33. ^{40}AR/^{39}AR DATING OF LEG 34 BASALTS

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INTRODUCTION

Two samples from Hole 319A and two from Site 321 were selected for dating by the $^{40}Ar/^{39}Ar$ (incremental heating) method. Small chips of each were irradiated along with biotite flux monitors in the McMaster University nuclear reactor. Thin sections (used in the sample selection procedure) had previously been cut from adjacent pieces (see Stukas and Reynolds, 1974, for a more detailed description of our procedure).

The results for three of the samples are given in Table 1. Data for the remaining sample are not reported since they are rather imprecise due to very high atmospheric argon corrections. Figures 1-3 are plots of apparent age and observed $^{37}Ar/^{39}Ar$ ratio, both as a function of percent ^{39}Ar released.

HOLE 319A

Sample 319A-3-1, 75-78 cm, appeared to be the freshest of the four samples studied. Still, some small amount of smectite was observed in the thin section. The observed small variation in the ratio $^{37}Ar/^{39}Ar$ suggests the outgassing of only one distinct Ca/K phase. The apparent ages for steps 3 and 4 may be more uncertain than is acknowledged due to the very high (and therefore more uncertain) interfering isotopes correction. Therefore, on the basis of the most precise data, the data for step 2, 550°C-680°C, suggest that the age of this rock is 24 ±4 m.y.

Note that the apparent ages obtained for Sample 319A-6-1, 106-109 cm are uniformly low (relative to those obtained for 319A-3-1). In fact, radiogenic argon was not definitely detected in several of the steps. However, since this sample appears to be relatively highly altered, the data for it are disregarded and the age of Hole 319A is estimated to be 24 ±4 m.y.

SITE 321

Sample 321-14-2, 115-117 cm again shows a small amount of smectite alteration. The apparent age-argon release pattern (Figure 3) is somewhat difficult to interpret. There appears to be a distinctive difference in apparent age between the first 50% or so of gas released and the last 50% (~37 m.y. versus ~25 m.y.). The total gas (equivalently the conventional K/Ar age) is of course intermediate in value at ~31 m.y. Again, there does not appear to be sufficient variation in the observed $^{37}Ar/^{39}Ar$ ratio to suggest the outgassing of two different Ca/K phases.

DISCUSSION

Independent estimates of basement ages have been obtained from studies of the overlying sedimentary sections. These range from middle-early Miocene (about 19 m.y.) for Site 319 to late Eocene (about 40 m.y.) for Site 321. The result for Sample 319A-3-1, 75-78 cm is consistent with these estimates as are the data for the initial ~50% of gas released from Sample 321-14-2, 115-117 cm. It is not, however, apparent why this part of the release spectrum should be believed over the results for the apparently more tightly bound gas. One possibility is that the nonradiogenic argon released at the higher temperatures has an isotopic composition distinctly different from the assumed atmospheric value. In order for steps 3 and 4 to yield the same apparent age as, say, step 2, an initial $^{40}Ar/^{36}Ar$ ratio of ~285 (atmospheric value = 296) would be required. Alternatively, some sort of isotopic fractionation process may be operative at the higher release temperatures. Seidemann (1974) has suggested that irradiation damage effects in fine-grained rocks should yield low temperature ages which are too young. This explanation is not adequate here since I seem to have observed exactly the opposite.

Release patterns of the type seen in Figure 3 have been observed previously, for example, for some of the lunar rocks returned by the Apollo teams (see, for example, Turner et al., 1971) and also for some other terrestrial basalt samples analyzed in this laboratory. Empirically, the gas released at low to medium temperatures always seems to give the "correct" age. More research is obviously required.

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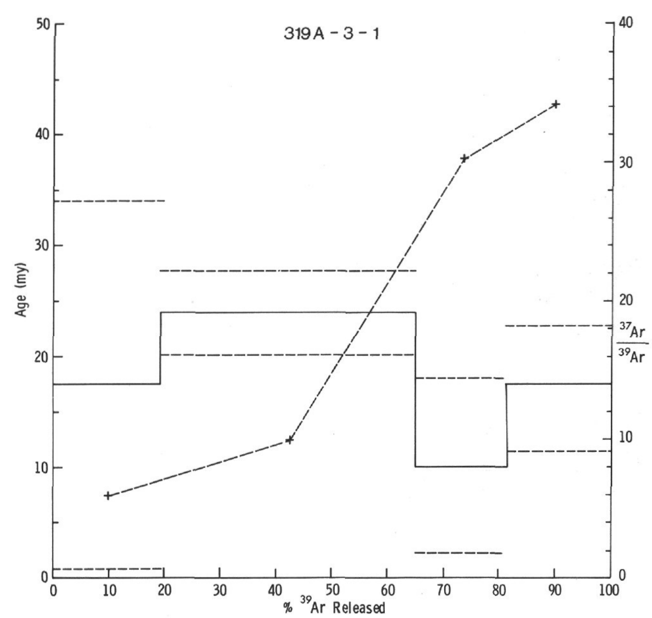

