Division of Geological & Geophysical Surveys

RAW-DATA FILE 2001-3

$^{40}AR/^{39}AR$ ANALYSES FROM THE IRON CREEK AREA, TALKEETNA MOUNTAINS QUADRANGLE, ALASKA

by

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Summary of the Analysis

Rock samples from the Iron Creek area, Talkeetna Mountains Quadrangle were submitted as part of a cooperative project between DGGS and USGS to UAF Geochronology lab for $^{40}Ar/^{39}Ar$ analysis. The samples were wrapped in aluminum foil and within aluminum cans of 2.5 cm diameter and 6 cm height. Standard monitor minerals were used to monitor the neutron flux. The samples were irradiated in position 5c of the uranium enriched research reactor of McMaster University in Hamilton, Ontario, Canada.

Upon their return from the reactor, the sample and monitors were loaded into 2 mm diameter holes in a copper tray which was then loaded in a ultra-high vacuum extraction line. The monitors were fused, and samples heated, using a 6 watt argon-ion laser following the technique described in York et al. (1981) and Layer et al. (1987). Argon purification was achieved using a liquid nitrogen cold trap and a SAES Zr-Al getter at 400C. The samples were then analyzed in a VG-3600 mass spectrometer at the Geophysical Institute, University of Alaska Fairbanks. The argon isotopes measured were corrected for system blank and mass discrimination, as well as calcium, potassium and chlorine interference reactions following procedures outlined in McDougall and Harrision (1999).

The hard copies of the analyses are given in Appendix 1 while a summary of all the $^{40}Ar/^{39}Ar$ results is given in Table 1, with all ages quoted to the +/- 1 sigma level and calculated using the constants of Steiger and Jaeger (1977).

Layer, P.W., Hall, C.M. & York, D., 1987. The derivation of $^{40}Ar/^{39}Ar$ age spectra of single grains of hornblende and biotite by laser step heating, *Geophys. Res. Lett.*, **14**, 757-760.

McDougall, I. and Harrison, T.M., 1999, Geochronology and Thermochronology by the 40Ar/39Ar method-2nd ed, Oxford University Press, New York, 269pp.

Steiger, R.H. and Jaeger, E., 1977, Subcommission on geochronology: Convention on the use of decay constants in geo and cosmochronology, Earth and Planet Science Letters, v. 36, p. 359-362.

York, D., Hall, C.M., Yanase, Y., Hanes, J.A. & Kenyon, W.J., 1981. $^{40}Ar/^{39}Ar$ dating of terrestrial minerals with a continuous laser, *Geophys. Res. Lett.*, **8**, 1136-1138.

Iron Creek samples for $^{40}Ar/^{39}Ar$ dating:

Sample #	UTM E*	UTM N*	Rock type	Mineral	Integrated Age (Ma)	Plateau Age (Ma)	Isochron Age (Ma)
99MBW529	396127	6915477	Quartz-sericite-pyrite schist	Sericite	140.3 ± 1.0	**145.7 ± 1.0** **10 fractions,** **88% release**	none
99JS048B	394795	6905572	Porphyritic, quartz-eye metarhyodacite	Biotite	98.2 ± 0.6	**100.5 ± 0.7** **13 fractions,** **93% release**	none
99JS048B	394795	6905572	Porphyritic, quartz-eye metarhyodacite	White mica	132.2 ± 0.9	**132.8 ± 0.9** **12 fractions,** **98% release**	none
99MBW516	395137	6912389	Porphyritic, quartz-eye rhyodacite	Biotite	**NOT DATED**		
99MBW468	394418	6922294	Diorite	Hornblende	341.3 ± 2.6	256.2 ± 2.5 4 fractions, 43% release saddle	Various, see discussion
						393.5 ± 3.8 4 fractions 32% release	99MBW468 high temperature mini-plateau
99MBW403	381545	6920029	Biotite hornblende granodiorite	Hornblende	58.0 ± 0.5	**57.7 ± 0.5** **6 fractions,** **87% release**	57.7 ± 0.5 *init* = 300 ± 11 MSWD = 0.65
99Pe21	393352	6919117	Felsite/ rhyodacite? flow	Biotite	52.0 ± 0.4	**52.1 ± 0.4** **9 fractions,** **95% release**	52.2 ± 0.3 i = 266 ± 10 MSWD = 0.51
99MBW541B	385301	6917121	Hornblendite	Hornblende	94.3 ± 1.7	84.0 ± 1.2 3 fractions 50% release saddle	**63.0 ± 8.4** **40/46i = 733 ± 142** **MSWD = 0.62**
99Pe66	393356	6908617	Hornblende diorite	Hornblende	282.5 ± 2.2	**251.1 ± 2.1** **5 fractions,** **93% release**	241.0 ± 10.9 i = 377 ± 6 MSWD = 0.41
99Arj028	388127	6909105	Biotite hornblende diorite	Hornblende	76.5 ± 0.7	**75.5 ± 0.6** **9 fractions,** **95% release**	73.2 ± 1.3 i = 467 ± 80 MSWD = 1.30
99MBW458	392985	6922947	Biotite granite	K-feldspar	68.3 ± 0.5	**68.5 ± 0.6** **4 fractions,** **79% release**	66.9 ± 0.5 i = 338 ± 8 MSWD = 1.92

Samples run against standard Mmhb-1 with an age of 513.9 Ma using the constants of Steiger and Jager (1977).
All errors quoted to ± 1 σ. **Bold ages are best interpreted ages.** i = initial 40Ar/36Ar ratio in isochron
*Clark 1866, NAD27, UTM Zone 6

Sample Discussion

10 Minerals from 9 samples were dated as part of the Iron Creek project. Interpreted ages from a variety of lithologies range from 52 Ma to 251 Ma. Below are age spectra interpretations, also summarized in table 1.

