$^{40}Ar/^{39}Ar$ geochronology of igneous rocks in the Taylor Mountains and Dillingham quadrangles in SW Alaska

by Alexander **Iriondo**[1,2], Michael J. **Kunk**[1], and Frederic H. **Wilson**[3]

[1] *U.S. Geological Survey, Denver, Colorado*
[2] *University of Colorado at Boulder, Boulder, Colorado*
[3] *U.S. Geological Survey, Anchorage, Alaska*

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INTRODUCTION

This publication contains $^{40}Ar/^{39}Ar$ geochronology data for 53 mineral and rock analyses from 48 igneous rocks collected in the Taylor Mountains and Dillingham 1:250,000-scale quadrangles in southwestern Alaska (Figures 1 & 2). Wilson and others (2003) present detailed geologic descriptions of these igneous samples. This open file report includes a summary table containing information on the rock type, geographic location, mineral dated, type of age, age and analytical error (Table 1). The analyses were conducted at the U.S. Geological Survey (USGS) Argon Thermochronology Laboratory in Denver, Colorado. The results presented here are intended only as a preliminary publication of these geochronologic studies; the data are not interpreted in a geologic context. Therefore, users unfamiliar with argon isotopic data should use these results carefully. This report is primarily a detailed source document for subsequent scientific publications and maps that will integrate this data into a geologic context.

METHODS

Sample Preparation

All of the igneous rocks were crushed, ground, and sized using 250, 180, and 150 μm sieves (60, 80, and 100 mesh respectively). Mineral separates of hornblende, muscovite, biotite, K-feldspar, and plagioclase were produced using magnetic separation, heavy liquids and hand picking to achieve a purity of >99%. We used the largest size fraction possible of the target mineral that is free of inclusions from other mineral phases. Basalt, andesite, and rhyolite samples were processed through heavy liquids and or magnetic separation to remove phenocrysts from the volcanic matrix. The resulting volcanic matrix samples were leached at room temperature with 10% HCl to remove any traces of secondary calcite. All samples were washed in acetone, alcohol,

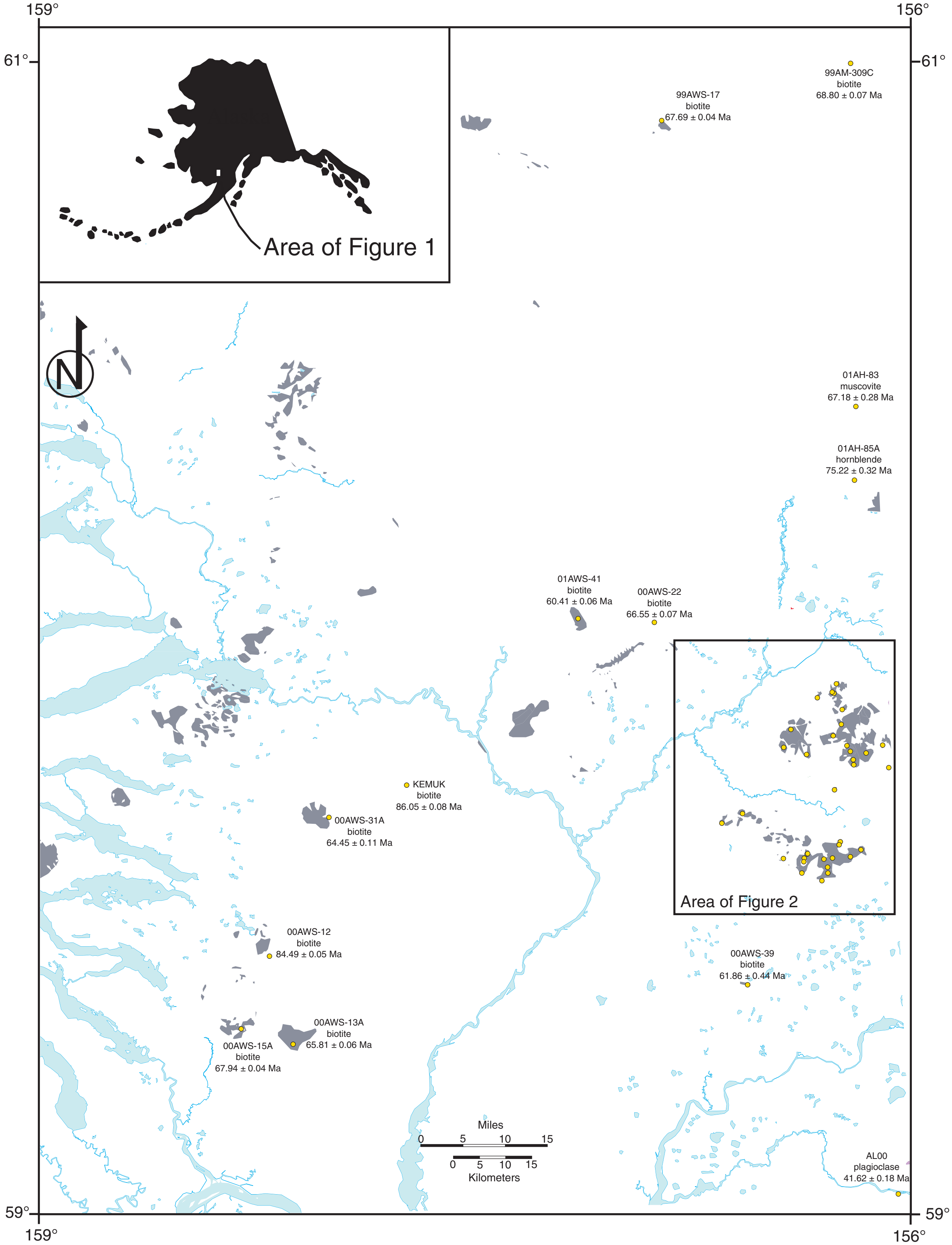

Figure 1. Location of dated rocks in the Taylor Mountains and Dillingham quadrangles, Alaska. Gray areas correspond to outcrops of Late Cretaceous Early Tertiary igneous rocks.

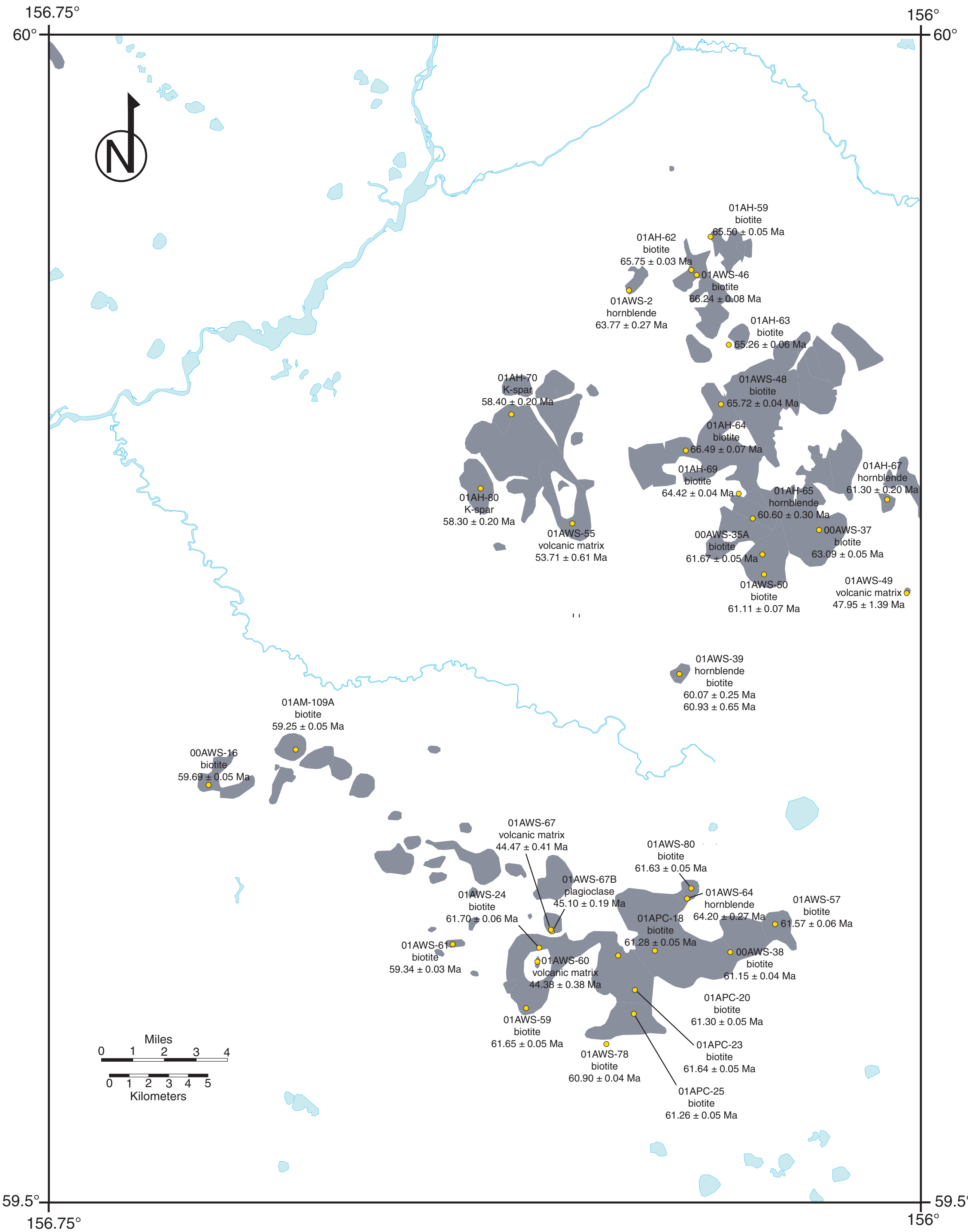

Figure 2. Close-up view with location of dated rocks in the Taylor Mountains and Dillingham quadrangles, Alaska. Gray areas correspond to outcrops of Late Cretaceous to Early Tertiary igneous rocks.

and triply deionized water in a Branson B-220 ultrasonic cleaner to remove dust-sized particles and then re-sieved by hand.

Aliquots of sample were packaged in copper capsules and sealed under vacuum in quartz tubes. The samples were then irradiated for 16 hours (irradiation package KD25) in an aluminum container in the central thimble facility at the TRIGA reactor (GSTR) at the USGS in Denver, Colorado. The monitor mineral used was Fish Canyon Tuff (FCT-3) sanidine with an age of 27.79 Ma (Kunk and others, 1985; Cebula and others, 1986) relative to MMhb-1 with an age of 519.4 ± 2.5 Ma (Alexander and others, 1978; Dalrymple and others, 1981). The type of container and the geometry of samples and standards is similar to that described by Snee and others (1988).

Sample Analysis

The samples were analyzed using the $^{40}Ar/^{39}Ar$ step-heating method of dating using a VG Isotopes Ltd., Model 1200B Mass Spectrometer fitted with an electron multiplier. The samples were heated for 10 minutes per step on a schedule of four to seventeen steps per sample. The number and temperature of heating steps was selected to limit the percentage of gas released to less than 20 percent per step for most samples. Additional biotite aliquots were also melted in a single heating step to produce total fusion ages.

Heating of samples was done in a small volume, molybdenum-lined, low blank tantalum furnace similar to that described by Staudacher and others (1978). The temperature was monitored by a W_5Re-$W_{26}Re$ thermocouple and controlled by a proportional programmable controller. The furnace and the rear manifold of the extraction system were pumped between steps with a turbo molecular pump. Two isolated ion pumps evacuated the front manifold and the mass spectrometer tube between each incremental step. The gas to be analyzed was purified in the first manifold by a SAES ST707 Zr-V-Fe getter operated at room temperature and by a hot tungsten filament to break up hydrocarbons. Gas was equilibrated with the second manifold with an empty cold finger in the first manifold at LN_2 temperature to trap water and other condensibles, then isolated and cleaned in the front manifold with a SAES ST101 Al-Zr getter operated at 400^0 C and with a Ti getter operated at 350^0 C.

