GEOCHEMISTRY OF GLASSY IMPACTITE "BOMBS" FROM THE ELGYGYTGYN IMPACT STRUCTURE (RUSSIA): A PROGRESS REPORT.

Christian Koeberl[1] and Eugene P. Gurov[2], [1]Institute of Geochemistry, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria (e-mail: christian.koeberl@univie.ac.at), [2]Institute of Geological Sciences, National Academy of Sciences of the Ukraine, 55b Oles Gontchar Street, Kiev 01054, Ukraine.

Introduction: The Elgygytgyn impact structure is a circular depression, about 18 km in diameter, located in the central part of Chukotka, Russia [e.g., 1,2]. The crater floor is mostly filled with Lake Elgygytgyn and surrounding terraces that are up to 80 m high. Figure 1 shows a satellite image of the crater structure. The crater is formed in volcanic rock strata of Cretaceous age, which include lava and tuffs of liparites, dacites, and andesites. Figure 2 shows a geological sketch map of the crater areas. The ejecta layer around the crater is completely eroded. Shock-metamorphosed volcanic rocks, impact melt rocks, and bomb-shaped impact glasses occur in lacustrine terraces, but are not in place, as they have been redeposited after the impact event. Glassy bombs and clasts of shock metamorphosed rocks occur in terrace deposits inside the crater and rarely on the outer slopes of the crater rim, while fragments and rare lumps of impact melt rocks are spread inside crater basin only.

Fig. 1. Satellite view of Elgygytgyn impact structure.

Impactites: Clasts of volcanic rocks, which range in composition from liparite to dacite, represent all stages of shock metamorphism, including selective melting and formation of homogeneous impact melt (e.g., [1, 2]). Remnants of impact melt glass on the surface of some shocked rock clasts are evidence that their sources were suevite (polymict glass-bearing impact breccia) and impact melt breccia. Impact melt rocks contain dark gray vesicular glass with abundant clasts of shocked volcanic rocks, minerals, and glasses. Figure 3 shows an example of a shocked quartz clast with multiple sets of planar deformation features (PDFs) within impact glass. Aerodynamically shaped glassy impactite "bombs" are composed of black to dark gray homogeneous glass with rare mineral inclusions. The shapes of the bombs indicate that they were melted when they were ejected and subsequently solidified during transportation in the atmosphere. Traces of ablation on some of the bomb surfaces are evidence of their passage through the atmosphere with high velocity after solidification.

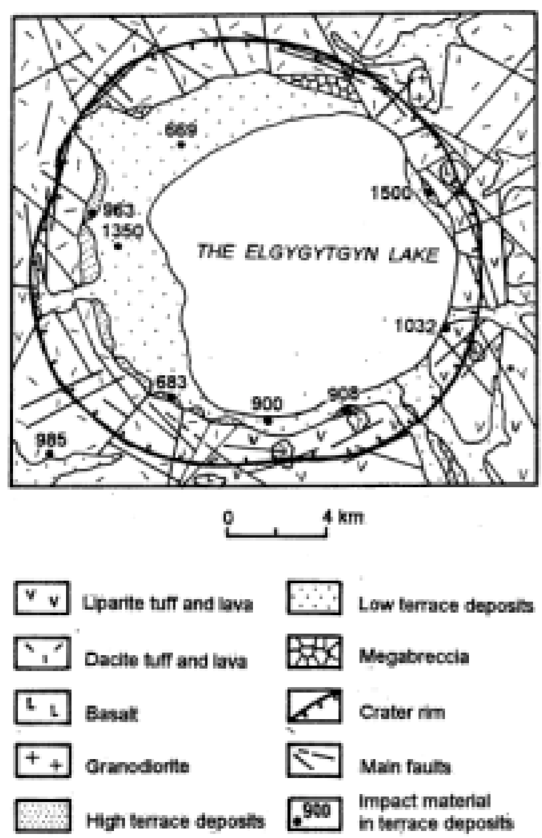

Fig. 2. Geological sketch map of Elgygytgyn impact structure, Russian Siberia (after [1-3]).

Geochemistry of Bombs: A number of samples of impactite "bombs" were studied for their petrographic and geochemical characteristics.