99MBW529: This sericite sample has a very well defined plateau age of 145.7 ± 1.0 Ma. There is evidence of 0 aged argon loss (~6%).

99JS048B: Both biotite and white mica were dated from this sample. Neither age spectrum shows a truly "flat" plateau. The white mica age of 132.8 ± 0.9 Ma is a good estimate of the closure age of this mineral (although given the structure on the plateau, the true age may be slightly older). The biotite age of 100.5 ± 0.7 Ma, which is much younger than the white mica, probably reflects the fact that the biotite is rather severely altered. At this time, we cannot say if this age represents a real thermal event. Better geologic controls are needed to make this call.

99MBW516: Biotite from this sample was too altered to date. Sample 99JS048B was substituted.

99MBW468: This hornblende sample has a lot of excess argon and in that sense it is similar to 99MBW541B (discussed below), although this sample is much older. On the Ca/K plot, there are two "phases", the first with Ca/K values of 40-50, and the second with Ca/K values of about 80. The "low Ca/K" phase has a saddle age of 256 Ma, but an isochron (errorchron) age of 220 ± 12 Ma (initial 40AR/36Ar = 575 ± 33). The higher Ca/K phase has an apparent "plateau" age of 393 Ma, but an isochron age of 115 ± 34 Ma (initial 40Ar/36Ar = 1466 ± 158). Additional geologic information may allow us to determine which of these ages represents the "true" age of the diorite. Until such data are available, we do not feel confident of any of the ages reported for this sample.

99MBW403: This hornblende has a very flat plateau associated with high (>9) Ca/K ratios. The age of 57.7 ± 0.5 Ma represents the closure age of this mineral.

99Pe21: Biotite from this sample has a well-defined flat plateau age of 52.1 ± 0.4 Ma. This is an excellent closure age for this mineral.

99MBW541B: This hornblende clearly has had a complex thermal history. It appears to have significant excess argon. A six-fraction isochron age of 63.0 ± 8.4 Ma is our best estimate of the age of this sample. This isochron has an initial 40Ar/36Ar value of 733 ± 142. Although it is difficult to say, this age is probably some type of reset age for this mineral, however additional geologic information is needed to better interpret this age spectrum. The poorly defined "saddle" age of 84 Ma is probably biased to be too old by the excess argon.

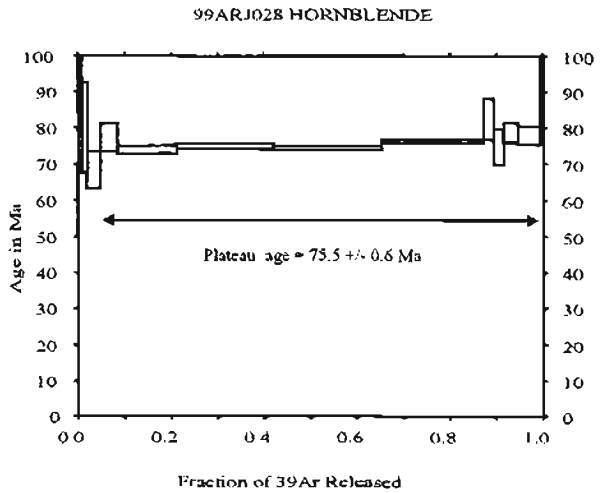
99Pe66: There is a lot of excess argon in this hornblende sample. Plateau age of 251.2 ± 2.1 Ma is our best interpretation, however this age may be biased to be slightly old due to excess

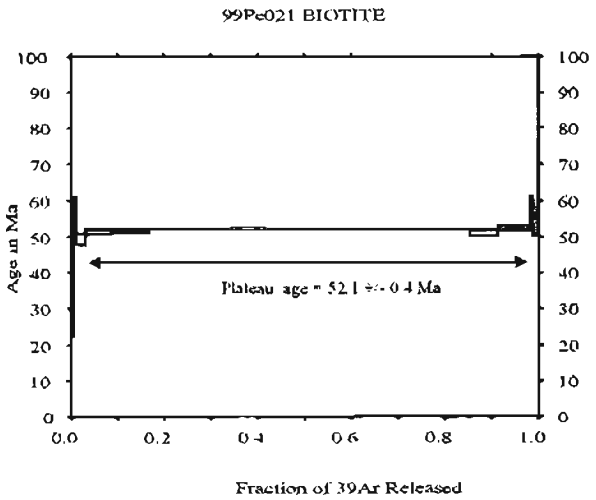
argon throughout the sample. The isochron age of 241.0 ± 10.9 is not significantly younger.

