^{40}AR-^{39}AR STUDIES OF LUNAR BRECCIAS. E.C. Alexander, Jr.* and S.B. Kahl, Physics Dept., Univ. of Calif., Berkeley, Calif. 94720.
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14301 and 14313. Three Apollo 14 breccias, 14301, 14313 and 14318, contain fissiogenic Xe attributable to the decay of extinct ^{244}Pu (1, 2) but the effect is marginal in the case of 14313 (3). We have previously reported (2) that 14318 has a reasonably well defined ^{40}Ar-^{39}Ar age of 3.69 ± 0.09 b.y. and contains a large trapped Ar component with an unusual isotopic composition, $(^{40}Ar/^{36}Ar)_t$ = 13.68 ± 0.25. Megrue (4) using a laser probe technique has presented evidence that 14301 contains 3.7 b.y. old clasts and that the matrix of 14301 contains trapped Ar with $(^{40}Ar/^{36}Ar)_t$ = 14. We report here step-wise heating experiments on 14301 and 14313 designed to determine if a $(^{40}Ar/^{36}Ar)_t$ ∿14 is common to all three breccias and to see of Megrue's laser probe technique is directly comparable to step-wise heating experiments.

Neither 14301 nor 14313 yield isochrons on $^{40}Ar/^{36}Ar$ versus $^{39*}Ar/^{36}Ar$ plots as did 14318 (2). Rather the data scatter in a fashion which indicates that the two breccias contain variable trapped components. To resolve the variable trapped components we assumed that both of the breccias are 3.7 ± 0.2 b.y. old and calculated the composition of the trapped Ar in each temperature fraction. The results of this calculation for 14301 are shown in Fig. 1. Data for 14313 yield a very similar pattern. However, 14313 contains ∿6 times more ^{36}Ar and the $(^{40}Ar/^{36}Ar)_t$ values are ∿3.5 times smaller with a total $(^{40}Ar/^{36}Ar)_t$ = 2.7 ± 0.1.

Evidently laser probe and step-wise heating experiments yield different though complimentary data. The trapped gas that is evolved as a unique composition in the laser probe experiments is resolved into different components by a step-wise heating experiment.

The low temperature fractions contain much more ^{40}Ar than the higher temperature fractions and even the latter do not yield $(^{40}Ar/^{36}Ar)_t$ values ≤ 1 which are typical of lunar soils. We speculate that the low temperature enrichment might be due to the trapping (in pores, bubbles, etc.) of an incompletely homogenized, localized "internal atmosphere" rich in ^{40}Ar during the formation of the breccias. In this context Heymann and Yaniv (5) have demonstrated the existence of a pore gas in breccia 10065. Incomplete homogenization of rare gases in 14301, 14313 and 14318 is also indicated by the Xe data (1, 2, 3).

The $(^{40}Ar/^{36}Ar)_t$ ratios in these breccias are not constant and are probably accidents of the random details of the individual samples' formation. The three breccias were not formed in the presence of a unique trapped Ar composition.

15455. Fig. 2 gives the results of ^{40}Ar-^{39}Ar determinations on the dark and light portions of the "black and white" breccia 15455. Although the K/Ca ratio remains relatively constant as shown in the top of Fig. 2, both the light and dark phases contain the high temperature "drop off" characteristic of many Apollo 14 breccias. Although the occurence of this "drop off" phen-

omena is restricted to breccias, Davis (6) has recently shown that it is probably not a shock phenomena. The apparent younger age of the light portion is in direct conflict with the petrographic data which shows that the dark phase is intruding the light phase. The low age of the light portion is probably due to the less retentative nature of the white portion. (Note that 43% of the $^{39*}Ar$ in the dark phase is released by 700°C while 63% is released at the same temperature in the light phase.) The >400°C total age, 3.92 ± 0.04 b.y., for the dark portion is the best estimate of the age of 15455.

Fig. 3 gives the spallation data for 15455. The line is fit to the 500° through 900°C fractions of both samples. The nominal exposure age is 215 m.y. However the ratio of the slope of the line in Fig. 3 to its ordinate intercept implies a value for P_K^{38}/P_{Ca}^{38} (the ratio of the production rates of ^{38s}Ar from K and Ca) of ∿70. This high value is indicative of a "soft" or shielded irradiation. The value of 215 m.y. is probably a lower limit to the exposure age of 15455. A long exposure age for 15455 indicates that mass wasting down the Apennine front in the vicinity of Spur crater is a slow process.

