

GEOCHEMISTRY OF GLASSY SPHERULES OF THE ELGYGYTGYN IMPACT CRATER STRUCTURE, SIBERIA: LASER ABLATION ICP-MS DATA

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Introduction: The 3.58 ± 0.04 Ma old Elgygytgyn impact structure (Central Chukotka, NE Siberia) with a diameter of 18 km [1, 2] is one of only two terrestrial craters with a volcanic target; therefore, analysis of its target and impact lithologies are of basic interest for comparative planetology. Lake Elgygytgyn is a very valuable climate archive in the Arctic as it was neither covered by glaciers [3] nor has the lake ever fallen dry. Impactites like melt rocks and breccias are rarely found in outcrops yet are present in the 80 m terrace of Lake Elgygytgyn [1].

Samples: Numerous investigations on petrography, shock metamorphism, and geochemistry of impactites from Elgygytgyn have been published so far (e.g. [4]). We report the first trace element data for seven 30- to 760- μm -sized impact glass spherules that have been collected about 10 km off the crater center from a terrace deposit of the Enmyvaam River outside the crater rim. The spherules are translucent with colors ranging from amber, dark brown to nearly black; they contain a few circular bubbles, schlieren, and rarely mineral clasts and breccia fragments.

Methods and Results: Major elements were measured with the JEOL JXA 8600 MX superprobe, 31 trace elements were analyzed with the Finnigan Element2 laser ablation ICP-MS with 5 Hz and 8 to 9 J/cm² with Si as internal, and NIST612 as external standard (both at Institut f. Mineralogie, WWU Münster). The spot size was 60 μm . All spherules show a very homogeneous major and trace element distribution yet clear differences exist between the samples in their SiO₂ ranging between 53 and 68 wt%. Four of the glasses are dacites, two andesites, and one a basaltic-andesite. In addition the spherules display wide ranges in concentration in wt% like, MgO (2.1–9.2), K₂O (0.6–3.3), and in ppm Ni (317–1096), Co (25–79), Zr (100–169), Rb (18–107), and Ba (459–1092). The Ni/Co ratio is consistently high (11–14), Zr/Hf ranges between 36 and an anomalous high value of about 50; the Nb/Ta ratio varies from 17.6 to 14.9. The REE distribution patterns are similar, yet samples with low SiO₂ contents (53.1–58.4) have lower REE concentrations except for Eu.

Discussion: The new trace element data for impact glass lithologies from Elgygytgyn extent the range of known impactites [4] into the field of more mafic compositions. Basalts to andesites are known to occur in the Elgygytgyn area, and obviously form the precursor lithologies for two of the spherules. All impact glass samples plot in the Zr-Ti-Y-diagram in the tectonic setting for calc-alkaline rocks, as expected from the larger geological frame [5], indicates that impact melting did not change the primary characteristics of the precursor rocks. In agreement with this setting are the Nb/Ta and Zr/Hf values although a Zr/Hf of 50 is remarkable. We exclude, however, technical reasons for these data as analyses of standard glass NIST 612 measured as unknown yielded satisfactory results.

References: [1] Gurov E.P. and Gurova E.P. 1979. *Doklady Akademii Nauk USSR* 249:1197-1201. [2] Layer P. 2000. *MAPS* 35:591-599. [3] Melles P.S. et al. 2007. *J. Paleolimn.* 37:89-104. [4] Gurov E.P. et al. 2007. *MAPS* 42:307-319. [5] Chekhovich V.D. et al. 1999. *Island Arc* 8:168-180.