Figure 1. *Sample 319A-3-1, 75-78 cm; apparent age—solid lines ±1σ (dashed lines); $^{37}Ar/^{39}Ar$ ratios indicated by crosses.*

TABLE 1
Age-Dating Results; Hole 319A and Site 321, Leg 34

Sample (Interval in cm)	Temperature Step	Apparent Age (m.y.)	Atmospheric Argon Correction (%)	Interfering Isotopes Correction (%)	Apparent K Concentration (%)
319A-3-1, 75-78	300°C-550°C	12 ±17[a]	97.8	7	0.03
	550°C-680°C	24 ±4	92.6	9	
	680°C-820°C	10 ±8	96.3	65	
	820°C-950°C	17 ±6	96.4	44	
	Total gas	19			
319A-6-1, 106-109	300°C-550°C	13 ±3	96.8	3	0.09
	550°C-680°C	14 ±5	97.0	18	
	680°C-820°C	4 ±6	98.4	361	
	820°C-950°C	9 ±27	99.7	247	
	950°C-1120°C	33 ±132	99.2	290	
	Total gas	13			
321-14-2, 115-117	300°C-550°C	27 ±6	95.3	3	0.07
	550°C-680°C	37 ±1	75.	3	
	680°C-820°C	24 ±3	91.5	13	
	820°C-950°C	25 ±3	94.5	20	
	Total gas	31			

[a]1 standard deviation.

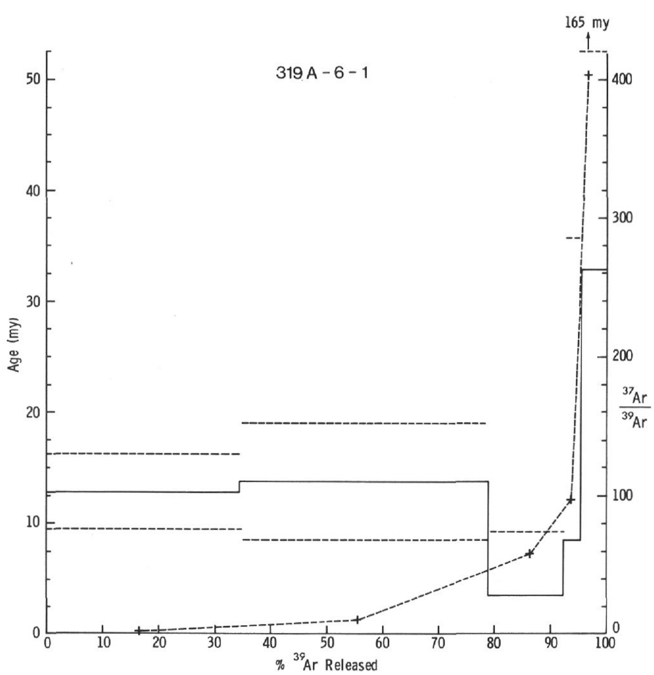

Figure 2. *Sample 319A-6-1, 106-109 cm; apparent age—solid lines ±1σ (dashed lines); $^{37}Ar/^{39}Ar$ ratios indicated by crosses.*

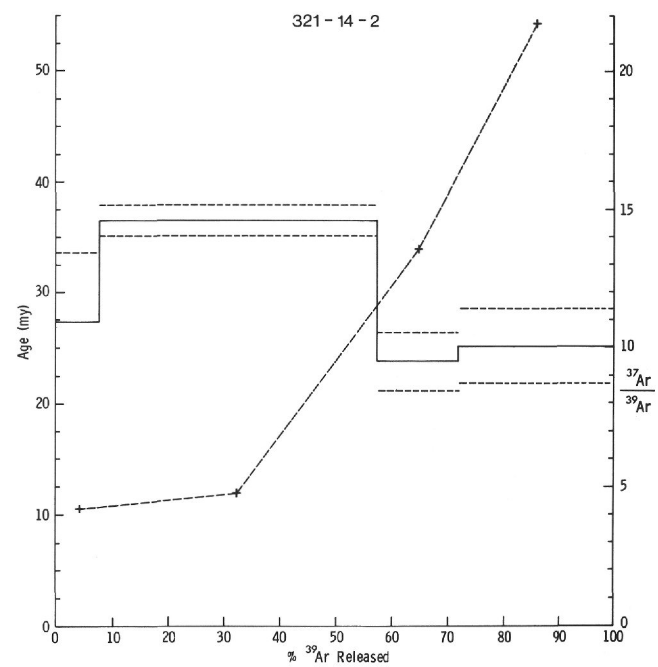

Figure 3. *Sample 321-14-2, 115-117 cm; apparent age—solid lines ±1σ (dashed lines); $^{37}Ar/^{39}Ar$ ratios indicated by crosses.*

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