An activated charcoal finger submerged in an equilibrated mixture of dry ice and acetone was used to remove gasses with a molecular weight greater than 60 or 80 (primarily other noble gasses) prior to expansion of the argon dominated gas into the mass spectrometer. A second SAES ST101 active gas getter operated at room temperature further purified the argon-rich gas in the mass spectrometer. Its successful operation could be monitored by the consistent drop in counts of mass 44 (dominated by CO_2) after the first gas analysis cycle. Argon isotopes with masses 40 through 36 and CO_2 (mass 44) were analyzed as a function of time in five analysis cycles. ^{40}Ar, ^{39}Ar, ^{38}Ar, ^{37}Ar, and ^{36}Ar peaks and their baselines, were measured for five-second integrations in each of the five cycles. All phases of the sample heating, cleanup, equilibration and sample analysis were performed under computer control.

<u>Isotopic Data Reduction</u>

All argon isotopic data were reduced using an updated version of the computer program ArAr* (Haugerud and Kunk, 1988), using the decay constants recommended by Steiger and Jäger (1977). The net peak measurements made in the five-cycle analysis were regressed using standard linear regression techniques to time zero. Sample blanks measured before the analyses were subtracted from the regressed results for ^{40}Ar, ^{39}Ar, ^{37}Ar and ^{36}Ar. Error estimates of the blanks were quadratically combined with the regression errors and propagated through the error equations.

Corrections for interfering reactor-produced argon isotopes from Ca, K, and Cl in the sample were made using the production ratios given in Dalrymple and others (1981) and Roddick (1983). Errors in calculating ages or ratios include the measurement errors in the analysis, decay factor uncertainties, measured atmospheric or calculated initial $^{40}Ar/^{36}Ar$ ratios, the irradiation parameter J, the production ratios of the various reactor induced argon producing reactions, the initial $^{38}Ar/^{36}Ar$ ratio, and the age of the monitor (Haugerud and Kunk, 1988).

The data table (Table 2) and $^{40}Ar/^{39}Ar$ diagrams presented in this report (Figures 3 to 12) include the identification of individual step ages, total gas ages, plateau ages, average ages, total fusion ages and inverse isochron ages.

An individual step age represents the apparent age obtained for a single temperature step analysis. Total gas ages represent the age calculated from the addition of all of the measured argon peaks for all steps in a single sample and are roughly equivalent to conventional K-Ar ages. No analytical precision is calculated for total gas ages. Plateau ages were determined using the definition of Fleck and others (1977) as modified by Haugerud and Kunk (1988). Average ages are calculated in the same manner as a plateau age but fail the definition of Fleck and others (1977). A total fusion age represents the age calculated from totally melting the sample in a single step. Inverse isotope correlation analysis of the analytical data to assess if non-atmospheric argon components were trapped in any samples and to calculate an inverse isochron age was done using the method of York (1969). For additional information on the sample data reduction procedure see Haugerud and Kunk (1988).

RESULTS

$^{40}Ar/^{39}Ar$ Geochronology Data

The $^{40}Ar/^{39}Ar$ geochronology results are presented in age-spectra diagrams that plot the cumulative percent $^{39}Ar_K$ of the steps against apparent age in millions of years (Figures 3 to 12). The precision estimate used to construct the error boxes of each step is displayed at the 95% confidence level (2 sigma). The upper, smaller graph plots the apparent K/Ca ratio of each step against cumulative $^{39}Ar_K$ released.

In addition, data are presented in tabular form (Table 2). The table starts with a line that gives the sample number, the material analyzed, and the J-value with its analytical uncertainty, the sample weight in milligrams, and the packet and package number from the irradiation. The table includes the temperature of the step, the percent of potassium derived $^{39}Ar_K$ for each step, the radiogenic yield (percentage of $^{40}Ar_R$ that is derived from the decay of potassium), moles of $^{39}Ar_K$, a corrected $^{40}Ar_R/^{39}Ar_K$ ratio from which the age can be directly calculated, apparent K/Ca, and K/Cl ratios for each step, a calculated apparent age for the step (in millions of years), and an estimate of the precision of each age at the 98% confidence level (1 sigma). The sample precision includes estimates of the errors that are unique to a single sample and can be used only for comparisons with other steps of the same sample. This error estimate does not include the error in "J". The last line in the table represents the total gas results for the sample. Note that no analytical error is calculated for the age in this line. If the sample has a plateau age, the percentage of ^{39}Ar on the plateau, the steps on the plateau, and the plateau age and its precision are indicated.

We have calculated isochron ages using inverse-isotope correlation diagrams that plot $^{39}Ar/^{40}Ar$ against $^{36}Ar/^{40}Ar$ (Figures 3 to 12). When reporting isochron ages we include the apparent age of the sample (calculated from the inverse of the x-axis intercept), the calculated initial $^{40}Ar/^{36}Ar$ ratio of the sample (the inverse of the y-axis intercept), the MSWD a goodness of fit indicator of the data (Mean Standard of Weighted Deviates), the number of steps used in the age regression, and the percentage of ^{39}Ar they represent.

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REFERENCES

Alexander, E. C., Jr., Mickelson, G. M., and Lanphere, M. A., 1978, Mmhb-1: a new $^{40}Ar/^{39}Ar$ dating standard, *in* Zartman, R. E., ed., Short papers of the fourth international conference, geochronology, cosmochronology, and isotope geology: U.S. Geological Survey Open-File Report 78-701, p. 6-8.

Cebula, G. T., Kunk, M. J., Mehnert, H. H., Naeser, C. W., Obradovich, J. D., and Sutter, J. F., 1986, The Fish Canyon Tuff: A potential standard for the $^{40}Ar/^{39}Ar$ and fission track dating methods: Terra Cognita, v. 6, n. 2, p. 140.

Dalrymple, G. B., Alexander, E. C., Lanphere, M. A., and Kraker, G. P., 1981, Irradiation of samples for $^{40}Ar/^{39}Ar$ dating using the Geological Survey TRIGA reactor: U.S. Geological Survey Professional Paper 1176, 55 p.

Fleck, R. J., Sutter, J. F., and Elliot, D. H., 1977, Interpretation of discordant $^{40}Ar/^{39}Ar$ age spectra of Mesozoic tholeiites from Antarctica: Geochimica et Cosmochimica Acta, v. 41, p. 15-32.

Haugerud, R. A., and Kunk, M. J., 1988, ArAr*, a computer program for reduction of ^{40}Ar-^{39}Ar data: U.S. Geological Survey, Open-File Report 88-261, 68 p.

Kunk, M. J., Sutter, J. F., and Naeser, C. W., 1985, High-precision $^{40}Ar/^{39}Ar$ Ages of sanidine, biotite, hornblende, and plagioclase from the Fish Canyon Tuff, San Juan Volcanic Field, South-central Colorado [abs.]: Geological Society of America Abstracts with Programs, v. 17, p. 636.

Roddick, J. C., 1983, High precision calibration of ^{40}Ar-^{39}Ar standards: Earth and Planetary Science Letters, v. 47, p. 887-898.

Snee, L. W., Sutter, J. F., and Kelly, W. C., 1988, Thermochronology of economic mineral deposits: Dating the stages of mineralization at Panasqueira, Portugal, by high precision $^{40}Ar/^{39}Ar$ age spectrum techniques on muscovite: Economic Geology, v. 83, p. 335-354.

Staudacher, Thomas, Jessberger, E. K., Dorflinger, D., and Kiko, J., 1978, A refined ultrahigh-vacuum furnace for rare gas analysis: J. Phys. E: Sci. Instrum. v. 11, p. 781-784.

Steiger, R. H., and Jäeger, Emil, 1977, Subcommission on geochronology: Convention on the use of decay constants in geo- and cosmo-chronology: Earth and Planetary Science Letters, v. 36, p. 359-363.

Wilson, F. H., Hudson, T. L., Grybeck, Donald, Stoeser, D. B., Preller, C. C., Bickerstaff, Damon, Labay, Keith, and Miller, M. L., 2003, Preliminary geologic map of the northeast Dillingham quadrangle (D-1, D-2, C-1, and C-2), Alaska: U.S. Geological Survey, Open-File Report 03-105, 13 p.

York, Derick, 1969, Least squares fitting of a straight line with correlated errors: Earth and Planetary Science Letters, v. 5, p. 320-324.

Table 1. Summary table for dated igneous rocks from the Taylor Mountains and Dillingham quadrangles in SW Alaska.

Sample number	Rock type	Latitude deg. N	Longitude deg. W	Mineral	Type of age	Age (Ma)	Error (Ma)	Description
00AWS-12	Syenite	59.461	158.199	biotite	total fusion	**84.49**	**± 0.05€**	Okstukuk Hills at VABM Kokwok. Biotite granite or syenite having very coarse feldspar laths, medium-grained very fresh biotite and fine-grained clinopyroxene.
00AWS-13A	Granodiorite	59.304	158.121	biotite	total fusion	**65.81**	**± 0.06**	East side Muklung Hills. Biotite-hornblende granodiorite containing abundant hornblende and biotite. Biotite slightly chloritized, hornblende in fair shape.
00AWS-15A	Biotite granite	59.329	158.301	biotite	total fusion	**67.94**	**± 0.04**	Main part, Muklung Hills. Nearly hypabyssal appearing biotite granite having very fresh biotite and abundant K-feldspar. Fair to poor hornblende
00AWS-16	Dacite tuff	59.675	156.605	biotite	total fusion	**59.69**	**± 0.05**	Stuyahok Hills. Hornblende-biotite dacite porphyry. Contains excellent fresh biotite, hornblende fresh but loaded with biotite inclusions.
00AWS-22	Granodiorite	60.041	156.820	biotite	total fusion	**66.55**	**± 0.07**	Northeast end of Sleitat Mountain ridge. Biotite-hornblende granodiorite(?) intruding Kuskokwim Fm. Excellent biotite, poor hornblende.
00AWS-31A	Biotite granite	59.703	157.987	biotite	total fusion	**64.45**	**± 0.11**	Small cirque of northeast side of Kemuk Mountain. Medium-grained biotite granite, deep weathering rinds, slightly vuggy. Good biotite.
00AWS-35A	Quartz monzodiorite	59.778	156.134	biotite	total fusion	**61.67**	**± 0.05€**	Large tor of biotite granite. Coarse, almost pegmatitic phase containing excellent biotite. Clinopyroxene is common and hornblende after clinopyroxene.
00AWS-37	Quartz monzonite	59.789	156.088	biotite	total fusion	**63.09**	**± 0.05**	Similar rock to above (35a) however biotite not as fresh and secondary hornblende more common. Plagioclase is sericitized.
00AWS-38	Granite	59.606	156.159	biotite	total fusion	**61.15**	**± 0.04**	Granite, biotite is fine-grained and in good shape, also contains clinopyroxene and common K-feldspar. No hornblende.

Table 1. Summary table for dated igneous rocks from the Taylor Mountains and Dillingham quadrangles in SW Alaska (continued).

Sample number	Rock type	Latitude deg. N	Longitude deg. W	Mineral	Type of age	Age (Ma)	Error (Ma)	Description
00AWS-39	Granodiorite	59.386	156.535	biotite	isochron	**61.86**	**± 0.44€**	Isolated pluton containing excellent biotite and good hornblende, fair amount of K-feldspar.
01AH-59	Quartz monzonite	59.914	156.182	biotite	total fusion	**65.50**	**± 0.05€**	Outcrops of medium-grained, medium light gray equigranular biotite granodiorite. Small disseminated euhedral biotite books.
01AH-62	Quartz monzonite	59.900	156.198	biotite	total fusion	**65.75**	**± 0.03€**	Medium-grained, medium light gray seriate biotite granodiorite - small clean biotite crystals. Oxidized sulfides present?
01AH-63	Hypabyssal dacite	59.868	156.165	biotite	total fusion	**65.26**	**± 0.06€**	Biotite granodiorite, screens of metamorphic rocks locally, scattered xenoliths, and some fine-grained segregation within the granodiorite.
01AH-64	Quartz monzonite	59.822	156.201	biotite	total fusion	**66.49**	**± 0.07€**	Medium-grained, equigranular to seriate biotite granodiorite. Euhedral small biotite books.
01AH-65	Diorite	59.793	156.143	hornblende	isochron	**60.60**	**± 0.30€**	Diorite complex. Fine- to medium-grained greenish-gray diorite with some amphibole crystals to 1 cm long.
01AH-67	Quartz monzodiorite	59.802	156.028	hornblende	plateau	**61.30**	**± 0.20€**	Medium dark greenish gray, fine-medium grained, seriate to porphyritic quartz diorite(?) or granodiorite. Few K-spar crystals to 2cm long.
01AH-69	Quartz diorite	59.804	156.155	biotite	total fusion	**64.42**	**± 0.04€**	Fine- to medium-grained, equigranular hornblende-biotite granodiorite.
01AH-70	Alaskite	59.837	156.351	k-spar	average	**58.40**	**± 0.20€**	Rubble crop of orange weathering granite - interstitial graphic textures vuggy over most of area. Probably dueterically altered.
01AH-80	Alaskite	59.805	156.377	k-spar	average	**58.30**	**± 0.20€**	Aplitic granite with greenish tourmaline clots and vug fillings. Locally, vugs also have euhedral quartz and K-spar.