The glassy bombs occur in terrace deposits together with shock-metamorphosed rocks and massive impact melt rocks. While impact melt rocks occur inside the crater basin only, glassy bombs are located not only inside the crater but are found outside the crater as well, in terrace deposits of some nearby creeks. The bombs have aerodynamical shapes, including drops, ropes, cakes and cylinders, and some are of irregular shape (Fig. 15). The surface of the bombs is rough and without luster. The sizes of the bombs range from 1 to 15 cm in diameter. Their weights vary from 3-5 g to 200-400 g and a few rare large ones of up to 1500-2000 g were found as well. The densities of the glass vary from 2.40$\pm$0.05 g/cm^3 to 2.50$\pm$0.05 g/cm^3. The density of vesicular and microporous glass is as low as about 2.35 g/cm^3. The color of the glass is black, rarely dark gray in hand samples, and colorless in thin section. Bands of brown glass indicate its fluidal structure (Fig. 16). Gas bubbles to some millimeters in diameter occur within the glass. Refractive indices vary from 1.505 to 1.510-1.515 and reach up to 1.540 for brown glass. The glasses are fresh and devitrification is rare. Mineral inclusions in the glass are shocked quartz (Fig. 3), diaplectic quartz glass and lechatelierite (e.g., [3]). Rare inclusions of ore minerals found include magnetite, titanomagnetite, and ilmenite. These minerals form spherical and clustered grains within the glass.

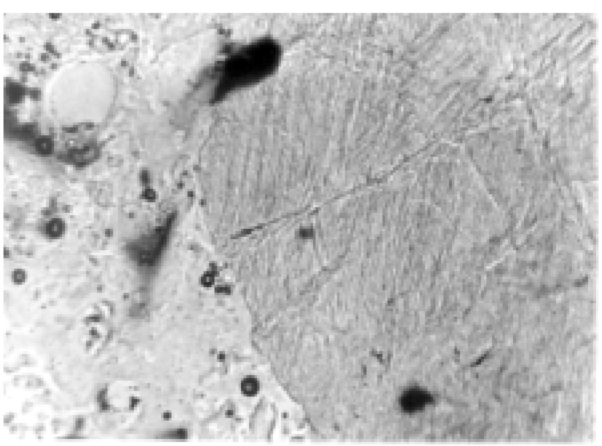

Fig. 3. Shocked quartz clast with multiple sets of PDFs within impact glass of a "bomb". Long dimension ca. 0.5 mm.

A number of samples were analyzed by XRF and INAA for their chemical composition. Their composition is similar to that of local volcanic target rocks (e.g., Fig. 4); the results will be discussed elsewhere. In addition, we used the multiparameter gamma-gamma coincidence spectrometry method after neutron activation to determine the abundances of iridium; this method allows to measure Ir contents in the ppt range. Three samples of Elgygytgyn glass bombs were analyzed in a search for a meteoritic component. The results ranged from 24 to 110 ppt Ir, which are not very high values compared to what has been found in other impact glasses. Nevertheless, the higher value could represent the presence of an extraterrestrial component, although at this time it is premature to draw any firm conclusions.

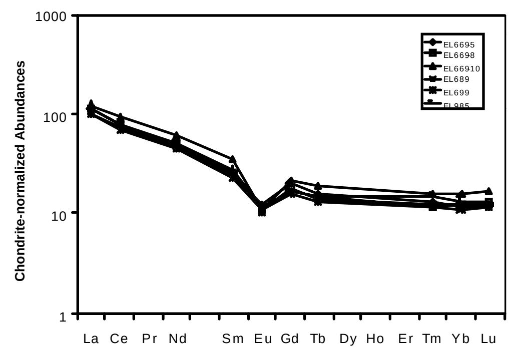

Fig. 4. Chondrite-normalized REE diagram for selected "bomb" samples from the Elgygytgyn structure.

Acknowledgments: This work is a progress report; support for this research came from the Austrian Science Foundation, project Y58-GEO (to C.K.).

References: [1] Gurov E.P. et al. (1978), in Russian, *Doklady Academii Nauk USSR*, 240, 1407-1410. [2] Gurov E.P. et al. (1979). *LPS X*, 479-481. [3] Gurov E.P. and Gurova E.P. (1979), in Russian, *Doklady Academii Nauk USSR*, 249, N 5, 1197-1201.