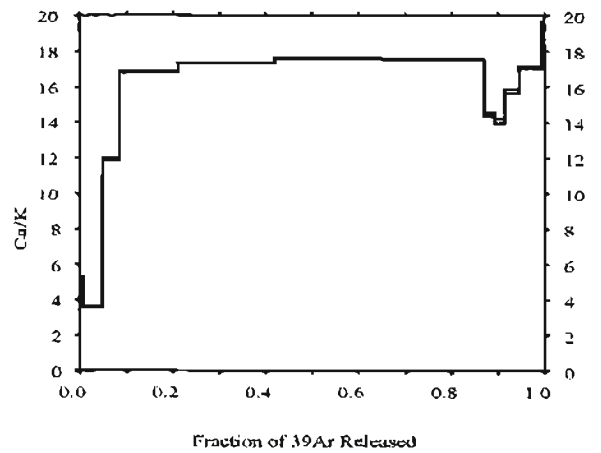
99Arj028: Hornblende age spectrum is flat. Plateau age reflects fractions with Ca/K ratios greater than 10. 75.5 ± 0.6 Ma is a "good" cooling age on this diorite.

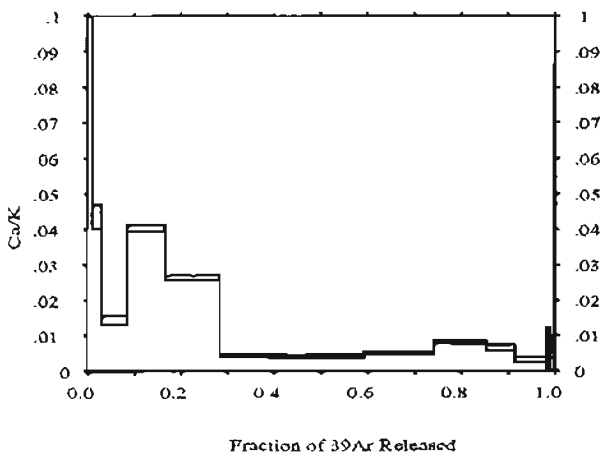
99MBW458: This potassium feldspar sample has a very flat age spectrum with little or no evidence of argon loss. The plateau age of 68.5 ± 0.6 Ma is our best estimate of the closure age of this feldspar.

