

15445 AND 15455: RESULTS OF 39AR-40AR AGE DATING

M.L. Bernstein. 270 Riverside Drive, New York, NY 10025

PURPOSE OF STUDY. This work (1) validates the age of the Imbrium Basin obtained from Apollo 14 samples (2), and confirms the results of a previous study of 15445/15455 (3).

IMPACT MELT ORIGIN. Determining such an origin is important, for only impact-melted rocks have certainly been completely degassed. The evidence for 15445/15455 follows: 1) The matrix shows no evidence of shock, but contains extensively shocked clasts. 2) Siderophile elements are found in the matrix (4,5), but the clasts are pristine (6,7). 3) The clasts are about 500 m.y. older than the matrix (8,9,10). 4) The microcrystalline texture of the olivine-plagioclase matrix has been replicated in dynamic crystallization experiments (11). Best results were obtained using high cooling rates (>25C/hr) consistent with a two-stage cooling model for fragment-laden impact melts (12).

DEPTH OF ORIGIN. Phase equilibrium experiments on 15445 spinel troctolites suggest a depth consistent with a large multi-ring basin (13). The absence of any surface-related clasts, such as basalt, KREEP, or regolith, is consistent with a deep origin.

INTERPRETATION OF STEPWISE RELEASE DATA. Apparent age vs. cumulative fraction 39-Ar released curves for samples 15445,236 and 15455,243 are similar to those previously obtained (3). There is a high apparent age between 800 and 950C, a low apparent age between 1000 and 1200C, and no plateau. These anomalous release curves are explained by the 39-Ar recoil process (14). The petrography of 15445/15455 duplicates the recoil experiment done by (14). The microcrystalline matrix has a K-rich mesostasis in contact with the olivine crystals. During neutron irradiation of the samples, some of the 39-K which captured neutrons also recoiled from the mesostasis into the olivine grains. The K-rich mesostasis, which degasses at temperatures below 1000C, was 39-K (39-Ar) impoverished. This results in a higher 40-Ar/39-Ar and greater apparent age for the lower temperature fractions. Similarly, the olivine, which degasses at temperatures mostly between 1000 and 1200C, was 39-K (39-Ar) enriched. This shows as a lower 40-Ar/39-Ar and lesser apparent age for the higher temperature fractions. The recoil process has disturbed the stepwise release curve only as the result of internal redistribution of 39-Ar. Therefore the stepwise release data obtained in this study and in (3) are valid, and can be used to calculate an age using the weighted average method.

AGES OF 15445/15455. The age calculated for 15445,236 is 3.74 ± 0.08 b.y., the age for 15455,243 is 3.86 ± 0.05 b.y. Ages obtained by (3) and converted to the new decay constants (15), are 3.77 ± 0.04 b.y. for 15455,70A, and 3.86 ± 0.04 b.y. for 15455,183. Assuming that 15445 and 15455 are samples of one formation, it is possible to treat these ages as replicate analyses of the same

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unit, and to average them. This gives an age of 3.81 ± 0.06 b.y. for the impact event. This is in good agreement with ages obtained at the Apollo 14 site and confirms the age of the Imbrium event.

EXPOSURE AGES. Calculated 38-Ar exposure ages are 220 m.y. for 15445,230, and 190 m.y. for 15455,240. This represents the approximate age of Spur Crater.

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