by sediment particles in the same manner as the cosmogenic isotope. Even with this correction in place, individual 10Be/9Be records are significantly influenced by climate, to the point that only major geomagnetic events, such as the MB reversal, can be recognized. We present a model, which, for the first time, enables to deconvolve, at least partially, the climatic and magnetic components of 10Be/9Be records on a set of cores from the Atlantic, Indian, and Pacific Ocean. The climatic modulation is composed of an additive term, which reflects Be recycling through diagenetic release from sediments, and a multiplicative term, which is dominated by oceanic current patterns. Knowledge of these terms enables to remove, at least partially, site-specific environmental effects, obtaining a corrected 10Be/9Be stack that can be inverted to reconstruct variations of the dipole moment during the last geomagnetic reversal.