Table 1. Summary table for dated igneous rocks from the Taylor Mountains and Dillingham quadrangles in SW Alaska (continued).

Sample number	Rock type	Latitude deg. N	Longitude deg. W	Mineral	Type of age	Age (Ma)	Error (Ma)	Description
01AH-83	Muscovite granite	60.410	156.069	muscovite	plateau	**67.18**	**± 0.28**	Probably 10+ foot wide medium-grained equigranular muscovite granite dike - euhedral
01AH-85A	Granodiorite	60.279	156.080	hornblende	average	**75.22**	**± 0.32**	Rubble crop of medium-grained, equigranular, medium-light gray biotite hornblende granodiorite. Both biotite and hornblende are euhedral.
01AM-109A	Dacite tuff	59.691	156.531	biotite	total fusion	**59.25**	**± 0.05**	Rubble crop of fine- to medium-grained, biotite granodiorite. Biotie looks great, grainsize about 1-3 mm.
01APC-18	Granite	59.606	156.223	biotite	total fusion	**61.28**	**± 0.05**	Pegmatitic biotite granite.
01APC-20	Granite	59.604	156.254	biotite	total fusion	**61.30**	**± 0.05**	Biotite granite.
01APC-23	Granite	59.589	156.240	biotite	total fusion	**61.64**	**± 0.05**	Granite.
01APC-25	Granite	59.579	156.240	biotite	total fusion	**61.26**	**± 0.05**	Hornblende biotite granite.
01AWS-2	Quartz diorite	59.891	156.251	hornblende	plateau	**63.77**	**± 0.27**	Pike Creek. Massive, dark-gray, medium-coarse-grained hornblende-bearing intermediate intrusive rock.
01AWS-24	Granite	59.607	156.321	biotite	total fusion	**61.70**	**± 0.06**	Biotie-hornblende granodiorite with 2 cm K-spar phenocrysts. Good fresh mafic minerals. Local xenoliths.
01AWS-39	Granodiorite	59.726	156.204	biotite	isochron	**60.93**	**± 0.65**	Isolated knoll in Stuyahok River valley. Medium- to coarse-grained hornblende granodiorite.
				hornblende	plateau	**60.07**	**± 0.25**	
01AWS-41	Granite	60.045	157.085	biotite	total fusion	**60.41**	**± 0.06**	Sleitat pluton, tin-bearing biotite granite.
01AWS-46	Quartz monzonite	59.898	156.193	biotite	total fusion	**66.24**	**± 0.08**	Granodiorite having quite a bit of chlorite and some epidote, little biotite.
01AWS-48	Quartz monzonite	59.842	156.171	biotite	total fusion	**65.72**	**± 0.04**	Coarse-grained biotite-hornblende granodiorite.
01AWS-49	Andesite	59.762	156.011	volc. matrix	isochron	**47.95**	**± 1.39**	Basalt plug.

Table 1. Summary table for dated igneous rocks from the Taylor Mountains and Dillingham quadrangles in SW Alaska (continued).

Sample number	Rock type	Latitude deg. N	Longitude deg. W	Mineral	Type of age	Age (Ma)	Error (Ma)	Description
01AWS-50	Quartz diorite?	59.769	156.133	biotite	total fusion	**61.11**	**± 0.07**	Biotite granite, south edge (?) of pluton.
01AWS-55	Basalt	59.791	156.298	volc. matrix	isochron	**53.71**	**± 0.61**	Columnar jointed basalt.
01AWS-57	Granite	59.618	156.122	biotite	total fusion	**61.57**	**± 0.06**	Dark colored, medium to coarse-grained hornblende-biotite quartz monzonite or granodiorite, with large 2 cm K-spar phenocrysts.
01AWS-59	Granite	59.581	156.332	biotite	total fusion	**61.65**	**± 0.05**	Yellowish biotite granite or quartz monzonite. Another mafic could be OPX.
01AWS-60	Basalt	59.601	156.323	volc. matrix	isochron	**44.38**	**± 0.38**	Incredibly fresh columnar jointed basalt flow.
01AWS-61	Dacite tuff	59.608	156.395	biotite	total fusion	**59.34**	**± 0.03**	Fine-grained porphyritic intrusive rock. Contains phenocrysts of very fresh biotite and feldspar in an aphanitic tuffaceous(?) matrix. Hypabyssal?
01AWS-64	Granite	59.629	156.196	hornblende	plateau	**64.20**	**± 0.27**	Coarse- to medium-grained porphyry granite. Large K-spar phenocrysts to 2 cm.
01AWS-67	Basalt	59.614	156.311	volc. matrix	isochron	**44.47**	**± 0.41**	Basalt flow - fresh, sparse olivine phenocrysts.
01AWS-67B	Rhyolite	59.614	156.311	plagioclase	plateau	**45.10**	**± 0.19**	Dacite tuff.
01AWS-78	Granite	59.566	156.263	biotite	total fusion	**60.90**	**± 0.04**	Stuyahok Hills pluton. Hornblende-biotite granodiorite with large 2-3 cm feldspar phenocrysts and common mafic xenoliths.
01AWS-80	Granite	59.633	156.193	biotite	total fusion	**61.63**	**± 0.05**	Stuyahok Hills pluton. Hornblende-biotite granodiorite with large 2-3 cm feldspar phenocrysts and common mafic xenoliths.
99AM-309C	Granite?	61.014	156.031	biotite	total fusion	**68.80**	**± 0.07**	Hook pluton. Biotite granite(?) having good, but intergrown biotite and hornblende. Abundant K-feldspar.
99AWS-17	Monzodiorite	60.926	156.732	biotite	total fusion	**67.69**	**± 0.04**	Hoholitna pluton. Biotite granite or quartz monzonite intruding Kuskokwim Group. Fair biotite, hornblende secondary after clinopyroxene.
AL00	Rhyolite	59.005	156.044	plagioclase	average	**41.62**	**± 0.18**	Maroon and white banded rhyodacite porphyry, fine-grained wholy crystalline. Phenos plucked in thin-section, remnants appear fresh plagioclase.
KEMUK	Pegmatitic ultramafic	59.720	157.700	biotite	total fusion	**86.05**	**± 0.08**	Kemuk iron-PGE prospect. Biotite book from core sample, hole number 6, depth 621'. Approx. location Sec. 24(?) T. 5 S., R. 50 W.

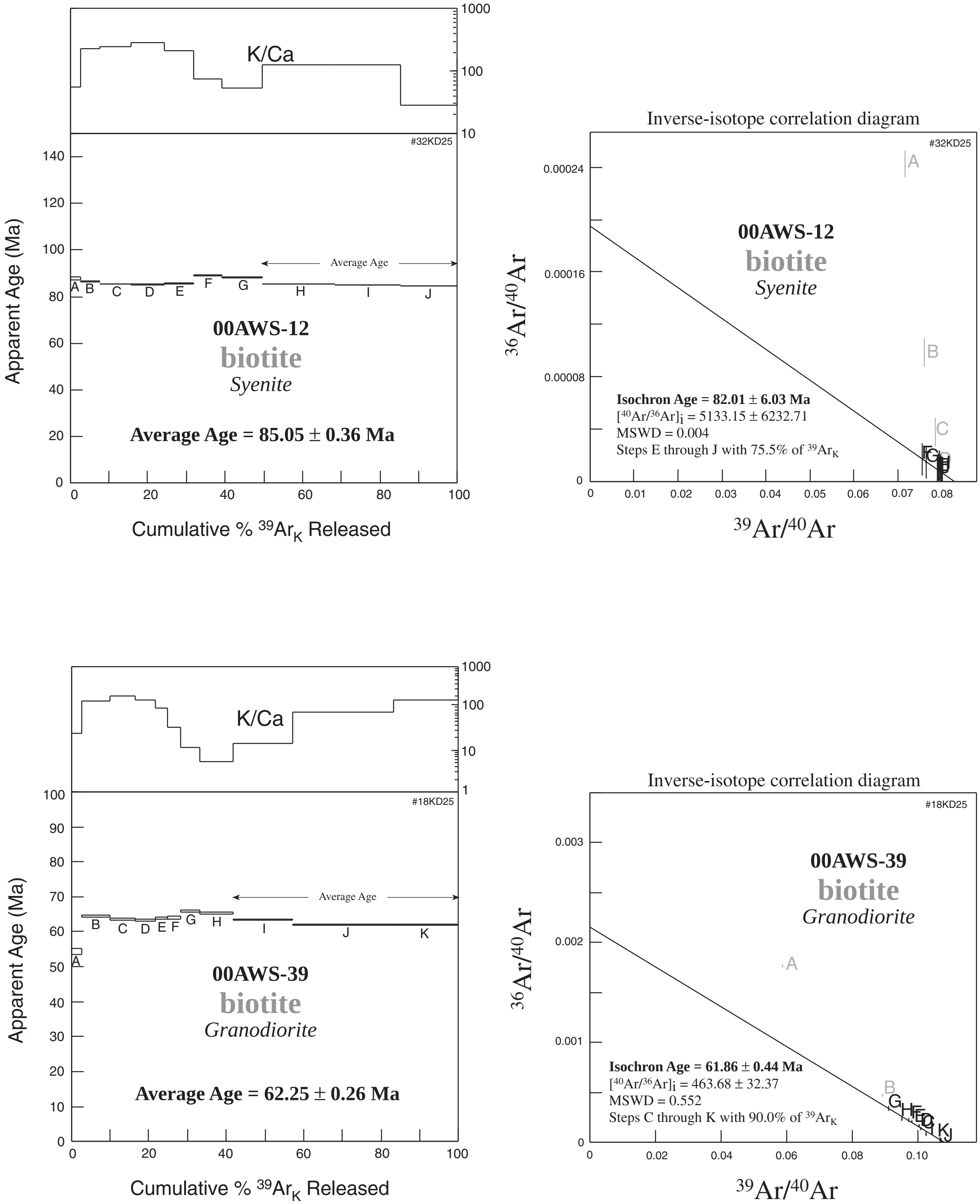

Figure 3. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 00AWS-12 and 01AWS-39

