Geochemistry, Geophysics, Geosystems, 2016, vol.17, N11, pages 4669-4683

Physical interpretation of isothermal remanent magnetization end-members: New insights into the environmental history of Lake Hovsgul, Mongolia

Fabian K., Shcherbakov V., Kosareva L., Nourgaliev D.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Acquisition curves of isothermal remanent magnetization for 1057 samples of core KDP-01 from Lake Hovsgul (Mongolia) are decomposed into three end-members using non-negative matrix factorization. The obtained mixing coefficients also decompose hysteresis loops, back-field, and strong-field thermomagnetic curves into their related end-member components. This proves that the end-members represent different mineralogical fractions of the Lake Hovsgul sedimentary environment. The method used for unmixing offers a new possibility to apply rock magnetism in paleoecological and paleoclimatic studies. For Lake Hovsgul, it indicates that a low-coercivity component with a covarying paramagnetic phase represents a coarse-grained magnetite fraction from terrigenous influx probably via fluvial transport. A second component with coercivities close to 50 mT is identified as a magnetite fraction related to magnetosomes of magnetotactic bacteria. The third component has coercivities near 85 mT and is identified as greigite of biotic or abiotic origin common in suboxic/anoxic sediments. Significant positive correlations between variations of intensity of all three mineralogical components along the core are found. A rapid drop in all end-member concentrations by more than one order of magnitude at about 20 m depth testifies to a major change of the environmental or geological conditions of Lake Hovsgul. It possibly is related to the onset of MIS 10 marking the termination of arid climate conditions. Short intervals of high productivity are characterized by an abundance of magnetite magnetosomes and may highlight glacial-interglacial transition intervals. For the rest of the core, greigite magnetization substantially exceeds that of magnetite, indicating a predominantly anoxic environment.

http://dx.doi.org/10.1002/2016GC006506

Keywords

end-member decomposition, environment reconstruction, remanent magnetization