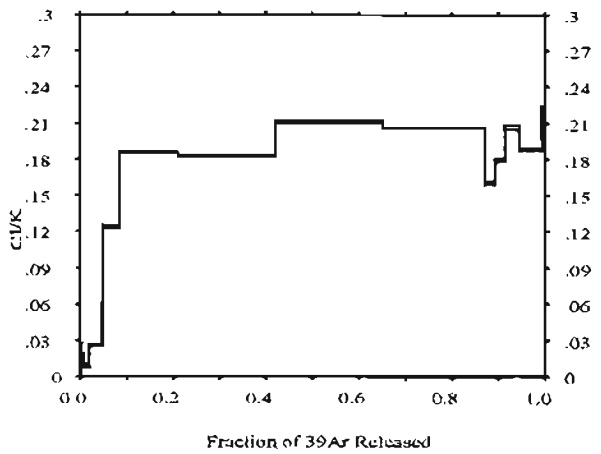
Appendix 1.
Data

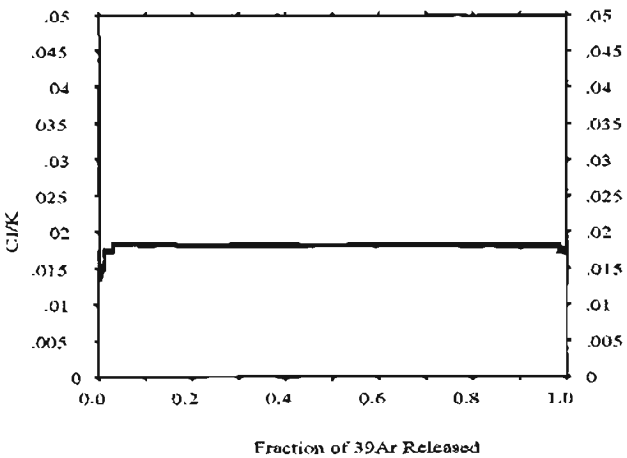




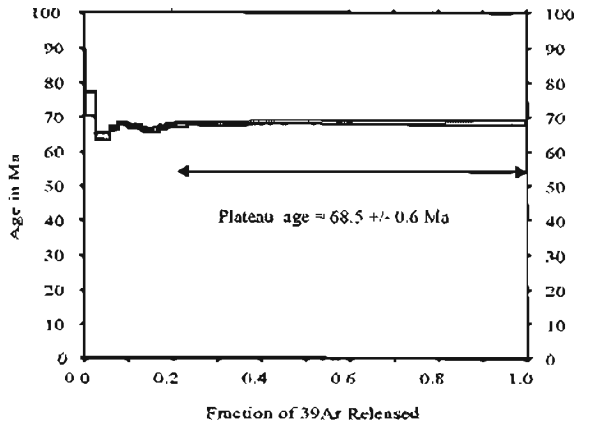




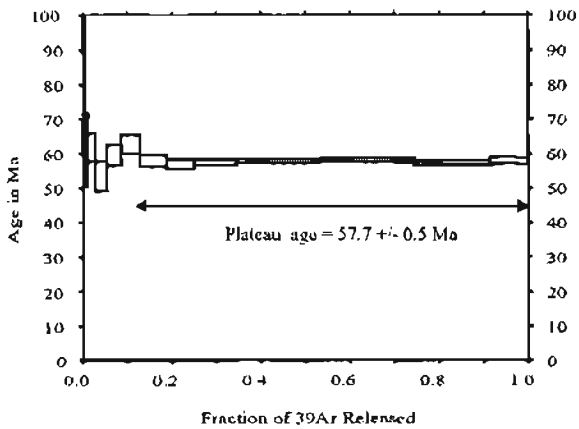


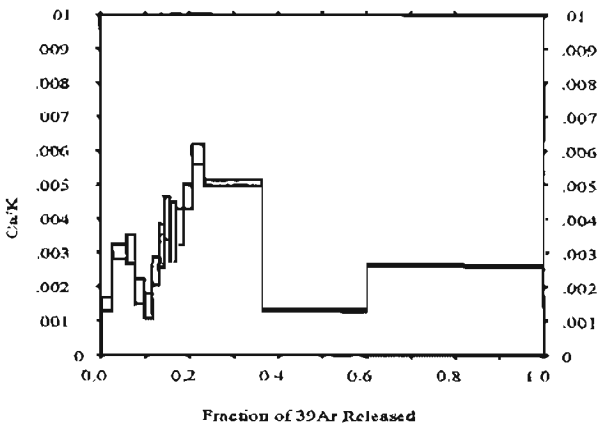


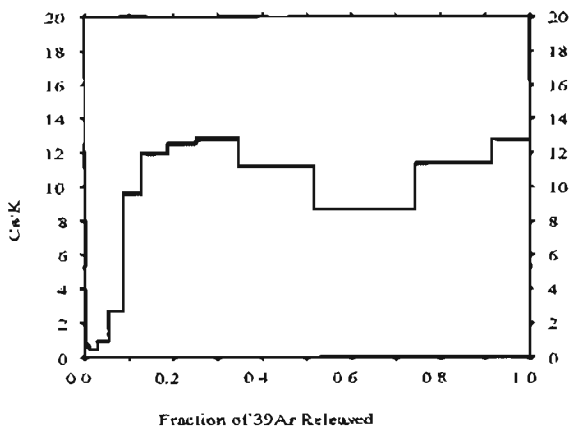
99MBW458 K-SPAR

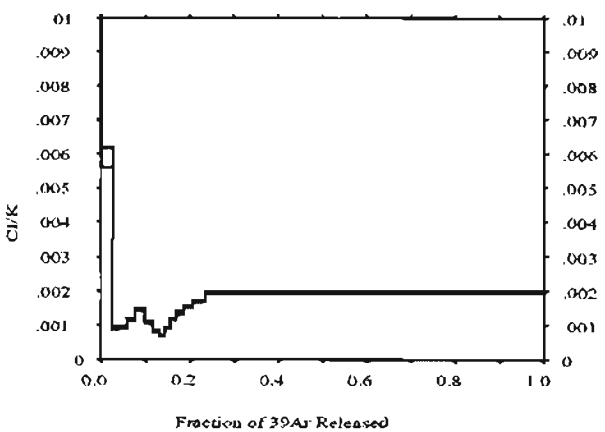


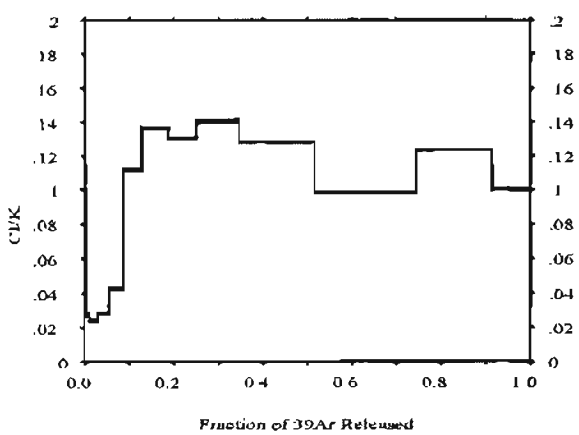