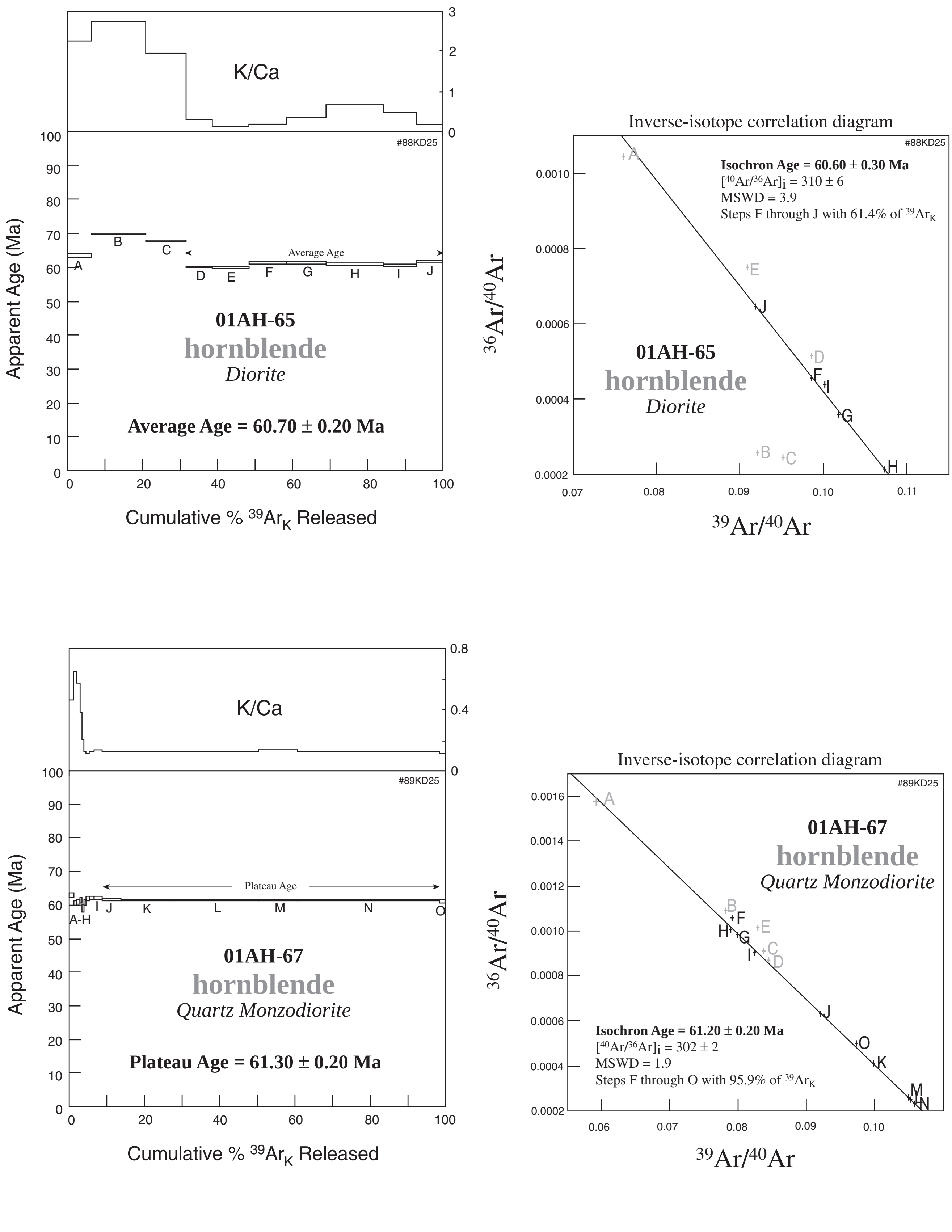

Figure 4. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AH-65 and 01AH-67

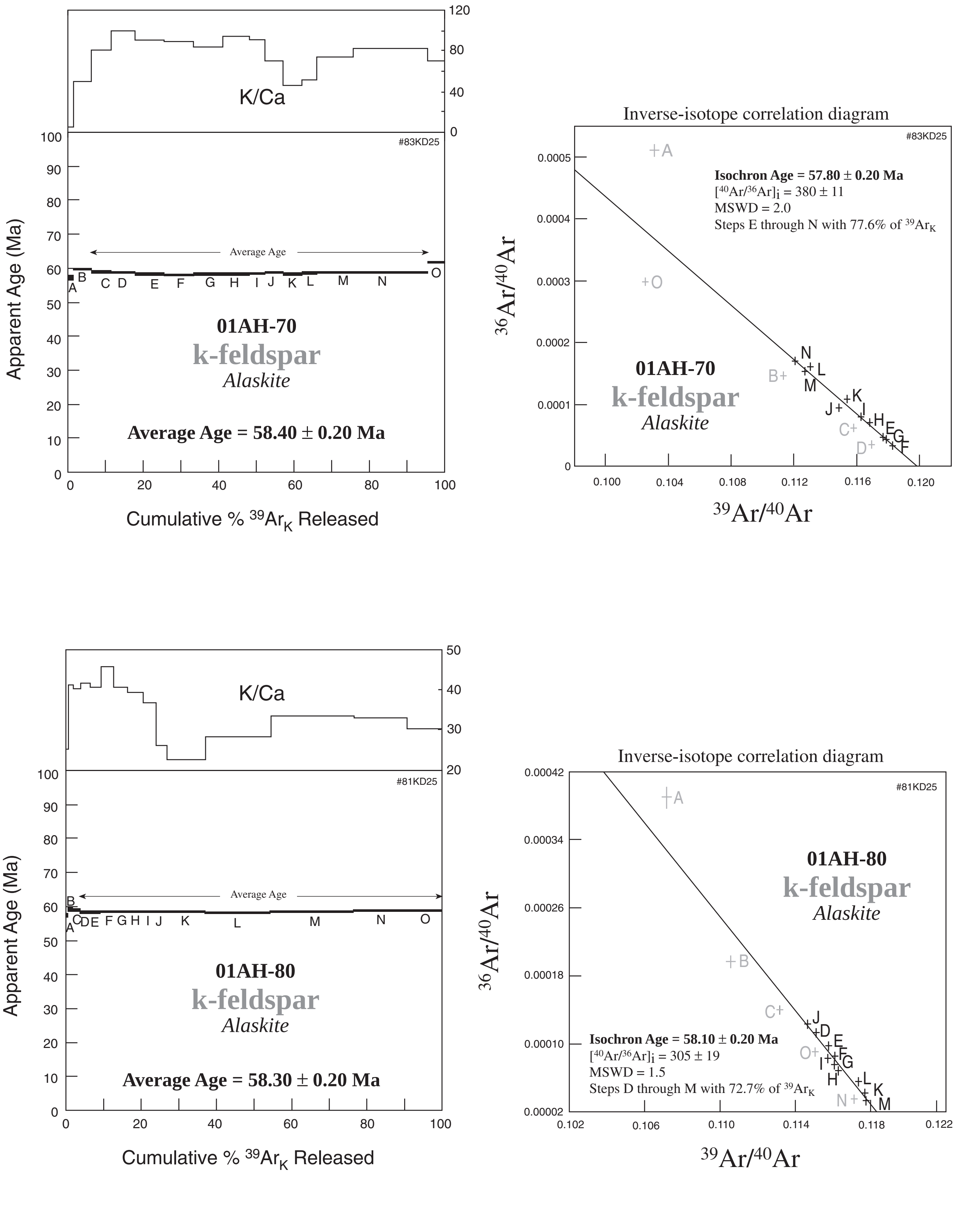

Figure 5. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AH-70 and 01AH-80

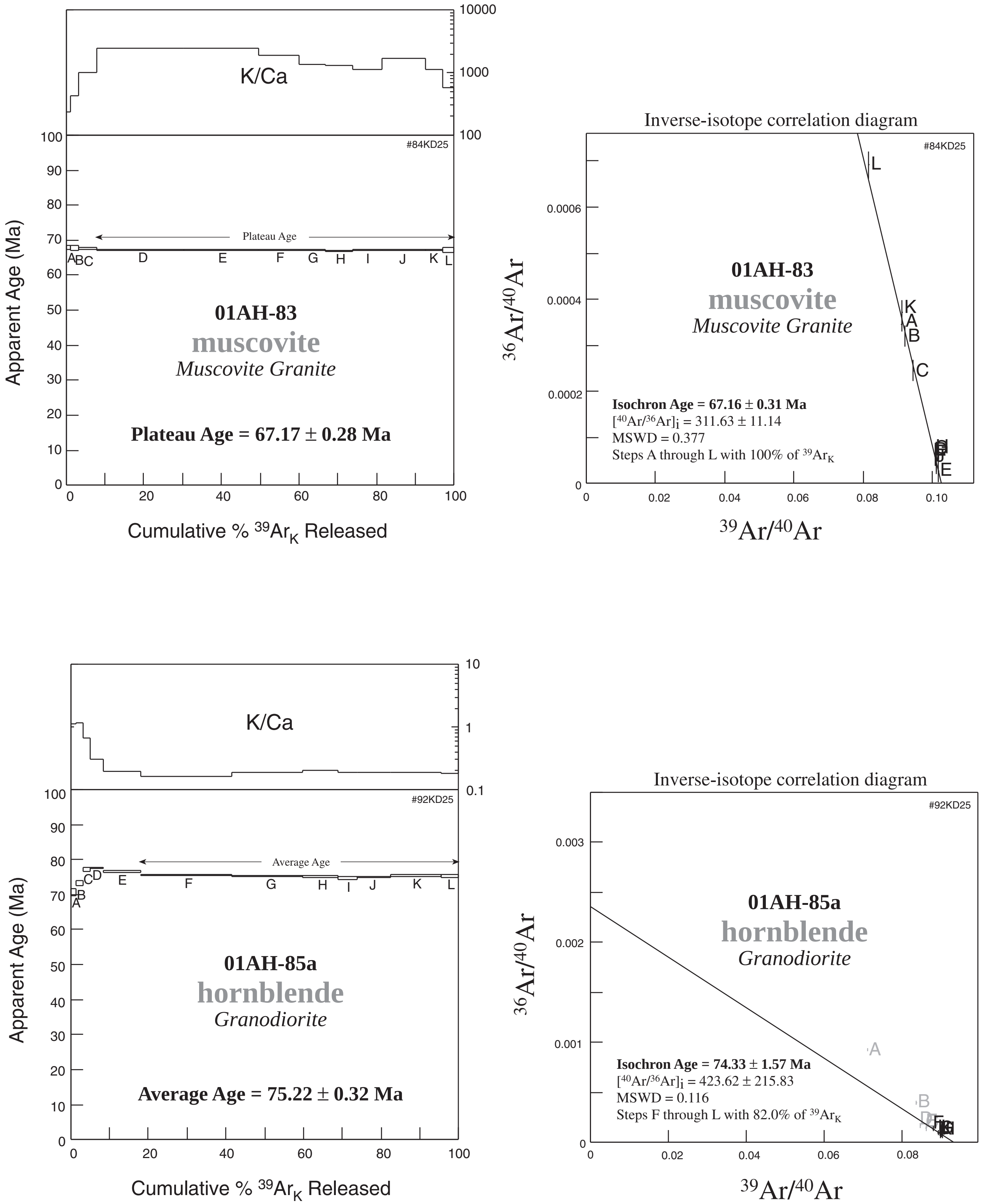

Figure 6. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AH-83 and 01AH-85A

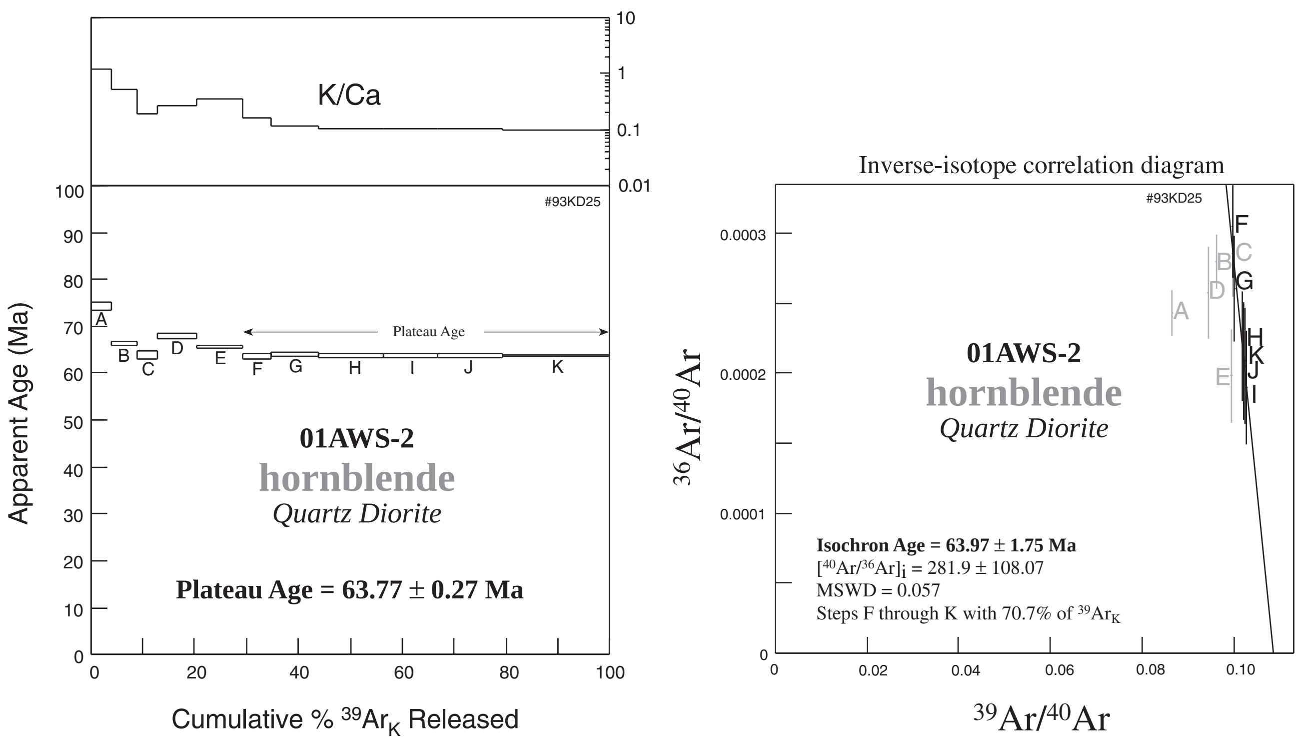

Figure 7. $^{40}Ar/^{39}Ar$ age spectrum and inverse-isotope correlation diagram for sample 01AWS-2

