Highly siderophile elements and triple-oxygen isotopes of tektite-like glasses from the Zhamanshin Impact Structure, Kazakhstan

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The Zhamanshin Impact Structure contains a variety of impact glasses derived from unconsolidated sediments and rocks of local stratified target. Here, we focus on tektite-like splash-form glasses forming irregular droplets and bent rods up to 3 cm large, which are part of the fall-back ejecta. Two main groups can be defined: acid types ("irghizites", ~72–75% SiO_2) formed by coalescence of <1 mm-sized glass droplets, and basic splash forms (~53–56% SiO_2), which do no show the droplet coalescence. The droplets in irghizites are usually compositionally uniform with the exception of their surface layers, which show strong enrichments in Ni, Fe, and locally Cr and P. Bulk irghizites are also enriched in Ni, Co, Cr and some highly siderophile elements (HSE; Pt, Pd), compared to the basic splash forms. The HSE pattern of irghizites is strongly fractionated. The contents of Os (0.001–0.011 ppb), Ir (0.030–0.16 ppb) and Ru (0.26–0.57 ppb) follow typical upper continental crust, while the contents of Pt (up to 5.3 ppb) and Pd (up to 11.7 ppb) are elevated. The basic splash forms show lower HSE contents as well as different fractionation pattern.

The $\delta^{18}O$ data of basic splash forms (8.0 to 9.1‰ V-SMOW) are lower than those of the irghizites (11.9 to 14.4‰). This, together with the difference in major element chemistry, is interpreted to reflect the difference in their precursor rocks – surficial Paleogene sands and clays or Cretaceous sediments for the irghizites versus deeper seated Lower Paleozoic volcanosedimentary series for the basic splash forms. The irghizites show lower $\Delta^{17}O$ (–0.174 to –0.248‰, defined relative to a RL with slope 0.5305 and zero intercept) while the $\Delta^{17}O$ of the basic splash-forms (–0.075 to –0.118‰) mimic common upper crustal range.

The low $\Delta^{17}O$ values of irghizites, elevated contents of Ni, Co and Cr, and elevated contents of Pt and Pd, indicate a meteoritic admixture, e.g. from a carbonaceous chondrite. The fractionated HSE pattern probably reflects evaporation and condensation processes.