Magnetic properties of late Pliocene-Pleistocene lacustrine sediments of the western Qaidam Basin (NE Tibetan Plateau): their use for detecting paleoenvironmental changes

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Abstract: The study of magnetic properties in lacustrine sediments for reconstructing past environmental changes plays an important role, both concerning dating using magnetostratigraphy and as high-resolution climate proxies. One important requirement for considering magnetic proxies in climate studies is to investigate their controlling factors (e.g., allogenic and diagenetic processes). The magnetic record of the lacustrine sediments in the 940-m-long drill core SG-1 from the western Qaidam Basin (NE Tibetan Plateau) is investigated in detail and offers diverse fields of applications in reconstructing past climate of the late Pliocene-Pleistocene in the study region. First, previous magnetostratigraphic dating (2.77–0.1 Ma) is refined with an orbitally-tuned age model by applying time series analysis on the magnetic susceptibility (χ) depth series within sliding windows, determining depths of characteristic spectral changes as tie points for sediment accumulation rate (SAR) changes, and finally refining the depth-time transformation by fitting to orbital frequencies. With this approach a higher-resolution SAR variation and so a more precise age model is obtained. Second, χ variation is investigated by the comparison with other magnetic properties and additionally with pollen results. For that purpose parameters of SG-1 indicating magnetic mineralogy and magnetic grain sizes are studied: hysteresis properties (M_{rs}/M_s, H_{cr}/H_c, M_s, χ_p, FORCs, 'Day Plot'), frequency-dependent susceptibility, laboratory-induced remanences (ARM, IRM, S-ratio, SIRM demagnetization, 'King Plot') and temperature-dependence of magnetic susceptibility. For the comparison of χ with pollen results the ratio of the taxa *Artemisia* and Chenopodiaceae (A/C ratio), which reflects vegetation dynamics in the study region, is taken into account. The results of these considerations suggest that χ variation is caused by both a changing catchment area and low-temperature oxidation (LTO) in the catchment area. LTO is manifested by the alteration of magnetite to maghemite and

further transformation to hematite as a consequence of weathering during wetter phases and corresponding higher lake levels. Other controlling factors as dissolution in the lake environment and LTO in the lake sediments can be excluded from the magnetic results. Summarized, the analyses of magnetic properties of the deep drilling core SG-1 offer a high-resolution humidity fluctuation record for the region of the western Qaidam Basin during the past 2.69 Ma.

Keywords: Magnetic proxies; Lacustrine sediments; Qaidam Basin; Tibetan Plateau