99MBW403 HORNBLENDE

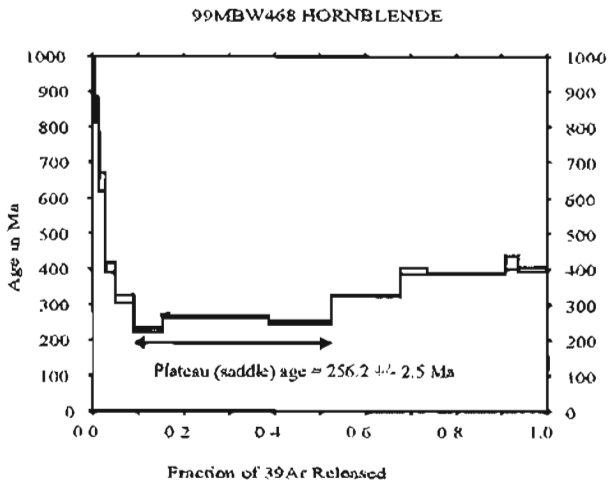


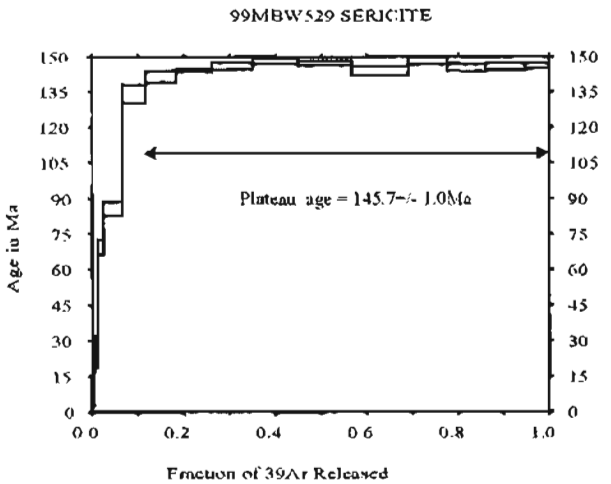


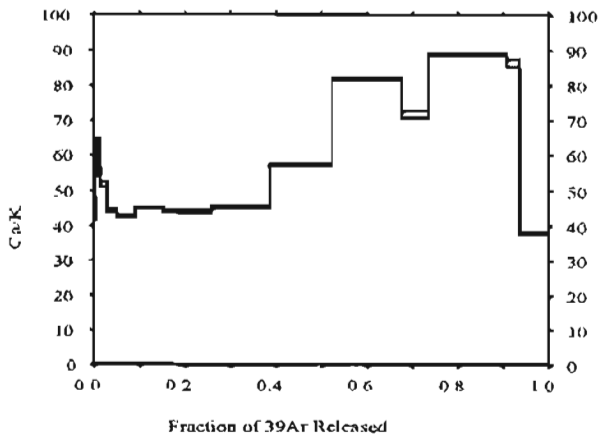


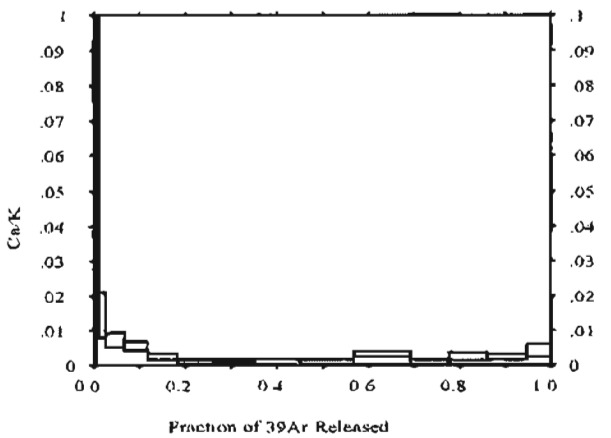


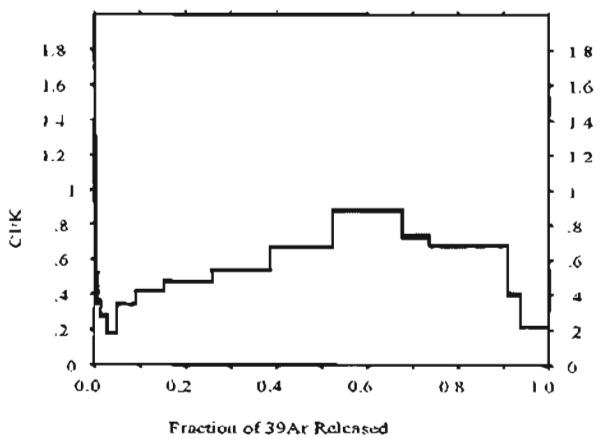


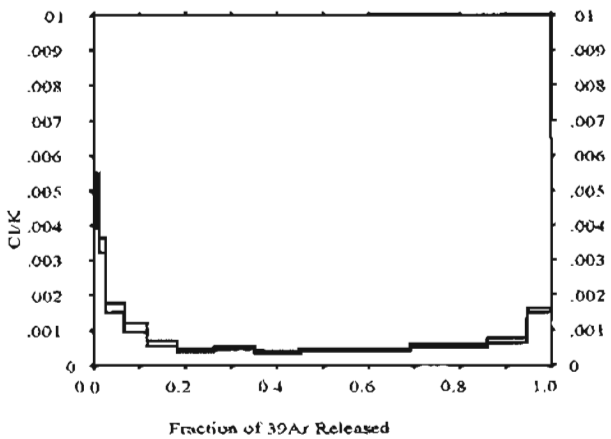

99MBW468 HORNBLENDE
Age in Ma
Plateau (saddle) age = 256.2 +/- 2.5 Ma
Fraction of 39Ar Released

