OSMIUM ISOTOPIC INVESTIGATION OF TEKTITE-LIKE GLASSES FROM BELIZE.

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Summary: Tektite-like glasses from western Belize were postulated to be of impact origin [1,2], although this is not yet unambiguously confirmed. Here we present preliminary results of the first Os isotope analysis of these samples and provide clues for their derivation from volcanics of the Central American Arc and show no clear evidence for an extraterrestrial signature within these samples.

Introduction: Tektites are a sub-species of impact glasses up to a few centimeters in size, with geochemical signatures resembling the upper continental terrestrial crust. They are interpreted to represent melts of crustal material ejected from the impact site of an extraterrestrial object.

Tektites occur in four geographically extended strewn-fields, the 35.5 Ma North-American strewn field, the 14.4 Ma old Central European strewn field, the 1.1 Ma Ivory Coast strewn field, and the relatively large 0.8 Ma Australasian strewn field, which is also the only one for which a source crater has not yet been identified. The extents of three of the four strewn fields (all but the Central European one) are defined mostly by the occurrences and geographic distribution of microtektites in deep-sea sediments.

Tektites were derived from close to the surface of the target area (as indicated by the elevated contents of the cosmogenic isotope Be-10) and may have formed and were ejected prior to the main crater excavation phase [e.g., 3]. In general, tektites contain very low amounts of meteoritic material; the highest contents of extraterrestrial material reach only up to a few tens of percent and were identified in some Ivory Coast tektites [4].

Possible Tektites from Belize: During the last two decades, tektite-like glasses have reported from western Belize [e.g., 5,6]. Their impact origin is supported by their low water content of ~80 ppm [6], their petrography [1] and the general extent of the Belize tektite area of at least 600 km^2 [7]. The glasses were dated by the ^{40}Ar-^{39}Ar method, yielding total fusion ages of 820±40 ka (2σ) [8], or a plateau age 769±16 ka [9]. Even though their ages are similar to those of Australasian tektites, their distinct SiO_2 contents of around 62 wt.% [6,7] and Sr and Nd isotopic compositions [2] might support the existence tektite-like glasses different from those in the four known strewn fields.

In order to better characterize the precursor material from which these tektite-like glasses were derived and to search for possible meteoritic components within them, a detailed platinum-group element (PGE) and Re-Os isotope study of Belize glass samples, found and donated by J. Cornec (Denver), is conducted. Preliminary results of this study are summarized here and will be presented at the conference.

Samples and Methods: The samples have appearances similar to normal splash-form tektites, although there are many irregular forms as well [7]. About 60 to 260 mg of sample material in the form of chips was cleaned in an ultrasonic bath and crushed in an agate mortar. All samples were spiked with a mixed tracer composed of ^{99}Ru, ^{105}Pd, ^{185}Re, ^{190}Os, ^{191}Ir and ^{194}Pt isotopes and digested in a HNO_3/HCl (5+2) acid mixture at 250°C and 125 bar pressure in a high pressure asher for 12 hours. Osmium was purified using carbon tetrachloride (CCl_4) based solvent extraction techniques as described in [10], followed by microdistillation purification [11]. The Os total processing blank was ~0.5 pg. All Os isotope analyses were performed using a Thermo Triton Thermal Ionization Mass Spectrometer, equipped with an SEM detector used in negative mode at the Department of Lithospheric Research at the University of Vienna, Austria.

Results and Discussion: Osmium concentrations for the analyzed tektite samples range from ~0.5 to ~5 ppt and $^{187}Os/^{188}Os$ ratios vary between ~0.20 and ~0.58. Notably, there is no apparent correlation between Os concentration and $^{187}Os/^{188}Os$ ratios (Fig. 1). Both Os concentrations and Os isotope ratios are significantly lower compared to typical values of the terrestrial upper continental crust (UCC), which has average values of around 31 ppt Os and $^{187}Os/^{188}Os$ of 1.05 ± 0.23 [12].

This supports the Sr-Nd isotope based interpretation raised by [2] of a more depleted precursor of the tektite-like glasses from Belize, possibly volcanics from the Central American arc. Such rocks range from ~0 to ~ +7 for εNd and from 0.70296 to 0.70417 for $^{87}Sr/^{86}Sr$ [e.g., 13] and overlap with the trend defined by the Belize glasses, which exhibit fairly homogeneous εNd values around +3.8 $\pm$ 0.1 and an average $^{87}Sr/^{86}Sr$ ratio of 0.704019 $\pm$ 0.000037 [2]. Although (to our knowledge) no detailed Os concentra-

tion and Os isotope data are available for the Central American arc, our here reported Os data exactly mirror those of typical arc volcanoes from other localities around the world (Fig. 1), which all exhibit exceptionally low Os concentrations, ranging from ~0.1 to ~46 ppt and mantle- to UCC-like $^{187}Os/^{188}Os$ ratios between ~0.13 and ~1.52 [e.g., 14].

It might, thus, be reasonable to assume that the Os signature of Belize tektite-like glasses reflect the primary signature of the precursor material (most likely volcanoes of the Central American arc), rather than indicating a meteoritic admixture as was, for example, confirmed for the Ivory Coast tektites [4].

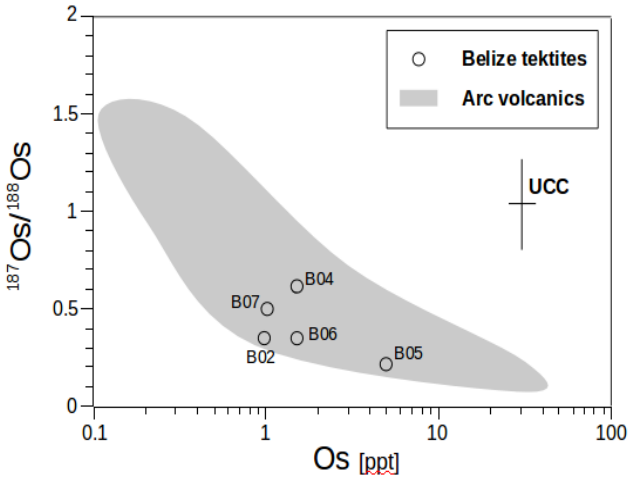

Fig. 1: Plot exemplifying the similar trends defined by Belize tektite-like glasses and arc lavas from worldwide locations (data from [12]). Average data for the upper continental crust (UCC) is shown for comparison [10].

Notably, both isotopic investigations performed so far (Sr-Nd [2] and Os) provide no confirmation of an impact origin of the tektite-like glasses from Belize. Instead, both isotope analyses support the view of a close relationship to local arc lavas, supporting the claim raised by [1] that the glasses were not transported far from their source (e.g. volcano or impact crater). Any evidence for the possible impact origin of these glasses rests, therefore, on the petrographic characteristics reported by Koeberl and Glass [1].

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