COMPARATIVE STUDY OF TWO CHELYABINSK LL5 ORDINARY CHONDRITE FRAGMENTS WITH LIGHT LITHOLOGY AND THE FUSION CRUST USING MÖSSBAUER SPECTROSCOPY.

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Introduction: Chelyabinsk LL5 meteorite fragments fell as a shower on February 15, 2013 in Russian Federation were immediately collected by the Meteoritical Expedition of the Ural Federal University. These fragments demonstrated different lithology and their iron-bearing phases can be analyzed using Mössbauer spectroscopy in order to evaluate these phases composition and compare the ^{57}Fe hyperfine parameters for the same phases in different fragments. After preliminary study of the first fragment of Chelyabinsk LL5 ordinary chondrite [1, 2] we present a detailed comparison of two fragments with light lithology and study of the fusion crust of the second fragment using Mössbauer spectroscopy and some other techniques.

Experimental: Samples of two Chelyabinsk LL5 fragments with light lithology (the first and the second) were used for slices preparation to carry out metallography and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) analysis. Then the surface thin layers of these slices were removed to prepare powdered samples for X-ray diffraction (XRD) analysis. The fusion crust was also prepared as a powder from the second fragment for XRD study. Mössbauer spectra of powdered samples were measured at room temperature using automated precision Mössbauer spectrometric system with a high velocity resolution [3].

Results and Discussion: Metallography and SEM analysis demonstrated the presence of metal grains and troilite inclusions in silicate matrix in both fragments. XRD analysis showed the presence of the main iron-bearing phases such as olivine, pyroxene and troilite in the studied fragments while the fusion crust XRD pattern contains additional reflexes correspondent to magnesioferrite ($MgFe_2O_4$). The Mössbauer spectra of two fragments of Chelyabinsk LL5 meteorite were similar to other ordinary chondrites [4]. However, these spectra showed different content of iron-bearing phases in the first and the second fragments, respectively: ~58 % and ~53 % of olivine, ~25 % and ~19 % of pyroxene, ~12 % and ~19 % of troilite, ~5 % and ~9 % of metal. Moreover, a component related to ~0.7 % of chromite was found in the spectrum of the second fragment. The Mössbauer spectrum of the fusion crust demonstrated the presence of spectral components related to ferric compound (magnesioferrite) in addition to subspectra for olivine, pyroxene, troilite and metal.

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References:

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