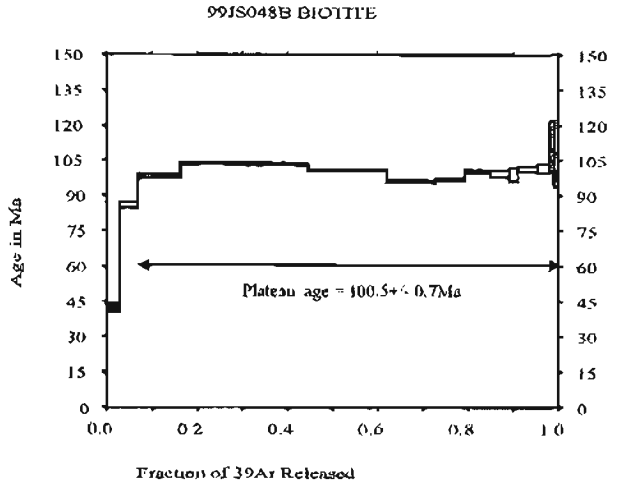

99MBW529 SERICITE
Age in Ma
Plateau age = 145.7+/- 1.0Ma
Fraction of 39Ar Released

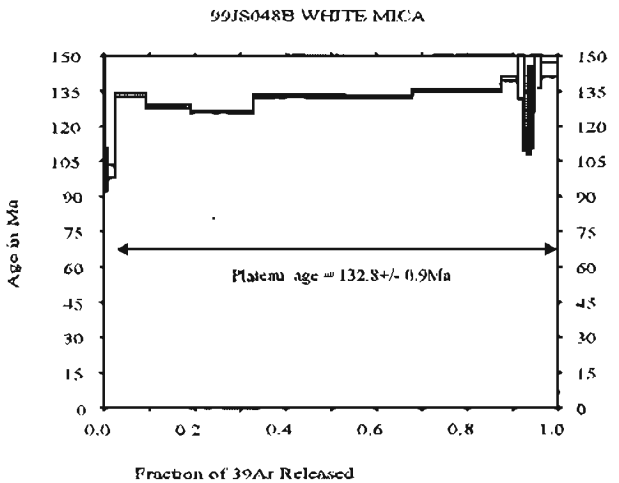

Ca/K
Fraction of 39Ar Released

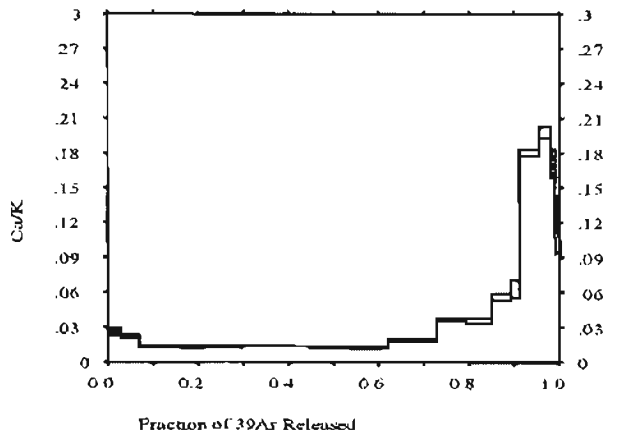

Ca/K
Fraction of 39Ar Released

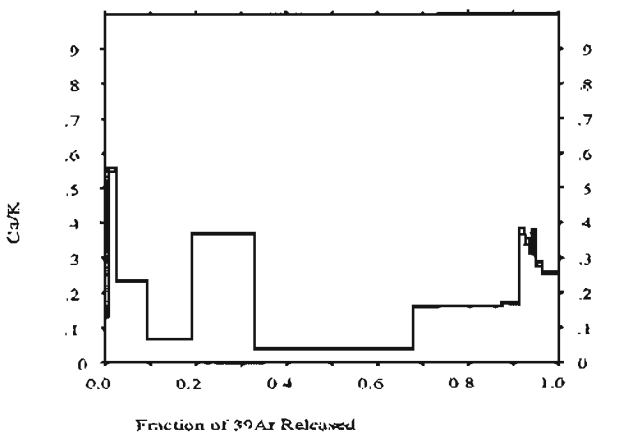

Cl/K
Fraction of 39Ar Released

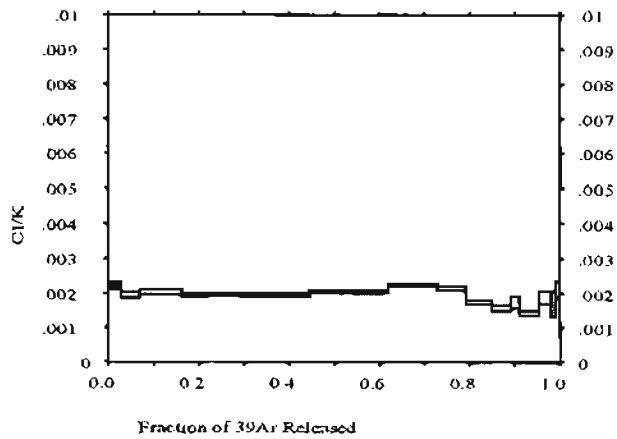

Cl/K
Fraction of 39Ar Released


99JS048B BIOTITE
Age in Ma
Plateau age = 100.5+/- 0.7Ma
Fraction of 39Ar Released


