STRUCTURAL FEATURES OF THE IMPACT MELT OF THE ORDINARY CHONDRITE OZERKI L6: PRELIMINARY DATA.

Introduction: The fall of the Ozernyi meteorite shower occurred on June 21, 2018 (at 01:16:20 UT) in the Lipetsk region, Russia. The meteorite was classified as ordinary chondrite L6, S4/5, W0. Most fragments represent samples of light lithology, several fragments of dark lithology (shock-melted substance) have also been found. This work presents the results of the study of the structural features in the shock-melted sample.

Samples and Methods: Fragment with a shock-modified structure (15.4 g, density 3.7 g/cm³) was the object of this research. This sample was found on August 12, 2018. The coordinates of the finding are 52°47.956′N, 38°10.508′E. Part of the sample was prepared for microscopic analysis by standard metallographic procedures: grinding, polishing, and etching with 2% nital. The meteoritic microstructure was examined using a Zeiss Axiosvert 40 MAT inverted microscope and FE-SEM SIGMA VP equipped with EBSD and EDS units.

Results and Discussion: The sample under study has two visually distinct zones (two lithologies). The first zone is gray in color, this area correspond to complete remelting of the chondrite substance followed by recrystallization. In this structure, new olivine grains, metal-sulfide globules with an eutectic structure and impact veins are observed. The second zone is black, this lithology is an intermediate between the initial light substance and complete remelting. The structure of the black lithology contains relict chondrules in a silicate matrix, which consists of large grains of olivine and pyroxenes. The grain boundaries in the matrix are filled with a metal-troilite melt. Chromite, albite, and apatite grains are also observed. The metal is present in the form of kamacite, taenite, and martensite. In the zone with black lithology, several grains with the structure of lenticular martensite are founded. Troilite grains have a porous, spongy-like structure. High-nickel nanoscale grains were found in veins and globules. The phase composition in the metal-sulfide components varies greatly. Chemical mapping shows the background enrichment of various elements of the platinum group in different metal grains, metal-sulfide veinlets and globules. If in troilite it is Pt-Os-Ir, then inapatite it is Ru and Rh. Earlier in [1, 2], phases with PGE in a meteoritic substance were described. It is believed that the metal in the LL and L chondrites is more enriched in PGE than the metal in the H-chondrites [3]. At the border of two lithologies, there is a massive metallic inclusion, which contains martensite, kamacite, and taenite. Precipitation of pure copper has been found on the border of kamacite and martensite.

In this sample, there is a small amount of fusion crust. The fusion crust contains dendrites of magnetite and olivine in a silicate matrix, as well as a large number of gas bubbles.

Conclusions: On grounds of the shock-metamorphosed structure of gray lithology and the newly formed olivine grains it can be concluded that the pressure exceeded 45 GPa and the temperature reached 1400°C. This corresponds to the shock stage S5. In intermediate lithology, the pressure did not exceed 35 GPa, the degree of metamorphism corresponding to this zone – S4. A higher density than the original substance (the density of light lithology is 3.3 g/cm³) may be due to a large number of metal-sulfide inclusions, as well as the presence of PGE.

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