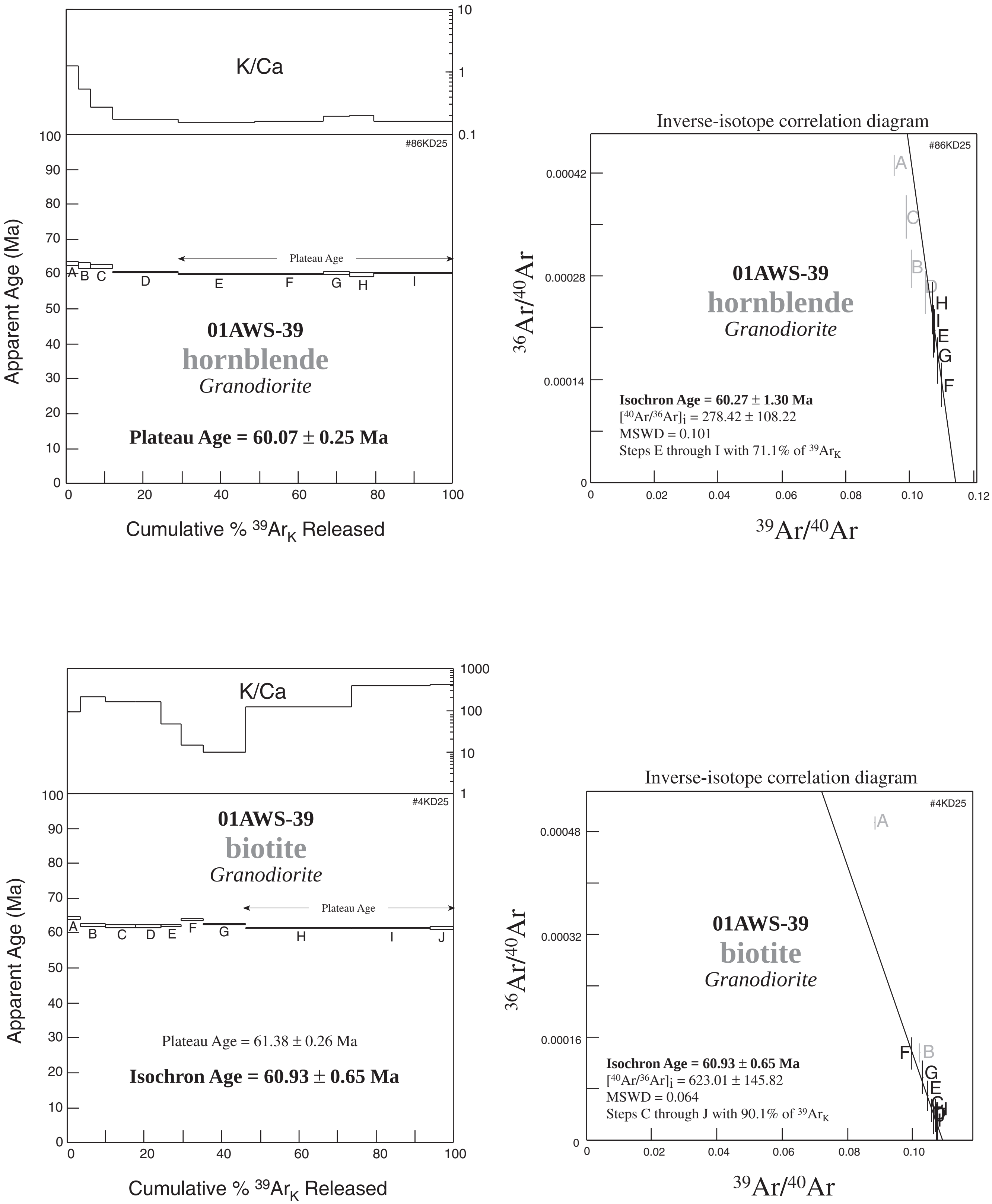

Figure 8. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for sample 01AWS-39

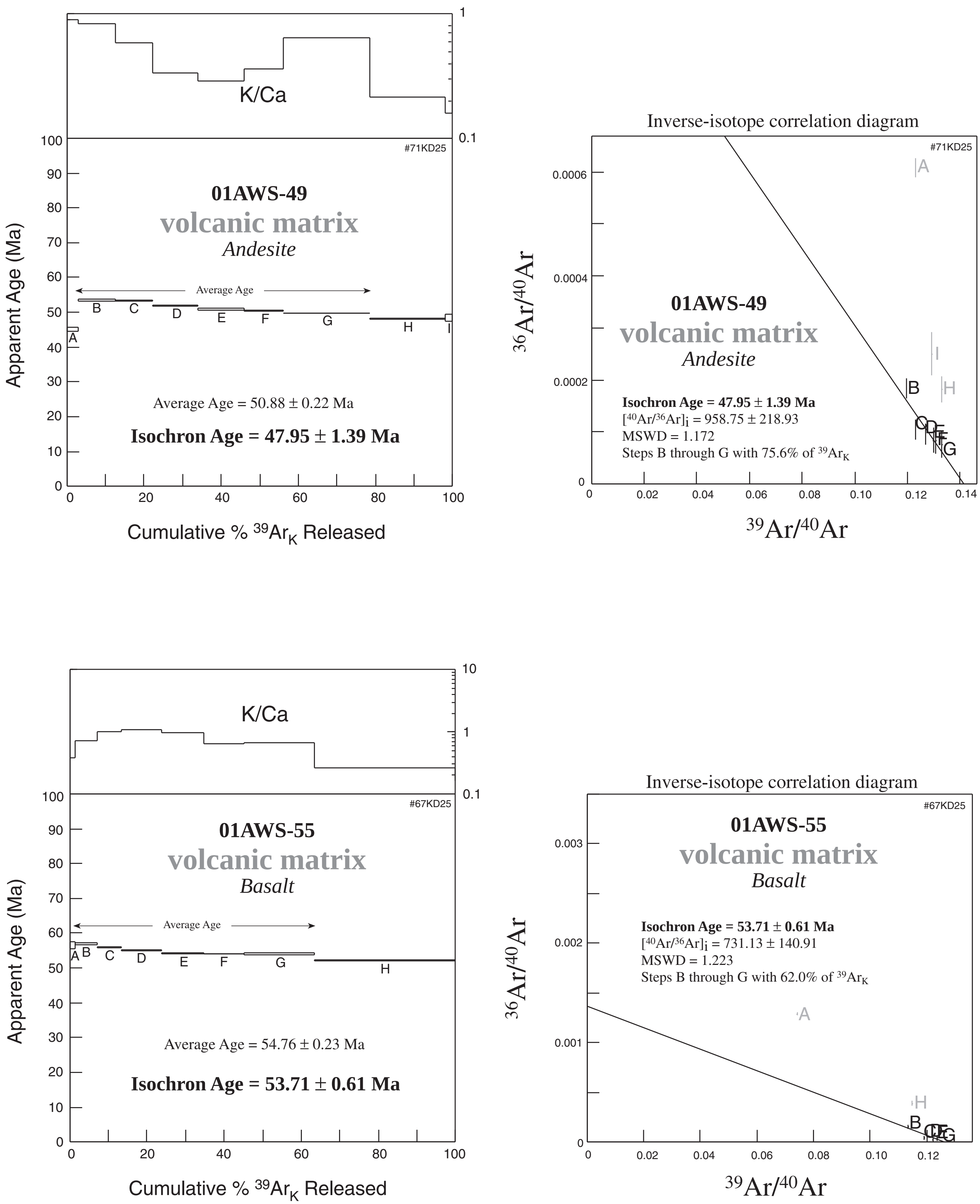

Figure 9. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AWS-49 and 01AWS-55

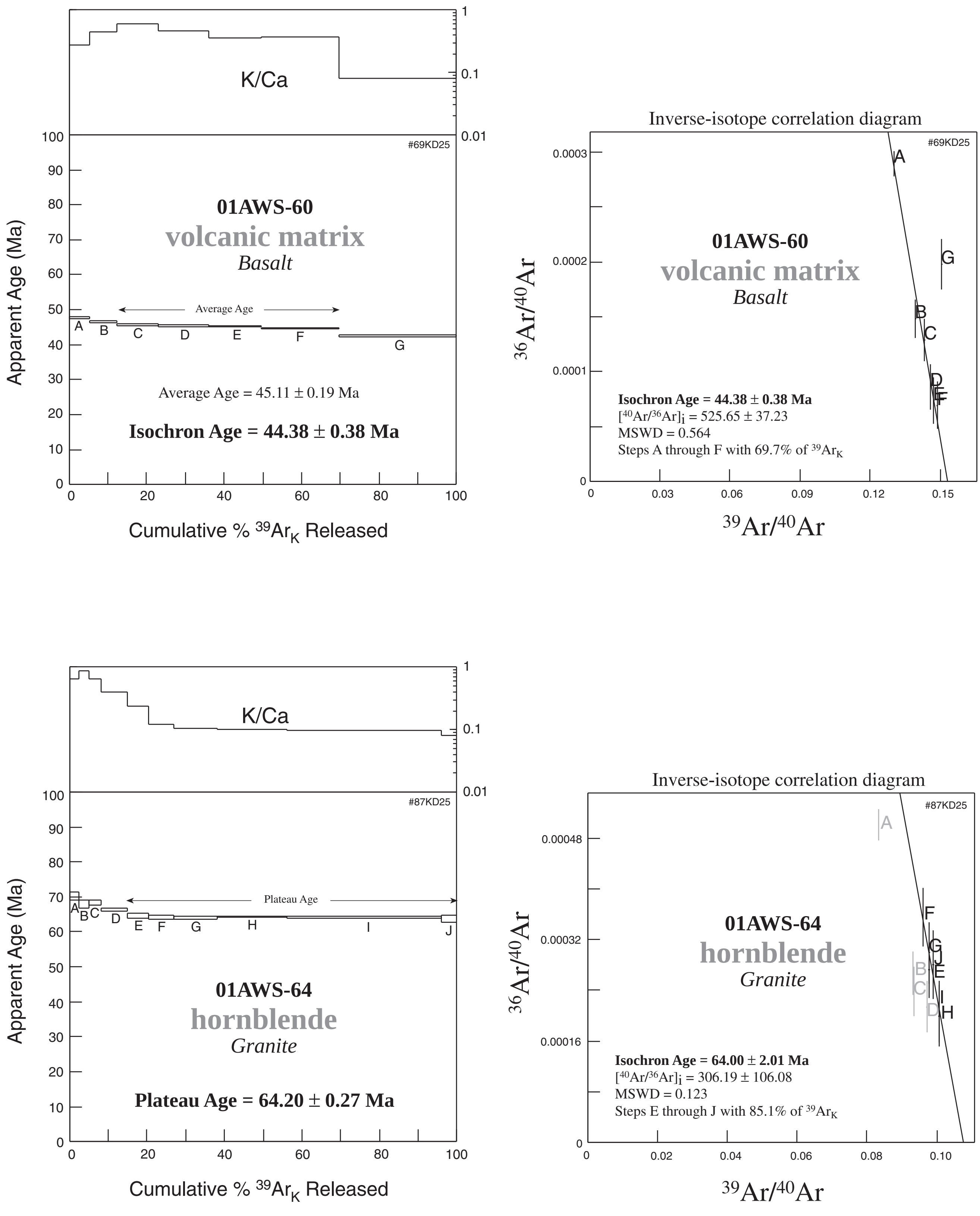

Figure 10. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AWS-60 and 01AWS-64

