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Laboratory experiments confirm re-magnetization of Chinese loess by thermal cycling

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In situ experiments on loess from the Chinese loess plateau have revealed that partial re-magnetization may take place in both 'wet' and 'dry' L1-loess during a autumn-winter-spring season (Løvlie et al., 2011). Since percolating water was apparently not necessary for the acquisition of post-depositional remanent magnetization (pDRM) in this loess, it was suggested that temperature-variations may be the controlling factor causing re-magnetization. Re-magnetization has been proposed to be caused by the release and subsequent re-alignment of a fraction of remanence-carrying mineral grains. The release-mechanism is tentatively attributed to differences in thermal expansion coefficients of mineral-grains composing loess.
The in situ experiments were performed by turning loess-blocks upside-down, in order to simulate a geomagnetic 'reversal' of the ambient magnetic field. By turning loess upside-down it is conceivable that equilibrium positions of mineral grains created by deposition in nature influenced by gravity, will change, so that grains initially 'resting on the floor' inside interstitial voids, becomes part of the roof. Thus easily fall down, and during this re-align.

We have therefore performed experiments on fresh blocks of loess from one of the previously reported localities (Sunzhuangzi) by repeated exposure to thermal cycling between +30°C and -5°C in controlled magnetic fields. Partial re-magnetization was observed in both inverted and not-inverted blocks. The imposed reversed-polarity vector was found to be removed by thermal demagnetization below 300-350°C that is above the blocking temperatures for any viscous magnetization imposed during the ca 4 weeks duration of the experiments.
Alternating field demagnetization revealed the surprising results that the magnetic overprint was effectively removed in alternating fields below 35mT, suggesting that secondary components are carried by relatively 'soft', i.e. physically 'big' magnetic grains. Further experiments and constraints to assess the reality of the hypothetical thermally induced release of magnetic grains in loess will be discussed.

Reference:

Løvlie, R., Wang, R. and Wang, X., (2011). In situ remagnetization experiments of loess on the Chinese Loess Plateau: Evidence for localized post-depositional remanent magnetization, Geochem. Geophys. Geosyst., 12, Q12015, doi:10.1029/2011GC003830