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Environmental history of Lake Hovsgul from physical interpretation of remanent magnetization endmember analysis

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The environmental history of Lake Hovsgul (Mongolia) is studied based on magnetic measurements of the core KDP-01. The drill hole reached a maximum depth of 53 m, from which sediment cores with a total length of 48 m were recovered. Coring gaps are due to the applied drilling technology. Following the approach by Heslop and Dillon, 2007, we develop the way of decomposition of the total magnetic fraction of a sample into not virtual but real three distinctive mineralogical components. For this, we first apply the end-member non-negative matrix factorization (NMF) modeling for the unmixing magnetic remanence curves. Having these results in hands, we decompose the hysteresis loops, backfield and strong field thermomagnetic curves into the components which now can be interpreted as certain mineralogical fractions. The likely interpretation of the components obtained is as follows. The soft component is represented by a coarse grained magnetite fraction as it typically results from terrigenous influx via fluvial transport. The second component is presented by a sharply defined magnetite grain size fraction in the 30-100 nm range that in lake environments is related to magnetosome chains of magnetotactic bacteria. It apparently covaries with a diamagnetic mineral, most likely carbonate. This indicates a link to organic authigenic fractions and fits to biogenic magnetite from magnetotactic bacteria. The third component also has a very high coercivity around 85 mT and is identified as a mixture of biogenic and abiotic greigite common in suboxic/anoxic sediments. The results of such the combined study are used to infer information on paleoclimatic and paleogeography conditions around the lake Hovsgul's area for the period of the last million years. A correlation between the outbursts of biogenic magnetite and greigite content with warm periods is found. Within some parts of the core the dominance of greigite contribution into magnetic signal is observed which we link to onset of icy anoxic environmental conditions.
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