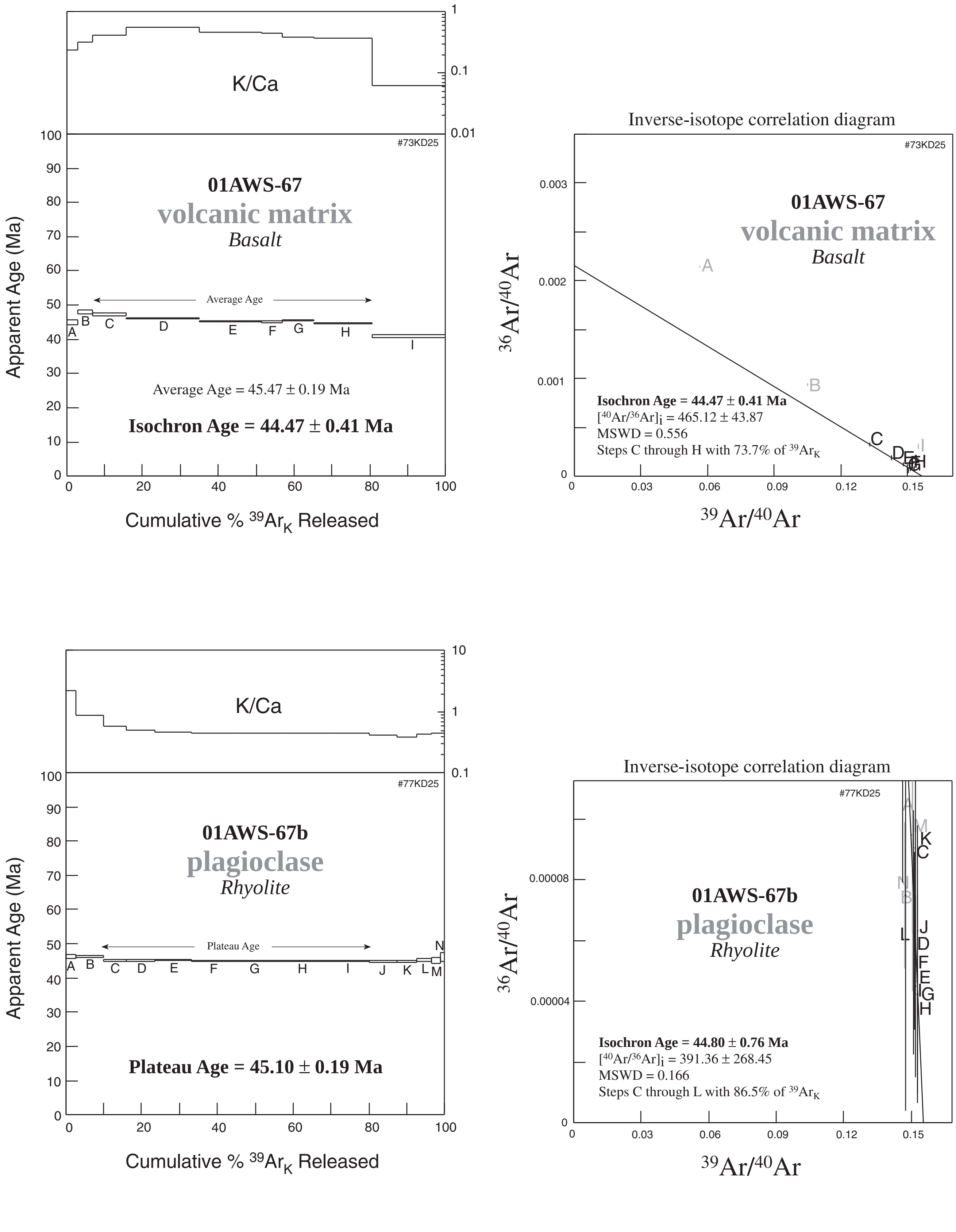

Figure 11. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples 01AWS-67 and 01AWS-67B

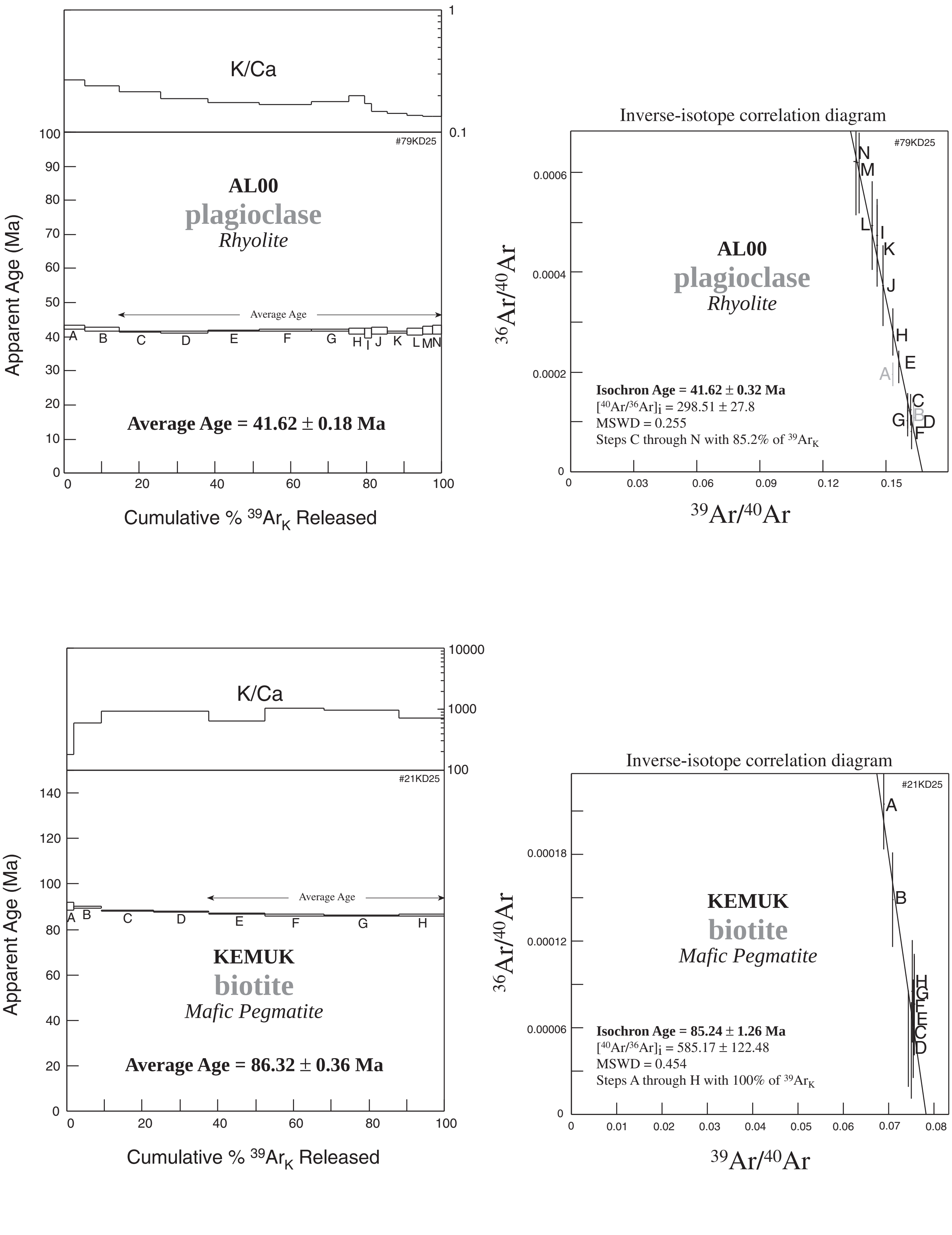

Figure 12. $^{40}Ar/^{39}Ar$ age spectra and inverse-isotope correlation diagrams for samples AL00 and KEMUK

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
00AWS-12	*biotite*	*J = 0.003848 ± 0.35%*	*wt = 27.8mg*	*#32KD25*					
A	850	2.7	92.8	7.99E-14	12.968	56.3	137.0	87.84	± 0.28
B	900	5.0	97.1	1.50E-13	12.771	226.3	161.0	86.54	± 0.09
C	950	8.0	98.9	2.40E-13	12.607	243.0	169.0	85.46	± 0.06
D	1000	8.7	99.6	2.62E-13	12.554	280.6	173.0	85.11	± 0.11
E	1050	7.3	99.8	2.19E-13	12.640	215.4	167.0	85.68	± 0.08
F	1100	7.4	99.5	2.22E-13	13.177	75.8	159.0	89.23	± 0.10
G	1150	10.4	99.6	3.11E-13	13.045	53.2	164.0	88.36	± 0.07
H	1200	18.8	99.7	5.62E-13	12.600	125.4	120.0	85.41	± 0.05
I	1250	17.0	99.8	5.09E-13	12.545	126.1	147.0	85.05	± 0.06
J	1350	14.6	99.8	4.37E-13	12.485	28.3	176.0	84.65	± 0.05
Total Gas		100.0	99.3	2.99E-12	12.681	132.9	154.8	85.95	
50.4% of $^{39}Ar_K$ gas released in steps 1200 through 1350						Average Age =		85.05	± 0.36
00AWS-12	*biotite (total fusion)*	*J = 0.003837 ± 0.35%*	*wt = 5.0mg*	*#33KD25*					
A	1450	100	98.2	5.29E-13	12.497	51.06	102.0	**84.49**	**± 0.05**
00AWS-13A	*biotite (total fusion)*	*J = 0.003878 ± 0.35%*	*wt = 4.6mg*	*#62KD25*					
A	1450	100	97.4	4.88E-13	9.581	60.98	27.0	**65.81**	**± 0.06**
00AWS-15A	*biotite (total fusion)*	*J = 0.003854 ± 0.35%*	*wt = 4.7mg*	*#44KD25*					
A	1450	100	96.2	5.05E-13	9.957	56.7	20.0	**67.94**	**± 0.04**
00AWS-16	*biotite (total fusion)*	*J = 0.003856 ± 0.35%*	*wt = 4.3mg*	*#46KD25*					
A	1450	100	94.6	3.94E-13	8.724	115.78	33.0	**59.69**	**± 0.05**
00AWS-22	*biotite (total fusion)*	*J = 0.003779 ± 0.35%*	*wt = 4.7mg*	*#25KD25*					
A	1450	100	96.7	5.19E-13	9.944	204.51	58.0	**66.55**	**± 0.07**
00AWS-31A	*biotite (total fusion)*	*J = 0.003759 ± 0.35%*	*wt = 3.1mg*	*#13KD25*					
A	1450	100	93.7	2.22E-13	9.675	42.93	13.0	**64.45**	**± 0.11**
00AWS-35A	*biotite (total fusion)*	*J = 0.003753 ± 0.35%*	*wt = 5.5mg*	*#9KD25*					
A	1450	100	96.1	5.15E-13	9.266	112.79	20.0	**61.67**	**± 0.05**
00AWS-37	*biotite (total fusion)*	*J = 0.003851 ± 0.35%*	*wt = 5.1mg*	*#39KD25*					
A	1450	100	92.7	4.78E-13	9.240	38.81	12.0	**63.09**	**± 0.05**
00AWS-38	*biotite (total fusion)*	*J = 0.003784 ± 0.35%*	*wt = 4.8mg*	*#23KD25*					
A	1450	100	94.6	5.04E-13	9.112	66.73	17.0	**61.15**	**± 0.04**
00AWS-39	*biotite*	*J = 0.003766 ± 0.35%*	*wt = 28.4mg*	*#18KD25*					
A	750	2.8	47.9	7.63E-14	8.131	25.7	17.0	54.41	± 0.41
B	850	7.2	86.0	1.96E-13	9.653	151.0	20.0	64.42	± 0.13
C	900	6.6	96.0	1.81E-13	9.521	201.1	21.0	63.55	± 0.10
D	950	5.0	95.1	1.36E-13	9.467	161.2	21.0	63.20	± 0.15
E	1000	3.3	93.9	9.06E-14	9.568	101.8	21.0	63.86	± 0.20
F	1050	3.3	93.3	8.94E-14	9.595	35.1	21.0	64.04	± 0.18
G	1100	5.1	89.9	1.39E-13	9.888	11.5	19.0	65.96	± 0.15
H	1150	8.5	93.1	2.32E-13	9.793	5.4	19.0	65.33	± 0.10
I	1200	15.3	97.4	4.18E-13	9.502	14.7	19.0	63.43	± 0.06
J	1250	26.2	99.3	7.15E-13	9.300	84.4	21.0	62.10	± 0.05
K	1350	16.8	99.5	4.59E-13	9.283	164.8	22.0	61.99	± 0.03
Total Gas		100.0	94.8	2.73E-12	9.434	90.5	20.2	62.98	
58.3% of $^{39}Ar_K$ gas released in steps 1200 through 1350						Average Age =		62.25	± 0.26
00AWS-39	*biotite (total fusion)*	*J = 0.003765 ± 0.35%*	*wt = 4.0mg*	*#19KD25*					
A	1450	100	89.5	3.57E-13	9.367	21.1	18.0	**62.53**	**± 0.04**

