$^{40}Ar/^{39}Ar$ AGES OF KAPOETA GLASS.

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Introduction: Glass/melt, samples often contain grains that do not completely melt – relict grains. Nonetheless, impact melts are common samples for Ar isotope dating of impact events. We set out to see if and how the relicts contained within glass from the howardite Kapoeat affect the apparent Ar age of the glass.

Samples and Procedures: Kapoeta AMNH4788 has a cross-cutting glass vein that is, in polished section, ~12 mm in length × ~1 mm in width. We broke the vein into 7 subsections with masses ≤745 μg for Ar/Ar dating using procedures described in [1]. Additionally, we used image analysis on backscatter electron and optical images of the glass surfaces to determine modal percentages of glass and relict grains.

Results: Ar apparent plateau ages of the glasses range from 3.09±0.01 (79% ^{39}Ar) to 4.20±0.10 Ga (69% ^{39}Ar). Integrated ages range from 2.71±0.01 to 4.07±0.11 Ga. Minimum and maximum modal abundance percentages of glass, pyroxene, and feldspar, respectively, are: 80.5-93.4, 1.3-14.75, 4.8-11.0. The overall trend shows an increase in the percentage of glass and a decrease in the percentage of relict grains (both pyroxene and feldspar) with increasing age.

Discussion: A simple, intuitive hypothesis is that vein material will be younger than the material it crosscuts. Further, samples with more relict grains should be older than samples more purely glass. The results support neither hypothesis. Our glass ages, which range over 1.1 Ga, fall within the wider range of ages for crystalline phases in Kapoeta, namely ~0.8 to 4.4 Ga [1]. Reported Ar ages of other glass samples have been younger than its host material [2], similar in age to its host material [2, 3] or older than its host material [4, 5].

In the last case, the older age of the glasses was attributed to 1) lower Ar diffusivity for the glass than host, 2) longer diffusion paths in the glass than crystalline material, and 3) incomplete ^{40}Ar loss from the glass on formation [4]. Both (1) and (2) would tend to limit diffusion losses.

Regardless of the specific mechanism of Ar retention, glass may not be useful in dating impact events. The observations that Ar plateau ages of glasses can have a 1.1 Ga range within one sample, along with published reports of glass ages that are both older and younger than the host material, render glass unreliable as sample material for dating impact events in Kapoeta, and perhaps other meteorites and rocky bodies as well.

Conclusions: We propose that glass is not the optimal material for dating discrete impact events. Ar ages of glass, or impact melts, can be misleading, giving arbitrarily older or younger ages than the events that caused melting. It follows that dates of impact event that rely on such Ar ages need reevaluation.

References: [1] Lindsay, F. N., et al. 2015. *Earth and Planetary Science Letters* **413**:208-213. [2] Rajan, R. S. et al. 1975. *Earth and Planetary Science Letters* **27**:181-190. [3] Kirsten, T. and Horn, P., 1974. *Moon* **11**:411–414. [4] Bogard, D. D. et al. 1985. *Geochimica et Cosmochimica Acta* **49**:941–946. [5] McConville, P. et al. 1988. *Geochimica et Cosmochimica Acta* **52**:2487–2499.