Magnetostratigraphy of Core SG-1 in the Western Qaidam Basin and its Tectonic-Environmental Implications

Weilin Zhang[1,2], Erwin Appel[2], Xiaomin Fang[1], Chunhui Song[3], Sihu Hu[3], Dongliang Liu[1]

[1] Institute of Tibetan Plateau Research, Chinese Academy of Science, Beijing 100085, China
[2] Institut für Geowissenschaften, Universität Tübingen, 72076 Tübingen, Germany, erwin.appel@uni-tuebingen.de
[3] Key Laboratory of Western China's Environmental Systems, Lanzhou University, Gansu 730000, China

The Qaidam basin, the largest intermontane basin on the Tibetan Plateau, contains a continuous long-term Cenozoic sedimentary record providing information on the history of tectonic activity and associated climatic change. We report a magnetostratigraphic study of a 938.5 m deep drill core (SG-1) in the sub-basin depocenter of the Chahansilatu' salt-alkali area between Eboliang anticline and Jianshan anticline in the western Qaidam basin (N38°24′35.3″, E92″30′32.6″) (Figure 1).

The sedimentary sequence comprises clay, clay-silt, and siltstone, intercalated with salt layers (mainly halite) and thin or scattered gypsum, representing long-term paleoclimate trends and fluctuations. From surface to ca. 350 m sedimentary cycles of thick salt and massive-laminated clay-siltstone with a ratio of about 1:3 are observed, while from ca. 350 to 720 m salt layers become much thinner. Below 720 m mainly siltstone/mudstone and intercalated sandstone interbeds dominate, with lesser salt nodules and scattered gypsum crystals.

Palaeomagnetic remanence was measured on 1257 samples from which 1128 samples were accepted for further interpretation, according to quality criteria. The demagnetization behavior is consistent throughout the core and separation of characteristic remanences is straightforward. Magnetite in a relatively hard coercive range is responsible for the magnetic signal. Normal and reverse polarity samples show antipodal inclinations and their numbers and values reflect the polarity distribution of Earth's magnetic field within the last ca. 3 Myr, with some shallowing of inclination. Combining our magnetostratigraphy results with data from previous boreholes and fossil ostracod ages, the age of SG-1 can be determined to the period between ca. 2.7 Ma to 12 ka, including the later Gauss epoch, the complete Matuyama epoch and almost the entire Brunhes epoch (Figure 2a).

The average sediment accumulation rate (SAR) (Figure 2b) and magnetic susceptibility (MS) variation (Figures 2c,d) indicate three major changes at about 2.6 Ma, 2.2 Ma and 0.8 Ma, respectively, correlating well with the changes of lithology and fossil ostracod data. From the trend and spectral characteristics of MS (Figure 2e) and the SAR changes, combined with other available results, we conclude that significant tectonic activity and fluctuating continental aridification were prevailed between 2.6 and 2.2 Ma, followed by ongoing tectonic deformation and strengthening of aridification during the period 2.2 to 0.8 Ma, finally culminating in further intensification of tectonic activity and extreme aridification since the early Brunhes epoch (post-0.8 Ma).

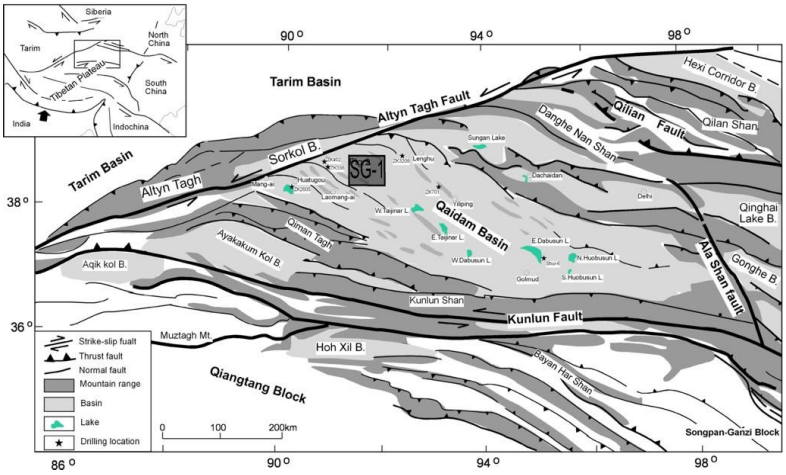

Figure 1. Structural setting of the Qaidam basin and adjacent regions (modified from Meyer et al. 1998). The drilling site SG-1 is indicated by the box.

