Rock Magnetic Properties of Loess-Paleosol Sections in Baikal Region

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Abstract: We studied three Upper Pleistocene sections in Baikal Region. Novorazvodnaya section is located on the right bank of Angara river near Irkutsk city, Ust-Oda section is located on the left side of Angara river valley 48 km downstream from the previous section in the foothills of East Sayan Mountain ridge and Malta section is located on the left bank of Angara river 54 km downstream of Ust-Oda section. All sections belong to the same climatic zone and contain two buried pedocomplexes (PC) separated by loess horizons. The age of upper PC on the base of radiocarbon ages in Malta and Ust-Oda sections corresponds to MIS3. Besides loessic strata Ust-Oda section includes deluvial (slope-outwash) deposits which were excluded from consideration. A detailed rock magnetic study of all sections includes measurements of magnetic susceptibility (K) and its frequency dependence (FD%) using Bartington MS2 and hysteresis measurements (Ms, Mrs, Bc, Bcr, Kpar, Kfer) using coercitivity spectrometer J_meter (Jasonov et al, 1998). Thermomagnetic curves K(T), Ms(T), Mrs(T) suggest a uniform magnetic composition for all sections – predominant magnetite with low content of hematite (in PC). Mean K value in Ust-Oda section for loess units is 250*10-8 m3/kg, in Malta section – 130*10-8 m3/kg and in Novorazvodnaya section – 80*10-8 m3/kg. K values in pedoxomplexes are generally 1,4-1,6 times lower than in loess units. Moreover, PC show enhanced magnetic hardness (increased Bc, Bcr and HIRM, decreased S-ratios) and smaller magnetic grain size versus loess. It is generally accepted that such magnetic susceptibility pattern follows so called “Alaskan mechanism” which is well known from Kurtak section in central Siberia (Chlachula et al, 1998). However, a full complaisance with “Alaskan mechanism” can be observed only in Ust-Oda section, where FD% values are nearly zero all over the section. On the contrary, FD% in PC from Novorazvodnaya and Malta sections demonstrate enhanced values (up to 5% in Malta and up to 7% in Novorazvodnaya). The presence of superparamagnetic grains in PC is common in loess-paleosol sections of West Siberia (Matasova, Kazansky, 2004; Kravchinsky et al, 2008). So, the rock-magnetic records in Malta and Novorazvodnaya sections are better corresponding to “Siberian mechanism” - a combination of wind-vigour and pedogenic origin of magnetic minerals in loess-paleosol sequences (Matasova et al., 2003). The

difference in magnetic mechanism in closely spaced sections in Baikal region can be understood through the difference in size of magnetic particles. In Ust-Oda section magnetic grains are sufficiently coarser than in other sections. Most of them are represented by large multidomain grains which cannot retain remanent magnetization but determine the high values of K, because magnetic susceptibility in such grains increases with their size. On the other hand FD signal in the pedocomplexes can be carried by hematite grains, because paleosols show increased values of coercive parameters. High concentration of coarse multidomain grains and hence high bulk K values can obscure a weak signal from hematite superparamagnetic grains and it becomes indistinguishable against the background. Reducing of the concentration of coarse grains reduces the bulk Ms values and FD signal becomes distinguishable. FD% values are higher in the sections with lower concentration of large magnetic grains, just what we saw in Baikal region. Thus, proximity to the source of the coarse magnetic grains (in our case - East Sayan Mountain ridge) determines the “Alaskan mechanism” of magnetic properties, with the distance from the source, "Alaskan mechanism" is changed to "Siberian” one. The same situation is observed in Pred-Altay plain: sections closely located to the Altai mountains (source of coarse magnetic grains) have high K, but low FD%, with distance from the mountains K decreases and FD% increases.

Keywords: rock magnetism, loess, paleosols, Baikal, Siberia

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