MORPHOLOGIES OF IMPACT-SIMULATED CONDENSATES AND OF THEIR NATURAL ANALOGS.

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Introduction: Processing of silicates during hypervelocity collisions is a fundamental process which affects the evolution of solid material in the universe and in the Solar system as well. Impacts on planetary surfaces proceed at velocities in excess of 10 km/s and provide partial or complete vaporization of colliding material. Subsequent expansion and cooling of impact-generated vapor plumes produce condensed particles with nanometer to micron sizes. Investigation of trends of differentiation of silicate material during impact-induced vaporization is important for understanding of early evolution of planetary bodies. Laboratory simulation of impact-induced vaporization - condensation processes is limited to a few millimeter scales. It is important to know the relevance of laboratory produced condensates to that produced in nature during real impacts. We tried to compare laboratory produced condensates with that found on Luna samples based on their morphology and chemical structure.

Simulation of lunar condensates: The Moon has preserved impact-produced condensates which can be found on surfaces of lunar rocks and glasses. These condensates have composition noticeably different from melts [e.g. 1, 2] that shows deep differentiation of silicate material during high-temperature pulse processing.

The goal of our work was to produce experimentally impact-simulated condensates with different elemental composition and compare their morphology with that of lunar condensates. Simulation of impact-generated condensates was done using laser pulse technology [3]. We used diverse samples representing terrestrial rocks and minerals, meteorites, and volatile-rich mixtures to simulate cometary impacts.

We have discovered several types of condensates many of which have twins among lunar condensates (e.g. Fig. 1 and 2). Histograms indicate that both lunar condensed particles and that from experiments have the main mode about 30-50 μm.

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References:

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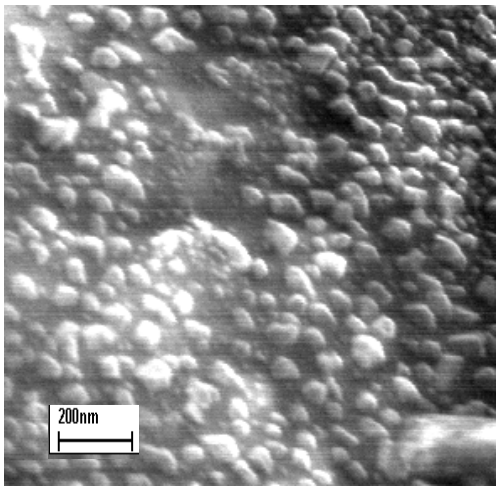

Fig.1. Condensed particles on surface of Apollo-17 glass spherule.

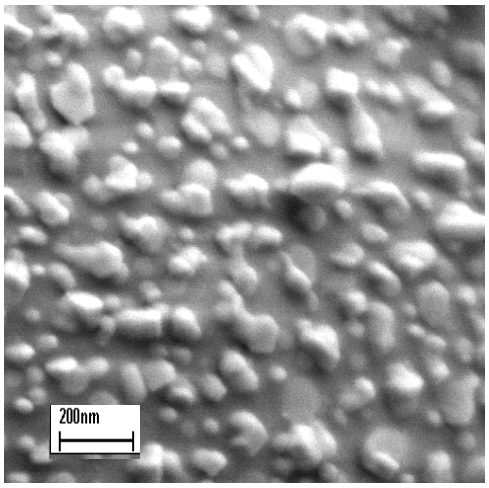

Fig.2. Condensed particles on surface of a melted droplet from the comet impact simulation experiment.