99JS048B WHITE MICA
Age in Ma
Plateau age = 132.8+/- 0.9Ma
Fraction of 39Ar Released


Ca/K
Fraction of 39Ar Released


Ca/K
Fraction of 39Ar Released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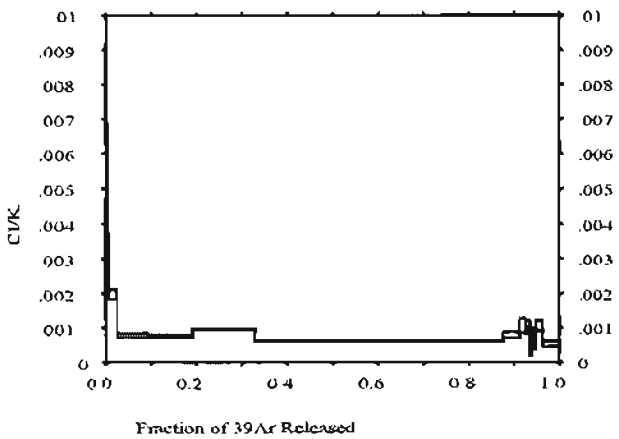
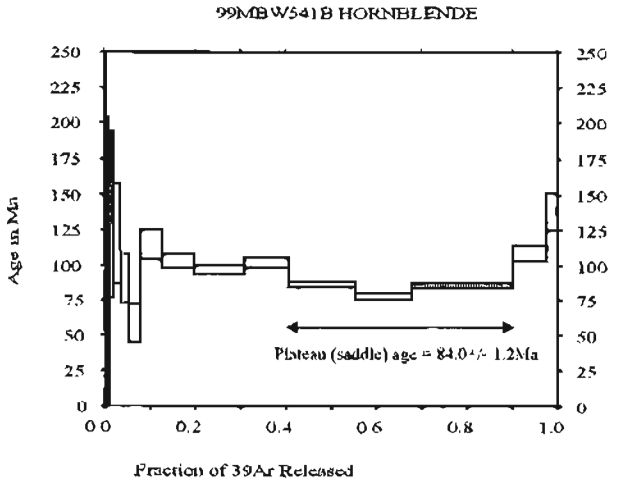
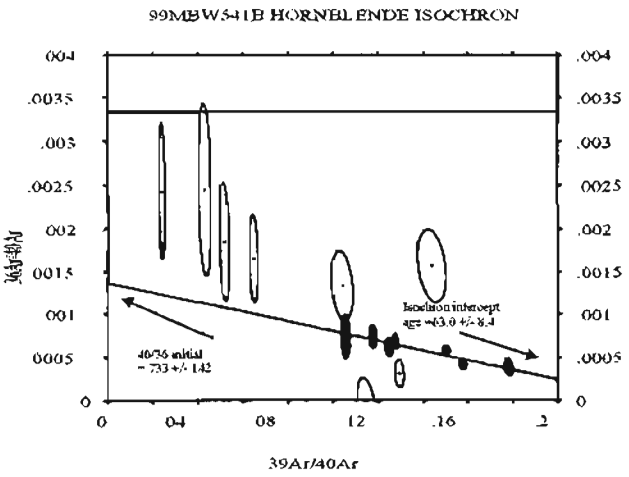
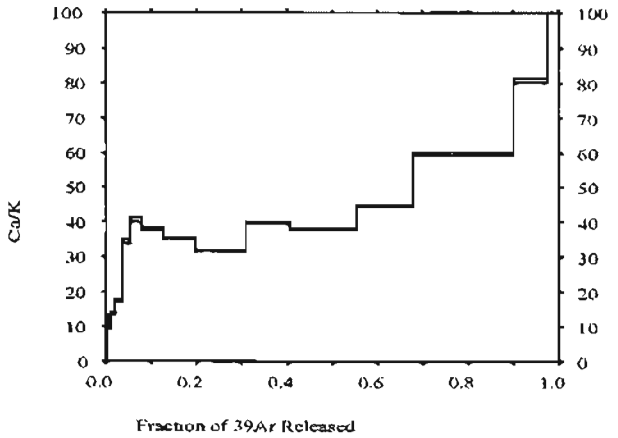

Cl/K
Fraction of 39Ar Released


99MBW541B HORNBLENDE
Age in Ma
Plateau (saddle) age = 84.0 +/- 1.2Ma
Fraction of 39Ar Released


