SPHERICAL SHOCK EXPERIMENTS WITH CHELYABINSK METEORITE: EXPERIMENT SETUP AND INSIGHT INTO RESULTS.

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Introduction: The Chelyabinsk chondrite is a fresh fall from February 2013 (Russia). The meteorite was officially classified as LL5 S4 W0. Its complex structure with different lithologies was described before in [1-4]. Light-colored and dark-colored lithologies of Chelyabinsk LL5 are supposed to be of identical LL5 composition mostly [1], but they are slightly different. There are few explanations of different lithologies formation from the initial substance [5].

We observed different lithologies in the large samples and in the main mass fragments recovered from Chebarkul Lake. However, small samples mostly possessed a single type of lithology. Relatively large sections (up to the 150 cm^2) of the massive Chelyabinsk meteorite fragments look like suevite structure from the impact craters described in [6]. We suppose that Chelyabinsk meteoroid was formed at the similar mechanism as suevite because it appears as the fragments of the host rock fell into the impact melt and were partly reheated. [7]. In this study, the intensive shock impact on the initial material of the light-colored lithology of Chelyabinsk LL5 meteorite was experimentally performed.

Experimental: The method of spherically converging shock waves is a useful technique for modeling of the effect of wide ranges of pressure and temperature on studied materials. Several meteorites (the Saratov chondrite; the Chinga ataxite; Sikhote-Alin octahedrite) were affected by the spherically converging shock waves previously [8,9] The results obtained revealed a wide range of structural changes from the surface to the center of the sphere. In the current experiment, the individual fragment with light-colored lithology was used. A sample was prepared in the shape of the ball of 40 mm in diameter. This ball was put into vacuumed steel container and loaded by the spherically converted shock waves. Details of the shock experiments were reported in [8]. The peak pressures and temperatures reached in the center of the ball can be estimated to be about 500 GPa and 5000^{o}C, respectively.

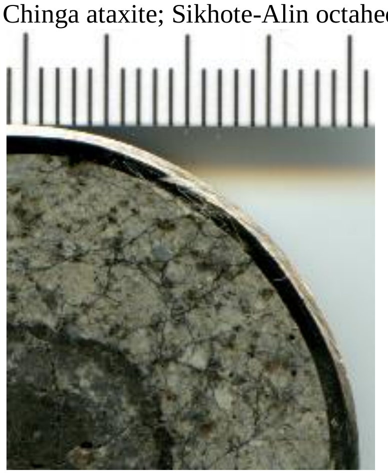

Figure 1 - Diametral section of the ball from Chelyabinsk meteorite after the shock experiment

From the naked eye observation of the diameter section of the experimentally shocked Chelyabinsk sample four visually different zones were distinguished (fig.1). At distance of 0,25 of the ball radius (R) from the center is the shock melted zone. From the 0,4R to 0, 45R from the center the dark-colored ring is situated, while a brighter zone is situated between them. Further at the distance of 0,45 - 1,0 R light-colored lithology presented.

Conclusions: Possibility of various lithologies formation in one sample has been demonstrated during converging shock waves experiment.

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