14270. Breccia 14270 is a typical A14 breccia complete with a high temperature "drop off" in the $^{40}Ar-^{39}Ar$ release pattern. The plateau age is 3.94 ± 0.03 b.y. and the >400°C age is 3.89 ± 0.05 b.y. The exposure age is 240 m.y. and the P_K^{38}/P_{Ca}^{38} ∿1.6 is indicative of a much "harder" irradiation than that experienced by 15455.

References

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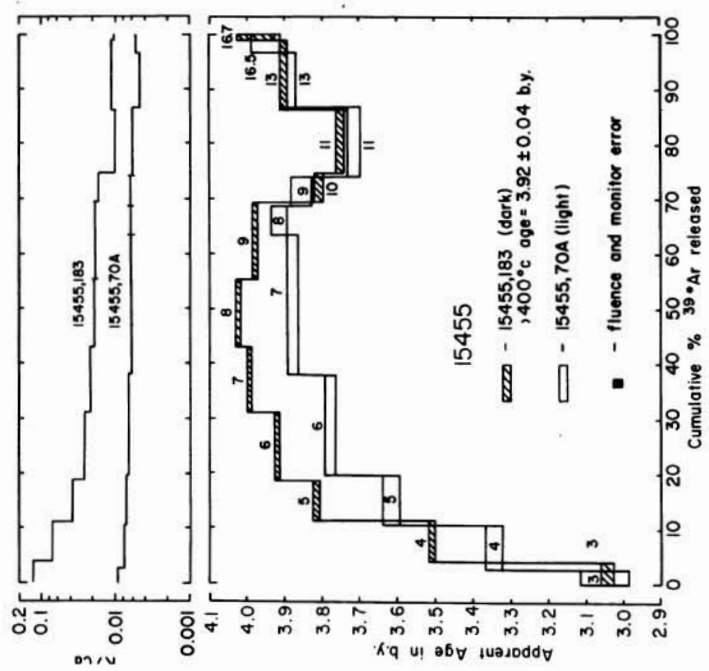

Figure 2. ^{40}Ar-^{39}Ar release patterns and K/Ca ratios in 15455. (The numbers by data in all three figures are the temperatures in hundreds of °C.)

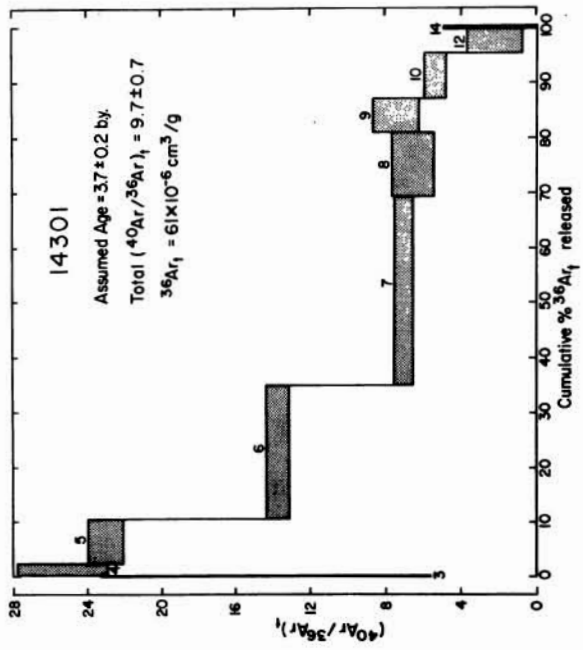

Figure 1. Trapped Ar in 14301.

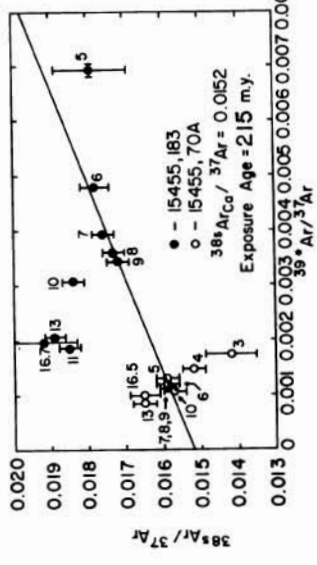

Figure 3. Spallogenic Ar in 15455.