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The El'gygytgyn impact crater (Siberia): a micro-chemical study of impact glasses

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The El'gygytgyn impact crater in NE Siberia, Russia, originated 3.6 Ma ago. With a diameter of ~18 km El'gygytgyn is one of only two terrestrial craters having volcanic target lithologies, hence, this structure is of fundamental importance in comparative planetology. The El'gygytgyn structure is target of a current ICDP project for climate and impact research (Melles, 2006). Various impact rocks and glass types occur in and around the impact structure, which are virtually unaltered because of the crater's young age. Here we report first results of a micro-chemical study on glass spherules in an ejecta deposit outside the crater rim as well as on various impactites collected along the shore of Lake El'gygytgyn. The glass spherules were sampled from a terrace deposit of the Enmyvaam River at about 10 km southeast of the crater center. The major element composition was analyzed with the JEOL JXA 8600 MX Superprobe (Inst. f. Mineralogie WWU) with the following settings: 15 kV acceleration voltage, 2 nA sample current, 10 μm defoc. beam, using obsidian and synthetic glass as standards, and a moldavite sample as monitor. The size of the seven spherical, in part slightly elongated spherules range from 30 to 760 μm. They are translucent with colors ranging from amber, dark brown to nearly black. All spherules contain a few circular bubbles, schlieren, and very rarely mineral clasts and breccia fragments partial that stuck at the surface of the spherules. These particles were either attached during ballistic ejection or after landing yet before the spherules have cooled below the glass transition temperature. All spherules have a very homogeneous composition; however, they cover a wide range in SiO2 (52.3–70.7 wt.%), Al2O3 (14.2–22.7 wt.%), FeOtot (4.66–10.1 wt.%) and MgO (1.26–9.46 wt.%) contents. Using the TAS classification by IUGS, four samples are dacitic, two samples andesitic, and one basaltic-andesitic. The schlieren and clasts differ from the host glass in high-silica and much lower iron, aluminum and titanium contents. In the published data set of various glassy impact lithologies from inside the El'gygytgyn crater, most samples are rhyolitic, dacitic, or trachydacitic, while andesitic and basaltic-andesitic compositions are lacking. Basaltic-andesitic rocks, however, are known to occur in the northeastern sector of the El'gygytgyn crater, and similar rocks must have been the precursor lithologies for the more mafic glass spherules investigated here. We are curious if similar mafic impactites will be encountered during the ICDP drilling campaign in 2009.