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
01AH-59 *biotite (total fusion)* *J = 0.003864 ± 0.35%* *wt = 3.7mg* *#50KD25*									
A	1450	100	97.4	3.98E-13	9.569	159.37	10.0	**65.50**	**± 0.05**
01AH-62 *biotite (total fusion)* *J = 0.003839 ± 0.35%* *wt = 5.5mg* *#27KD25*									
A	1450	100	97.3	4.97E-13	9.670	103.28	9.0	**65.75**	**± 0.03**
01AH-63 *biotite (total fusion)* *J = 0.003765 ± 0.35%* *wt = 4.0mg* *#15KD25*									
A	1450	100	96.0	3.93E-13	9.785	30.77	12.0	**65.26**	**± 0.06**
01AH-64 *biotite (total fusion)* *J = 0.003868 ± 0.35%* *wt = 4.3mg* *#58KD25*									
A	1450	100	93.6	4.15E-13	9.708	47.78	11.0	**66.49**	**± 0.07**
01AH-65 *hornblende* *J = 0.003918 ± 0.35% wt = 9.0mg #88KD25*									
A	800	6.6	69.1	1.39E-14	9.095	2.22	1.7	63.31	± 0.27
B	900	14.5	92.4	3.06E-14	10.036	2.71	4.4	69.74	± 0.13
C	1000	10.6	92.7	2.24E-14	9.744	1.93	5.1	67.75	± 0.13
D	1100	6.9	84.7	1.47E-14	8.601	0.27	4.4	59.93	± 0.17
E	1150	9.8	77.8	2.08E-14	8.563	0.09	2.7	59.67	± 0.18
F	1175	10.1	86.5	2.15E-14	8.785	0.14	3.3	61.2	± 0.15
G	1200	10.5	89.4	2.22E-14	8.78	0.33	4.8	61.16	± 0.14
H	1250	15.2	93.7	3.21E-14	8.725	0.64	5.9	60.79	± 0.11
I	1300	9	87	1.91E-14	8.693	0.45	0.8	60.56	± 0.16
J	1350	6.8	80.9	1.44E-14	8.803	0.14	3.3	61.32	± 0.19
Total Gas								62.92	
68.3% of $^{39}Ar_K$ gas released in steps 1100 through 1350							Average Age =	60.7	± 0.2
01AH-67 *hornblende* *J = 0.003918 ± 0.35% wt = 59.1mg #89KD25*									
A	900	1.3	53.4	9.43E-15	9.023	0.46	2.2	62.82	± 0.4
B	1000	0.8	67.7	6.08E-15	8.664	0.64	1.6	60.37	± 0.38
C	1050	0.8	73.1	6.11E-15	8.723	0.57	1.8	60.77	± 0.38
D	1075	0.6	74.3	4.20E-15	8.796	0.37	2.7	61.27	± 0.45
E	1100	0.5	70	3.92E-15	8.446	0.2	5.1	58.88	± 0.53
F	1125	0.6	68.6	4.70E-15	8.683	0.12	8.3	60.5	± 0.41
G	1150	0.8	70.9	6.28E-15	8.877	0.11	8.9	61.83	± 0.37
H	1175	1.2	70.2	9.38E-15	8.897	0.12	8.1	61.96	± 0.32
I	1200	2.2	73.3	1.65E-14	8.894	0.13	7.9	61.95	± 0.26
J	1225	4.9	81.3	3.69E-14	8.832	0.12	8.2	61.52	± 0.16
K	1250	14.1	87.8	1.06E-13	8.8	0.12	8.2	61.3	± 0.12
L	1275	22.5	92.5	1.69E-13	8.793	0.12	8.1	61.25	± 0.1
M	1300	10.3	92.4	7.75E-14	8.801	0.13	7.9	61.31	± 0.1
N	1350	37.7	93.1	2.84E-13	8.801	0.12	8.6	61.31	± 0.09
O	1400	1.6	85.2	1.18E-14	8.751	0.11	9	60.97	± 0.22
Total Gas								61.31	
89.5% of $^{39}Ar_K$ gas released in steps 1225 through 1350							**Plateau Age =**	**61.3**	**± 0.2**
01AH-69 *biotite (total fusion)* *J = 0.003749 ± 0.35%* *wt = 4.4mg* *#2KD25*									
A	1450	100	97.1	3.98E-13	9.697	105.03	30.0	**64.42**	**± 0.04**

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	$\%^{39}Ar$ of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^* / ^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)		Error (Ma)
01AH-70 <u>*K-feldspar*</u> *J = 0.003895 ± 0.35% wt = 4.1mg #83KD25*										
A	800	1.5	84.9	5.00E-15	8.233	3.6	15.9	57.08	±	0.27
B	900	4.9	95.7	1.65E-14	8.593	48.6	31.7	59.53	±	0.13
C	950	5.1	98.2	1.71E-14	8.477	79.6	58.4	58.74	±	0.12
D	1000	6.4	99	2.14E-14	8.465	98.4	77.6	58.66	±	0.1
E	1050	7.7	98.7	2.59E-14	8.376	90.2	78.9	58.05	±	0.1
F	1100	7.9	99	2.66E-14	8.374	87.7	79.6	58.04	±	0.09
G	1150	7.6	98.6	2.57E-14	8.378	83.5	59.1	58.06	±	0.1
H	1200	7.1	97.9	2.39E-14	8.38	93.4	34.9	58.08	±	0.1
I	1215	4.3	97.6	1.44E-14	8.398	90.3	26.1	58.2	±	0.13
J	1250	4.8	97.2	1.61E-14	8.464	70.2	19.7	58.65	±	0.11
K	1275	4.9	96.8	1.66E-14	8.389	45.1	17.7	58.14	±	0.12
L	1300	3.9	95.2	1.32E-14	8.427	50.5	5.7	58.4	±	0.13
M	1350	9.6	95.5	3.23E-14	8.473	72.5	3.5	58.71	±	0.1
N	1450	19.8	95	6.67E-14	8.476	80.7	17.7	58.73	±	0.09
O	1550	4.4	91.2	1.48E-14	8.893	70.2	5.9	61.57	±	0.14
Total Gas								58.59		
89.1% of $^{39}Ar_K$ gas released in steps 950 through 1450						**Average Age =**		**58.40**	**±**	**0.20**
01AH-80 <u>*K-feldspar*</u> *J = 0.003891 ± 0.35% wt = 4.7mg #81KD25*										
A	750	0.7	88.5	2.66E-15	8.253	25	11.8	57.16	±	0.28
B	800	1.2	94.2	4.50E-15	8.517	40.7	19.9	58.96	±	0.2
C	850	2	95.9	7.59E-15	8.469	39.8	30.7	58.64	±	0.15
D	900	2.5	96.7	9.44E-15	8.396	41	44.2	58.14	±	0.13
E	950	2.8	97.1	1.07E-14	8.388	40.2	53.4	58.08	±	0.14
F	1000	3.4	97.5	1.28E-14	8.396	45.6	69.7	58.13	±	0.11
G	1050	3.7	97.7	1.39E-14	8.419	40.4	68	58.29	±	0.1
H	1100	4.2	98	1.58E-14	8.423	39	49.4	58.32	±	0.1
I	1150	3.4	97.5	1.27E-14	8.427	36.6	24.5	58.35	±	0.11
J	1200	3.1	96.4	1.17E-14	8.404	25.7	12.2	58.19	±	0.12
K	1250	10.1	98.8	3.81E-14	8.392	22.2	24.3	58.11	±	0.08
L	1300	17.4	98.4	6.59E-14	8.38	28	4.4	58.03	±	0.07
M	1350	22.1	99	8.35E-14	8.412	32.9	19.3	58.25	±	0.07
N	1450	14.1	99	5.36E-14	8.448	32.8	25.9	58.49	±	0.07
O	1650	9.4	97.3	3.55E-14	8.457	30.2	19.1	58.55	±	0.09
Total Gas								58.26		
96.2% of $^{39}Ar_K$ gas released in steps 900 through 1650						**Average Age =**		**58.3**	**±**	**0.2**
01AH-83 <u>*muscovite*</u> *J = 0.003891 ± 0.35% wt = 254.0mg #84KD25*										
A	850	1.2	89.8	3.93E-14	9.86	239.2	633	67.92	±	0.32
B	900	2.1	90.5	6.64E-14	9.844	426.4	1032	67.81	±	0.4
C	950	4.8	92.8	1.53E-13	9.825	1014.3	1812	67.68	±	0.12
D	1000	22.2	98.2	7.17E-13	9.744	2448.8	62266	67.13	±	0.05
E	1050	19.4	99.2	6.26E-13	9.748	2480.5	0	67.16	±	0.04
F	1100	10.4	98.6	3.34E-13	9.758	1876.4	0	67.23	±	0.04
G	1150	6.8	98.1	2.20E-13	9.746	1359.5	5789	67.14	±	0.1
H	1200	6.9	98	2.24E-13	9.707	1319.7	3552	66.88	±	0.11
I	1250	7.5	98.5	2.41E-13	9.741	1110.3	275	67.11	±	0.07
J	1350	11.3	98.6	3.64E-13	9.769	1664.9	449	67.3	±	0.05
K	1450	4.5	89	1.47E-13	9.757	1140.9	1079	67.22	±	0.11
L	1650	2.9	79.6	9.23E-14	9.753	578.5	617	67.2	±	0.36
Total Gas		100	97	3.22E-12	9.755	1804.5	14741.9	67.2		
91.97% of $^{39}Ar_K$ gas released in steps 1000 through 1650						**Plateau Age =**		**67.18**	**±**	**0.28**

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	$\%^{39}Ar$ of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
01AH-85A *hornblende* *J = 0.003922 ± 0.35% wt = 180.0mg #92KD25*									
A	900	1.3	72.5	4.82E-14	10.194	1.12	86	70.72	± 0.46
B	1000	1.9	88.4	6.82E-14	10.565	1.16	138	73.25	± 0.32
C	1050	1.8	95.9	6.57E-14	11.141	0.68	96	77.16	± 0.35
D	1100	3.5	94.9	1.27E-13	11.208	0.3	36	77.61	± 0.12
E	1150	9.5	95.4	3.44E-13	11.063	0.2	22	76.62	± 0.13
F	1175	23.6	96	8.52E-13	10.916	0.16	18	75.63	± 0.11
G	1200	18.3	97.6	6.61E-13	10.867	0.19	20	75.29	± 0.08
H	1225	9.2	97.9	3.32E-13	10.831	0.2	23	75.05	± 0.16
I	1250	4.7	97.1	1.71E-13	10.783	0.19	22	74.72	± 0.17
J	1275	8.8	97.5	3.17E-13	10.837	0.19	23	75.09	± 0.06
K	1300	13.1	97.8	4.72E-13	10.886	0.19	22	75.43	± 0.1
L	1400	4.4	97.1	1.60E-13	10.872	0.18	20	75.33	± 0.2
	Total Gas	100	96.4	3.62E-12	10.892	0.23	25.6	75.47	
	82.0% of $^{39}Ar_K$ gas released in steps 1175 through 1400						**Average Age =**	**75.22**	**± 0.32**
01AM-109A *biotite (total fusion)* *J = 0.003832 ± 0.35% wt = 4.5mg #29KD25*									
A	1450	100	95.6	4.17E-13	8.714	145.53	33.0	**59.25**	**± 0.05**
01APC-18 *biotite (total fusion)* *J = 0.003854 ± 0.35% wt = 4.6mg #41KD25*									
A	1450	100	97.6	5.20E-13	8.965	76.13	18.0	**61.28**	**± 0.05**
01APC-20 *biotite (total fusion)* *J = 0.003869 ± 0.35% wt = 3.7mg #54KD25*									
A	1450	100	95.7	3.67E-13	8.933	35.8	13.0	**61.30**	**± 0.05**
01APC-23 *biotite (total fusion)* *J = 0.003853 ± 0.35% wt = 4.8mg #42KD25*									
A	1450	100	96.7	4.95E-13	9.022	14.07	13.0	**61.64**	**± 0.05**
01APC-25 *biotite (total fusion)* *J = 0.003848 ± 0.35% wt = 4.5mg #31KD25*									
A	1450	100	95.1	4.39E-13	8.977	94.84	15.0	**61.26**	**± 0.05**
01AWS-2 *hornblende* *J = 0.003917 ± 0.35% wt = 150.4mg #93KD25*									
A	900	4.0	92.8	6.43E-14	10.7350	1.22	68.0	74.30	± 0.39
B	1000	4.8	91.7	7.66E-14	9.5510	0.52	59.0	66.26	± 0.23
C	1050	4.1	91.6	6.50E-14	9.1970	0.20	36.0	63.85	± 0.48
D	1100	7.5	92.4	1.20E-13	9.8060	0.27	35.0	67.99	± 0.27
E	1150	8.9	94.1	1.42E-13	9.4710	0.36	40.0	65.72	± 0.16
F	1175	5.3	91.0	8.48E-14	9.1440	0.16	29.0	63.49	± 0.28
G	1200	9.3	92.3	1.48E-13	9.2210	0.12	30.0	64.01	± 0.24
H	1225	12.4	93.5	1.98E-13	9.1800	0.11	25.0	63.73	± 0.19
I	1250	10.5	94.4	1.67E-13	9.1870	0.11	34.0	63.78	± 0.21
J	1275	12.5	93.9	1.99E-13	9.1880	0.10	33.0	63.78	± 0.23
K	1300	20.7	93.8	3.29E-13	9.1850	0.10	33.0	63.76	± 0.10
	Total Gas	100.0	93.3	1.59E-12	9.3390	0.21	35.2	64.81	
	70.67% of $^{39}Ar_K$ gas released in steps 1175 through 1300						**Plateau Age =**	**63.77**	**± 0.27**
01AWS-24 *biotite (total fusion)* *J = 0.003874 ± 0.35% wt = 4.2mg #66KD25*									
A	1450	100	96.7	4.29E-13	8.981	44.98	13.0	**61.70**	**± 0.06**

