

46. LEG 37 BASALTS AND GABBRO: K-Ar AND ^{40}Ar - ^{39}Ar DATING

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INTRODUCTION

Twelve samples, considered by the shipboard party to be among the freshest available, were carefully examined in thin section. While all of these showed at least some alteration and hence were not completely suitable for argon dating, according to the rules of say Dalrymple and Lanphere (1969), three of the best (two basalt and one gabbro) were selected. The results discussed below are summarized in Table 1.

HOLE 332B, SAMPLE 22-3, 55-62 cm

This sample contains abundant small plagioclase crystals which show a slight but distinct and uniform alteration. Other phases include altered olivine and pyroxene and abundant opaque iron oxides. We were unable to detect any radiogenic argon in this sample. While our experimental uncertainty would permit an apparent age of $\cong 1$ m.y., even this is much less than the value expected for this site ($\cong 3$ -4 m.y.). We must therefore conclude that alteration of K-bearing phases has prevented the quantitative retention of radiogenic argon.

SITE 335, SAMPLE 14-4, 130-143 cm

Similar to 332B-22-3 but less altered, this sample has a positive apparent age (3 ± 1 m.y.). However, this too is much less than the value expected for the site ($\cong 10$ -16 m.y.) and again it appears that radiogenic argon has not been quantitatively retained.

SITE 334, SAMPLE 22-2, 110-120 cm

This is a coarse-grained rock consisting primarily of plagioclase feldspar ($\cong 70\%$) and pyroxene ($\cong 20\%$). The plagioclase appears to be slightly altered. A ^{40}Ar - ^{39}Ar

age spectrum plot (apparent age versus temperature of gas release) is shown in Figure 1.

The apparent ages are seen to range from a high of $\cong 600$ m.y. at the lowest extraction temperatures to a low of $\cong 130$ m.y. at the highest temperatures. Since these ages are all much higher than the value expected for the site ($\cong 10$ m.y.), it is clear that substantial quantities of excess radiogenic argon are present. This excess gas is apparently held mainly in low retention sites since it is preferentially released at the lower extraction temperatures. It should be noted that an isochron (i.e., $^{40}\text{Ar}/^{36}\text{Ar}$ versus $^{39}\text{Ar}/^{36}\text{Ar}$) plot fails to yield additional information.

If one assumes that the correct age is $\cong 10$ m.y., then the amount of excess ^{40}Ar turns out to be $\cong 2 \times 10^{-12}$ moles/g. Values of this order have been reported for various plagioclase feldspars; pyroxenes, on the other hand, frequently contain substantially higher quantities of excess gas (see, for example, Dalrymple and Lanphere, 1969). The difficulty here is that this relatively small amount of excess argon exists in a young (10 m.y. old) system which has an extremely low potassium concentration (only $\cong 0.01\%$ K₂O).

CONCLUSIONS

This preliminary K-Ar, ^{40}Ar - ^{39}Ar investigation of Leg 37 material failed to yield a satisfactory result. Because of the excess gas problem, argon methods are unlikely to succeed in dating the low-K gabbros. However, the ^{40}Ar - ^{39}Ar age spectrum technique might prove useful in the case of the freshest basalt from Site 335.

REFERENCE

Dalrymple, G.B., and Lanphere, M.A., 1969. Potassium-argon dating: New York (W.H. Freeman and Company).

TABLE 1
K-Ar and ^{40}Ar - ^{39}Ar Dating Results

Hole	Sample	Method	Temperature Step (°C)	K ₂ O (%)	Apparent Age $\pm 2\sigma$ (m.y.)	^{40}Ar Atmospheric / ^{40}Ar Total
332B	22-3, 55-62 cm basalt	K-Ar	Fusion	0.063	0 \pm 1	1.0
335	14-4, 130-143 cm basalt	K-Ar	Fusion	0.15	3.0 \pm 1.0	0.97
334	22-2, 110-120 cm gabbro	^{40}Ar - ^{39}Ar	300-500	14 ^a	635 \pm 102	0.83
			500-625	15 ^a	394 \pm 61	0.82
			625-750	19 ^a	228 \pm 180	0.95
			750-875	25 ^a	139 \pm 163	0.97
			875-1000	27 ^a	135 \pm 32	0.93

^aPercent ^{39}Ar released.

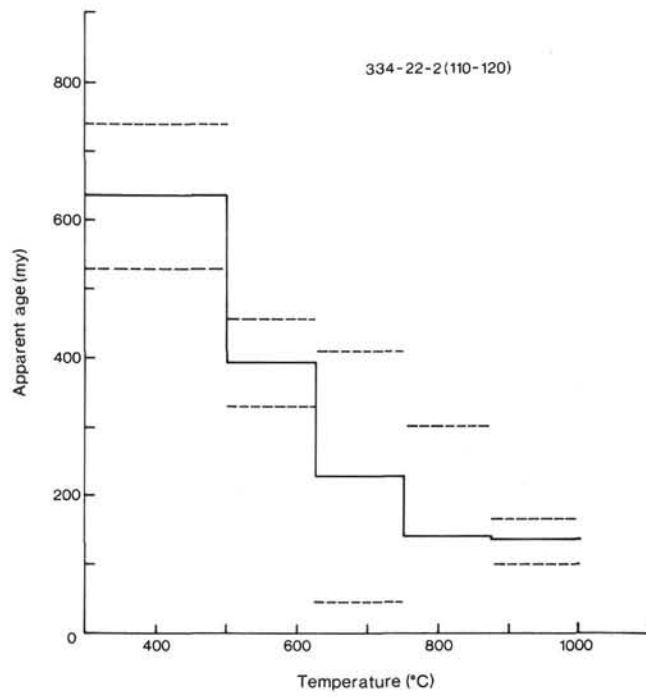


Figure 1. Age spectrum plot, Site 334 gabbro.