Supplementary material

for “Late Plio-Pleistocene humidity fluctuations in the western Qaidam Basin (NE Tibetan Plateau) revealed by an integrated magnetic-palynological record from lacustrine sediments” by Herb et al.

#### *FORC diagrams*

First-order reversal curve (FORC) results are investigated as an additional tool to understand the controlling factors of χ variation along core SG-1. The abscissa of a FORC diagram (Hc) shows the coercivity pattern reflecting magnetic grain size (i.e., magnetic domain state) for a given magnetic mineralogy, the ordinate (Hu) represents the degree of magnetic interaction between and within (i.e., between domains) magnetic grains of a sample whereby a wider vertical scattering identifies stronger magnetostatic interaction between particles (Roberts et al., 2000; Muxworthy, 2013). FORC diagrams of samples from the χl group (Suppl. Fig. 1a) are not uniform, which is consistent with the high scatter of the low χ data observed in the Day Plot (Suppl. Fig. 2). The common behavior in most χl diagrams is a pronounced maximum near the origin, which diffuses along the Hc axis. That points to particles in the multi-domain (MD) to pseudo-single-domain (PSD) range (Roberts et al., 2000; Muxworthy and Roberts, 2007). Some samples of the χl group (e.g., sample at 202.92 m depth) show FORC distributions partly comparable with the ones of the χh group (Suppl. Fig. 1c). Also in the Day Plot these samples are located in the same range as χh samples (Suppl. Fig. 2) pointing to an additional small PSD to single-domain (SD) component (Roberts et al., 2000; Muxworthy and Roberts, 2007). FORC diagrams of samples from the χh group all have a well-defined distribution maximum close to Hu = 0 and Hc around ~40 mT (values range between ~20 and 50 mT); the oval contours are mostly axis-symmetric concerning the abscissa. These observations point to a predominant SD behavior (i.e., dominating spin rotations) with strong interactions; only a minor contribution of larger PSD particles is identifiable in some samples by a shift and slight widening of the distribution towards the ordinate (Muxworthy and Dunlop, 2002; Carvallo et al., 2005). The vertical spread of the FORC diagrams tends to be smaller in the χl group than in the χh group, indicating less magnetic interaction in χl samples. In summary, the FORC results can be related to the physical grain sizes of magnetite particles: samples from the χh group are characterized by small particles below about a few μm (Stacey and Banerjee, 1974; Dunlop and Özdemir, 1997), while samples from the χl group contain a wide range of particle sizes mainly above about 10 μm (Stacey and Banerjee, 1974; Dunlop and Özdemir, 1997).



Supplementary Figure 1: FORC diagrams of samples with (a) low and (c) high χ values, (b) χ (11-point simple moving average; data from Zhang et al., 2012) with depth locations of the samples in the χl (blue) and χh group (red).



Supplementary Figure 2: Day plot (Day et al., 1977) of the 40 samples used for palynological analysis (stratigraphic positions in Suppl. Fig. 1b; data partly from Herb et al., 2013); included parameters are saturation magnetization (Ms), remanent saturation magnetization (Mrs), coercivity (Hc), and coercivity of remanence (Hcr). Theoretical mixing curves for magnetite after Dunlop (2002) are indicated.

#### *References supplementary material*

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