Geophysical Research Abstracts
Vol. 17, EGU2015-5154, 2015
EGU General Assembly 2015

Ferromagnetic, dia-/paramagnetic and superparamagnetic components of Aral Sea sediments: significance for paleoenvironmental reconstruction

Lina Kosareva (1), Danis Nourgaliev (1), Dilyara Kuzina (1), Simo Spassov (2), and Leysan Fattakhova (1)

(1) Kazan (Volga Region) Federal University, Institute of geology and petroleum technologies, Kazan, Russian Federation (Lina.Kosareva@mail.ru), (2) Centre de Physique du Globe de l'Institut Royal Météorologique de Belgique, Dourbes, Belgium

Modern lake sediments are a unique source of information for climate changes, regionally and globally, because all environmental variations are recorded by these sediments with high resolution. Magnetic minerals are hereby of particular interest, because they occur almost in any environment, because they are susceptible tracing environmental changes, which are closely related to their formation conditions, and because magnetic mineral concentrations in the ppm range can be detected.

Our goal is to decipher the magnetic susceptibility signal in lake sediments by decomposing the bulk susceptibility signal of a lake sediment sequence into ferromagnetic (χf), dia-/paramagnetic (χp) and superparamagnetic (χsp) components. Each of these has a different origin: paramagnetic minerals are usually attributed to terrigenous sediment input, ferromagnetics are of biogenic origin, and superparamagnetic minerals may be of either biogenic or terrigenous origin. In sediments, paramagnetic components contribute most to the bulk susceptibility signal, because the ferromagnetic contributions are low. Most sediments of modern lakes contain a lot of organic material and water, which are both diamagnetic. High-field susceptibility changes reflect thus changes in terrigenous input. The latter increases with precipitation which augments the influx of terrigenous material carried by rivers into the lake, consequently the susceptibility increases sharply. However, under certain conditions, such for instance during shrinking water table or withering of tributaries, the lake biota grows stronger and the bacterial activity, including magnetotactic bacteria, increases. This results in an enhanced ferromagnetic component (χf). Superparamagnetic (SP) components may also be formed, but their magnetic grain size is much smaller, i.e. in the order of about 30-40 nm.

This abstract presents a new method to discriminate and to quantify the contribution of dia- and paramagnetic, ferromagnetic and superparamagnetic components to the measured bulk magnetic low-field susceptibility in order to better understand and to interpret environmental changes. This new method is based on data obtained with a rotation coercivity spectrometer. Lacustrine sediments from the Aral Sea were taken to demonstrate the potential of this new method. It is shown that the terrigenous input is strongly related to changes in the paramagnetic susceptibility.

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University also by RFBR research projects No. 14-05-31376–a, 14-05-00785–a.