SURFACE WEATHERING PRODUCTS OF DRONINO IRON METEORITE FRAGMENT: A STUDY USING MÖSSBAUER SPECTROSCOPY WITH A HIGH VELOCITY RESOLUTION.

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Introduction: Dronino iron-ung meteorite has terrestrial age of more than 1000 years. Being found in swamp this iron meteorite was affected by water, salts and other various factors of weathering. Taking into account differences of the features of extraterrestrial Fe-Ni alloy in comparison with terrestrial alloys, study of meteorite metallic iron oxidation is of interest. Recent studies of Dronino metal weathering (see, for instance, [1]) demonstrated that it takes to get better knowledge about the products of metallic iron oxidation. Mössbauer spectroscopy is a useful probe for analysis the chemical composition of meteorite weathering products. This method was also used for the study of Dronino meteorite oxidation [2]. However, to increase the quality of extracted information we have used Mössbauer spectroscopy with a high velocity resolution for re-examination of Dronino meteorite weathering.

Experimental: Powdered samples of oxidation products were prepared from external and internal surface layers of Dronino iron-ung meteorite fragment. Mössbauer spectra of these samples were measured with a high velocity resolution at room temperature.

Results and Discussion: The Mössbauer spectra of external and internal surface oxidation products of Dronino meteorites demonstrated intensive paramagnetic two peaks and different shape of magnetic component. In the spectrum of internal surface oxidation products there were intensive magnetic components while weak magnetic components were observed in the spectrum of external oxidation products. The best fits of these Mössbauer spectra revealed three paramagnetic quadrupole doublets related to ferric compounds with the slightly different hyperfine parameters for external and internal surface oxidation products. As for magnetic components, the fit of the internal surface oxidation product spectrum revealed eight magnetic sextets with magnetic hyperfine field ranged from ~507 kOe till ~190 kOe and isomer shifts ranged from ~0.58 mm/s till ~0.28 mm/s. The fit of the spectrum of external surface oxidation product revealed four magnetic sextets with magnetic hyperfine field varied from ~297 kOe till ~127 kOe and isomer shifts in the range of ~0.43–0.10 mm/s. These results indicated the presence of ferric compounds in the form of ferric hydrous oxides and ferric oxides in both samples. However, internal surface products were in the form of particles with different sizes determined the presence of large contribution of magnetic components in the Mössbauer spectrum. In contrast, external surface oxidation products were in the form of nanosized superparamagnetic particles mainly.

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References:

[1] Yakovlev G. A., Grokhovsky V.I. 2014. *Meteoritics & Planetary Science* 49:A446. [2] Grokhovsky V. I., Oshtrakh M. I., Milder O. B., Semionkin V. A. 2005. *Hyperfine Interactions* 166:671–677.