Crystallographic ordering of the particles in sedimentary rocks

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The samples of sedimentary rocks of the Yenisei river were studied by using X-ray, Mössbauer spectroscopy and scanning electron microscopy methods. There was shown the influence of the size and form of the particles on the temperature stability of the remanent magnetization. The samples were re-precipitated under the given laboratory conditions in the Earth magnetic field and were investigated by using X-ray straight pole figures method. It was done for revealing the crystallographic ordering of the grains.

The particles have different shapes and sizes from 10 μm to 207 μm. The powder also contains elongated grains, grains of irregular shape with a size comparable in all dimensions, as well as granular masses, formed by micron particles of powder on top of the larger grains. Semiquantitative analysis showed the composition of the powder, the presence of elements such as Al, Si, Mg, Fe, Ca, K, C, O, and Na.

The three fractions, – namely strong-magnetic (Fe3O4– 87,3%, Fe2O3 – 0,7%), soft-magnetic (Fe2O3– 21,7%) and non- magnetic (FeO – 53,1%, FeOOH – 46,9%) – were extracted by using the magnetic separation method for determining the minerals – magnetization carriers. In the strong-magnetic fraction, the main iron-containing mineral is magnetite. The isomer Δ shifts and the quadrupole splitting δ indicate a different local surrounding emitting and absorbing the nuclei and the different valence of iron ions. The carriers of the magnetization of soft-magnetic fractions are hematite grains. The Δ and δ values indicate strong non - stoichiometry of wüstite. The compounds of FeOOH and FeO do not contribute to the residual magnetization.

The particle size of Fe_3O_4 in microns (in parentheses) and the corresponding intensity values: (0 ÷ 8) - 1,9; (9 ÷ 16) – 1,9; (17 ÷32) - 1,8; (33 ÷44) - 1,6; (45 ÷ 64) - 1,3; (65÷100) -1,2; (101÷ 150) - 1,1.

The above-mentioned studies show the prospects of applying the complex research in geology. The Mössbauer spectra can identify the types of magnetic minerals in complex compounds. The identification of the iron-containing natural minerals helps to reveal the stability of the residual magnetization in geological time scales.