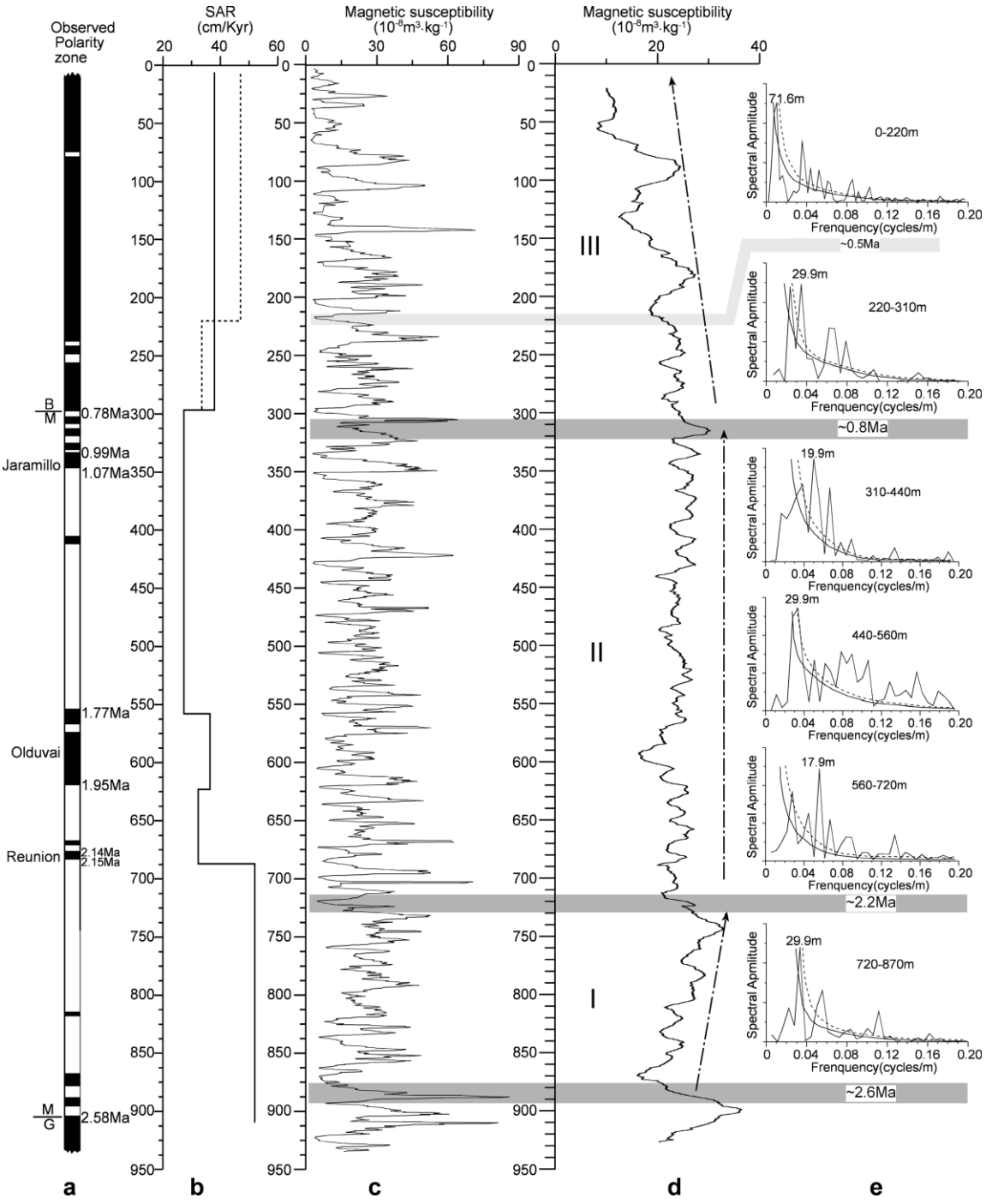

Figure 2. Results from SG-1: (a) observed magnetic polarity zones and interpreted boundaries; (b) sediment accumulation rate (SAR); SAR calculated by the magnetostratigraphic results is shown by solid line, and the dashed line represents a SAR model inferred from spectral analysis; (c-d) 5-point and 101-point running average of magnetic susceptibility; (e) spectral analysis of wavelengths using a smoothed 5-point running average susceptibility from distinct depth windows; full & broken lines denote red noise & 80% confidence level.

Reference

Meyer, B., and others, 1998, Crustal thickening in Gansu-Qinghai, lithospheric mantle subduction, and oblique, strike-slip controlled growth of the Tibetan plateau, Geophys. J. Int., 135, 1-47.

Cite as: Zhang, W., Appel, E., Fang, X., Song, C., Hu, S. and Liu, D., 2010, Magnetostratigraphy of Core SG-1 in the Western Qaidam Basin and its Tectonic-Environmental Implications, *in* Leech, M.L., and others, eds., Proceedings for the 25th Himalaya-Karakoram-Tibet Workshop: U.S. Geological Survey, Open-File Report 2010-1099, 2 p. [http://pubs.usgs.gov/of/2010/1099/zhangw/].