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Loess 10Be evidence for an asynchronous Brunhes-Matuyama magnetic polarity reversal

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In Chinese loess the Brunhes-Matuyama (B-M) geomagnetic reversal appears to occur about 25 ka prior to the established axial dipole reversal age found in many marine sediments, i.e. in Chinese loess this magnetic reversal boundary is found in glacial loess unit L8 which is thought to be correlated with Marine Isotope Stage 20 (MIS 20), in marine sediment records, however, this boundary is commonly found in interglacial period of MIS 19 (Tauxe et al., 1996; Zhou and Shackleton, 1999), leading to the debate on uncertainties of paleoclimatic correlation between the Chinese loess-paleosol sequences and marine sediments (Wang et al., 2006; Liu et al., 2008; Jin and Liu, 2011). Based on this issue, here we propose to use the cosmogenic 10Be to address this conundrum. 10Be is a long-lived radionuclide produced in the atmosphere by cosmic ray spallation reactions and carried to the ground attached to aerosols. Its atmospheric production rate is inversely proportional to the geomagnetic field intensity (Masarik and Beer, 1999). This allows us to reconstruct past geomagnetic field intensity variations using 10Be concentrations recorded in different sedimentary archives. We carried out both the 10Be studies and paleogeomagnetic measurements in Luochuan and Xifeng sections in Chinese Loess Plateau. Both loess profiles show that 10Be production rate was at a maximum-an indication of the dipole field reversal-at ca. 780 $\pm$ 3 ka BP., in paleosol unit S7 corresponding to MIS 19, proving that the timing of B-M reversal recorded in Chinese loess is synchronous with that seen in marine records (Tauxe et al., 1996). These results reaffirmed the conventional paleoclimatic correlation of loess-paleosol sequences with marine isotope stages and the standard loess timescale as correct. However, it is $\sim$25 ka younger than the age (depth) of the paleogeomagnetic measurements which show that the B-M boundary is in L8 in these two Chinese loess-paleosol sequences, demonstrating that loess magnetic overprinting has occurred.

References:
1. Jin, C.S., and Liu, Q.S., 2011, Revisiting the stratigraphic position of the Matuyama-Brunhes geomagnetic polarity boundary in Chinese loess: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 299, p. 309–317.
2. Liu, Q.S., Roberts, A.P., Rohling, E.J., Zhu, R.X., and Sun, Y.B., 2008, Post-depositional remanent magnetization lock-in and the location of the Matuyama-Brunhes geomagnetic reversal boundary in marine and Chinese loess sequences: Earth and Planetary Science Letters, v. 275, no. 1–2, p. 102–110.
3. Masarik, J., and Beer, J., 1999, Simulation of particle fluxes and cosmogenic nuclide production in the Earth's atmosphere: Jounal of Geophysical Research, v. 104, p. 12099-12111.
4. Tauxe, L., Herbert, T., Shackleton, N.J., and Kok, Y.S., 1996, Astronomical calibration of the Matuyama-Brunhes boundary: Consequences for magnetic remanence acquisition in marine carbonates and the Asian loess sequences: Earth and Planetary Science Letters, v. 140, p. 133–146.
5. Wang, X.S., Yang, Z.Y., Løvlie, R., Sun, Z.M., and Pei, J.L., 2006, A magnetostratigraphic reassessment of correlation between Chinese loess and marine oxygen isotope records over the last 1.1Ma: Physics of the Earth and Planetary Interiors, v. 159, p. 109–117.
6. Zhou, L.P., and Shackleton, N.J., 1999, Misleading positions of geomagnetic reversal boundaries in Eurasian loess and implications for correlation between continental and marine sedimentary sequences: Earth and Planetary Science Letters, v. 168, p. 117–130.