PHYSICAL PROPERTIES, STRUCTURE AND FRACTURING OF THE CHELYABINSK LL5 METEORITE BODY.

V.I. Grokhovsky[1], T. Kohout[2,3], M. Gritsevich[1,4], E.V. Koneva[1]. [1]Institute of Physics and Technology, Ural Federal University, Ekaterinburg, 620002, Russian Federation. E-mail: grokh47@mail.ru. [2]Department of Physics, University of Helsinki, Finland. [3]Institute of Geology, Academy of Sciences of the Czech Republic. [4]Finnish Geodetic Institute, Masala, Finland.

The Chelyabinsk LL5 meteorite fell on February 15, 2013 with a huge amount fragments weighted from mgs up to 650 kg main mass found in Chebarkul lake [1]. Physical and mechanical properties of meteoroid material influence the fracture processes during its space collisions or high velocity atmospheric entry. In this study we present the physical properties (density, porosity, and magnetic susceptibility), mechanical properties and structural features of the individual Chelyabinsk meteorite fragments with various sizes and a piece of the main mass available in the Ural Federal University collection.

It was observed that Chelyabinsk meteorite demonstrated several types of lithology: the light, dark, black and gray impact-melt, etc. The mineralogical analysis showed that these lithologies had the origin from the same LL5 chondritic source [2]. The difference between them is in the level of shock. This gives us a unique opportunity to study effects of high shock on the mineralogy, reflectance spectra and physical properties of chondritic material.

As magnetic susceptibility in ordinary chondrites mainly reflects the amount of magnetic minerals, it was apparent that, compared with typical LL chondrites, the Chelyabinsk meteorite was enriched with chromite and Co in Fe(Ni) phases.

The measured bulk and grain densities and the porosity closely resemble other LL chondrites as summarized in [3]. Shock darkening does not have a significant effect on the material physical properties. Extensive areas of completely re-melted material were presented along with the melted shock veins in the massive meteorite fragments. Inside these zones shrinked cavities and individual mineral condensates from the gas were observed. Black and gray lithologies demonstrated a higher hardness and strength in comparison with the those for other lithlogies. We discuss a scheme of destruction and fragmentation of the main body of the meteoroid based on the data of its structure at macro-, meso- and micro-scales as well as a very low mechanical strength.

References:

[1] Kocherov A.V. et al. 2014. Abstract #2227. *45th Lunar & Planetary Science Conference.* [2] Kohout T. et al. 2014. *Icarus* 228:78–85. [3] Consolmagno G. et al. 2008. *Chemie der Erde* 68:1–29.