99MBW541B HORNBLENDE ISOCHRON
40/36 initial
= 733 +/- 142
39Ar/40Ar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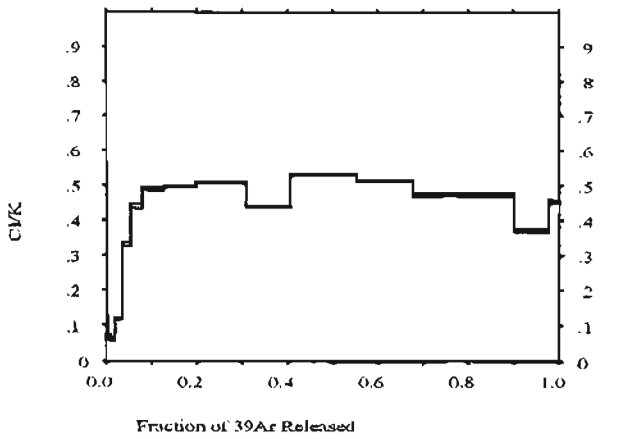
Cl/K
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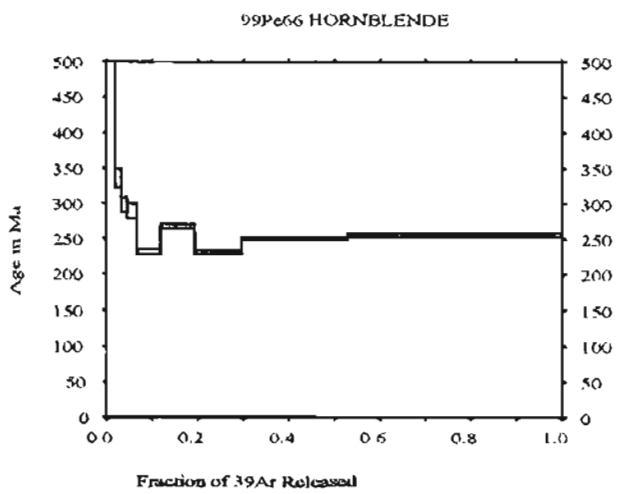
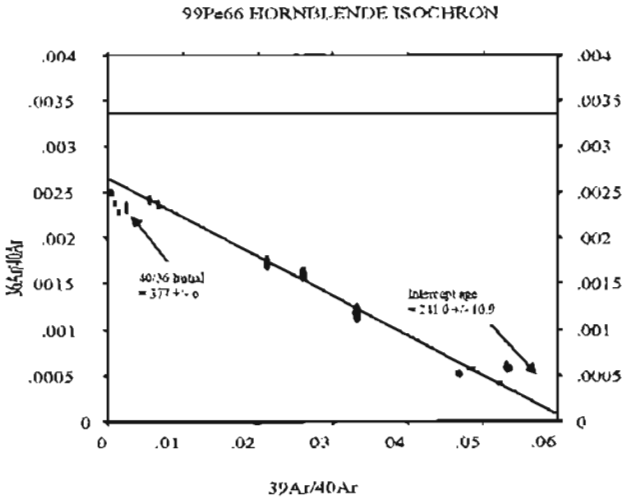
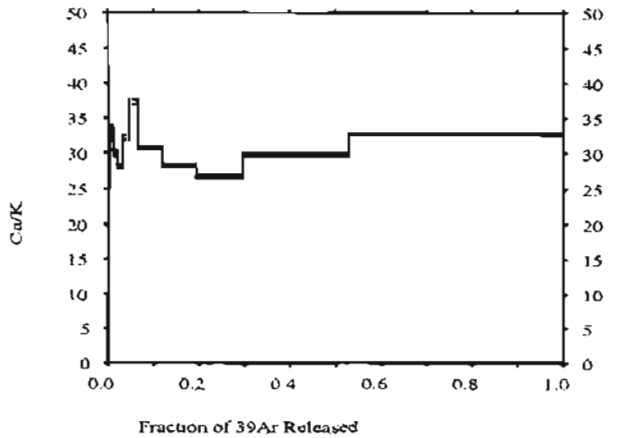
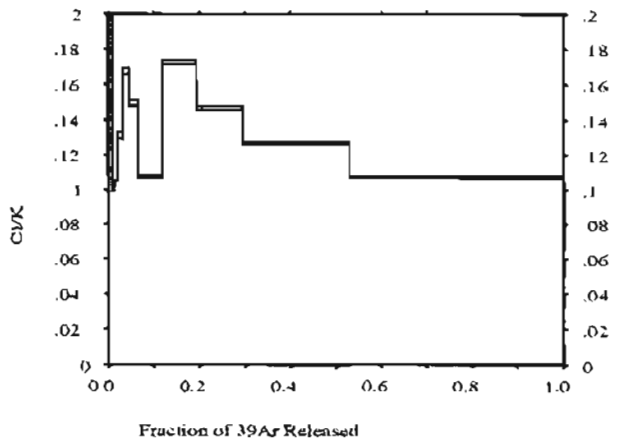

99Pe66 HORNBLENDE
Age in Ma
Fraction of 39Ar Released


99Pe66 HORNBLENDE ISOCHRON
36Ar/40Ar
39Ar/40Ar
40/36 Initial
= 377 +/- 6
Intercept age
= 211.0 +/- 10.9


Ca/K
Fraction of 39Ar Released


CV%
Fraction of 39Ar Released