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$\frac{^{40}Ar^*}{^{39}Ar_k}$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
01AWS-39	*hornblende*	*J = 0.003883 ± 0.35%*			*wt = 150.3mg*	*#86KD25*			
A	1000	3.3	87.3	6.78E-14	9.165	1.26	9.0	63.08	± 0.30
B	1050	3.1	91.4	6.36E-14	9.088	0.53	3.0	62.56	± 0.44
C	1100	5.6	89.4	1.14E-13	9.035	0.27	2.0	62.21	± 0.26
D	1150	16.9	92.4	3.46E-13	8.805	0.17	2.0	60.65	± 0.08
E	1175	19.9	93.9	4.07E-13	8.704	0.16	2.0	59.97	± 0.08
F	1200	17.6	96.1	3.60E-13	8.720	0.16	3.0	60.07	± 0.08
G	1225	7.0	95.1	1.42E-13	8.741	0.19	3.0	60.21	± 0.19
H	1250	6.1	93.0	1.25E-13	8.683	0.20	3.0	59.82	± 0.30
I	1300	20.5	93.9	4.19E-13	8.750	0.16	2.0	60.28	± 0.12
	Total Gas	100.0	93.5	2.04E-12	8.780	0.22	2.7	60.48	
	71.08% of $^{39}Ar_K$ gas released in steps 1175 through 1300						**Plateau Age =**	**60.07**	**± 0.25**
01AWS-39	*biotite*	*J = 0.003750 ± 0.35%*			*wt = 17.9mg*	*#4KD25*			
A	850	3.6	85.4	6.39E-14	9.669	93.1	11.0	64.25	± 0.23
B	900	6.4	96.0	1.15E-13	9.387	207.5	12.0	62.41	± 0.21
C	950	7.9	98.6	1.42E-13	9.322	161.4	12.0	61.99	± 0.20
D	1000	6.5	99.0	1.16E-13	9.308	162.5	12.0	61.90	± 0.23
E	1050	5.2	97.9	9.42E-14	9.363	47.6	12.0	62.25	± 0.16
F	1100	5.9	96.0	1.06E-13	9.625	14.3	10.0	63.97	± 0.18
G	1150	10.9	97.1	1.96E-13	9.421	9.7	11.0	62.64	± 0.10
H	1200	27.4	98.9	4.93E-13	9.234	122.2	12.0	61.41	± 0.04
I	1250	20.3	99.4	3.66E-13	9.219	394.9	12.0	61.31	± 0.06
J	1350	6.0	99.2	1.07E-13	9.239	415.0	13.0	61.44	± 0.20
	Total Gas	100.0	97.9	1.80E-12	9.318	182.7	11.7	61.96	
	53.7% of $^{39}Ar_K$ gas released in steps 1200 through 1350						Plateau Age =	61.38	± 0.26
01AWS-39	*biotite (total fusion)*		*J = 0.003745 ± 0.35%*			*wt = 3.4mg*	*#5KD25*		
A	1450	100	95.8	3.57E-13	9.199	59.9	11.0	61.10	± 0.09
01AWS-41	*biotite (total fusion)*		*J = 0.003873 ± 0.35%*			*wt = 4.9mg*	*#64KD25*		
A	1450	100	97.1	4.82E-13	8.792	182.22	23.0	**60.41**	**± 0.06**
01AWS-46	*biotite (total fusion)*		*J = 0.003746 ± 0.35%*			*wt = 4.0mg*	*#3KD25*		
A	1450	100	92.9	1.98E-13	9.985	8.79	7.0	**66.24**	**± 0.08**
01AWS-48	*biotite (total fusion)*		*J = 0.003764 ± 0.35%*			*wt = 3.1mg*	*#17KD25*		
A	1450	100	95.8	3.12E-13	9.856	89.06	11.0	**65.72**	**± 0.04**
01AWS-49	*volcanic matrix*		*J = 0.003809 ± 0.35%*			*wt = 259.7mg*	*#71KD25*		
A	750	3.0	82.0	1.18E-13	6.658	0.90	190	45.18	± 0.29
B	850	9.5	94.6	3.73E-13	7.899	0.84	402	53.48	± 0.10
C	900	9.6	96.9	3.76E-13	7.875	0.58	567	53.32	± 0.11
D	950	11.9	97.2	4.64E-13	7.654	0.33	544	51.85	± 0.10
E	1000	11.9	97.5	4.64E-13	7.508	0.29	423	50.87	± 0.17
F	1050	10.1	97.5	3.97E-13	7.452	0.36	266	50.49	± 0.12
G	1150	22.6	97.7	8.85E-13	7.337	0.65	130	49.72	± 0.05
H	1450	19.4	94.6	7.59E-13	7.103	0.21	95	48.16	± 0.05
I	1650	1.9	92.6	7.57E-14	7.157	0.16	155	48.52	± 0.52
	Total Gas	100.0	96.1	3.91E-12	7.442	0.47	291	50.43	
	75.6% of $^{39}Ar_K$ gas released in steps 850 through 1150						Average Age =	50.88	± 0.22
01AWS-50	*biotite (total fusion)*		*J = 0.003761 ± 0.35%*			*wt = 4.5mg*	*#7KD25*		
A	1450	100	91.0	4.18E-13	9.160	37.64	11.0	**61.11**	**± 0.07**

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
01AWS-55	*volcanic matrix*	*J = 0.003811 ± 0.35%*		*wt = 247.2mg*	*#67KD25*				
A	750	1.4	61.9	7.74E-14	8.342	0.38	32.0	56.46	± 0.49
B	850	5.7	95.5	3.17E-13	8.415	0.73	693.0	56.95	± 0.12
C	900	6.4	98.7	3.59E-13	8.278	0.99	13823.0	56.04	± 0.09
D	950	10.3	99.3	5.75E-13	8.124	1.09	0.0	55.00	± 0.08
E	1000	11.0	99.1	6.15E-13	8.016	0.96	18636.0	54.29	± 0.07
F	1050	10.5	98.9	5.88E-13	7.980	0.65	3132.0	54.05	± 0.06
G	1150	18.2	98.7	1.02E-12	7.970	0.67	962.0	53.98	± 0.15
H	1450	36.6	88.5	2.05E-12	7.696	0.26	229.0	52.15	± 0.10
	Total Gas	100.0	94.4	5.60E-12	7.942	0.61	3558.3	53.79	
	62.0% of $^{39}Ar_K$ gas released in steps 850 through 1150						Average Age =	54.76	± 0.23
01AWS-57	*biotite (total fusion)*	*J = 0.003868 ± 0.35%*		*wt = 4.6mg*	*#52KD25*				
A	1450	100	94.4	4.66E-13	8.976	23.16	23.0	**61.57**	**± 0.06**
01AWS-59	*biotite (total fusion)*	*J = 0.003771 ± 0.35%*		*wt = 4.6mg*	*#56KD25*				
A	1450	100	96.2	4.76E-13	9.221	64.54	19.0	**61.65**	**± 0.05**
01AWS-60	*volcanic matrix*	*J = 0.003814 ± 0.35%*		*wt = 264.0mg*	*#69KD25*				
A	850	5.4	91.4	1.92E-13	7.024	0.28	779	47.69	± 0.18
B	900	7.1	95.6	2.51E-13	6.857	0.44	2246	46.57	± 0.19
C	950	10.7	96.2	3.80E-13	6.711	0.59	4017	45.60	± 0.12
D	1000	12.8	97.5	4.55E-13	6.679	0.47	5601	45.38	± 0.09
E	1050	13.7	97.8	4.88E-13	6.646	0.36	2921	45.16	± 0.08
F	1150	20.1	98.0	7.13E-13	6.586	0.37	1460	44.75	± 0.07
G	1450	30.3	94.2	1.08E-12	6.247	0.08	214	42.48	± 0.10
	Total Gas	100.0	96.0	3.56E-12	6.560	0.32	2105	44.58	
	57.3% of $^{39}Ar_K$ gas released in steps 950 through 1150						Average Age =	45.11	± 0.19
01AWS-61	*biotite (total fusion)*	*J = 0.003849 ± 0.35%*		*wt = 5.1mg*	*#35KD25*				
A	1450	100	96.0	4.96E-13	8.689	95.69	35.0	**59.34**	**± 0.03**
01AWS-64	*hornblende*	*J = 0.003882 ± 0.35%*		*wt = 162.2mg*	*#87KD25*				
A	1000	2.5	85.2	3.83E-14	10.219	0.64	28.0	70.18	± 0.59
B	1050	2.5	92.1	3.86E-14	9.883	0.86	30.0	67.92	± 0.52
C	1100	3.3	93.0	5.11E-14	9.948	0.65	24.0	68.36	± 0.41
D	1150	6.6	93.7	1.01E-13	9.641	0.40	16.0	66.29	± 0.24
E	1175	5.5	92.0	8.47E-14	9.404	0.23	16.0	64.68	± 0.35
F	1200	6.6	89.5	1.02E-13	9.321	0.12	20.0	64.12	± 0.33
G	1225	11.2	91.2	1.73E-13	9.319	0.10	24.0	64.11	± 0.21
H	1250	17.9	94.1	2.76E-13	9.344	0.10	26.0	64.28	± 0.10
I	1300	40.1	93.9	6.19E-13	9.315	0.10	30.0	64.08	± 0.12
J	1400	3.9	91.7	5.98E-14	9.263	0.08	29.0	63.73	± 0.48
	Total Gas	100.0	92.8	1.54E-12	9.403	0.18	26.1	64.68	
	85.14% of $^{39}Ar_K$ gas released in steps 1175 through 1400						**Plateau Age =**	**64.20**	**± 0.27**
01AWS-67	*volcanic matrix*	*J = 0.003911 ± 0.35%*		*wt = 263.4mg*	*#73KD25*				
A	650	2.9	36.5	1.10E-13	6.454	0.24	30.0	44.97	± 0.37
B	750	4.0	72.3	1.52E-13	6.885	0.32	204.0	47.94	± 0.32
C	850	8.9	90.3	3.38E-13	6.789	0.42	1204.0	47.28	± 0.15
D	900	19.2	94.4	7.29E-13	6.613	0.55	3512.0	46.06	± 0.07
E	950	16.5	96.4	6.26E-13	6.509	0.46	4873.0	45.35	± 0.07
F	1000	5.6	97.8	2.13E-13	6.463	0.45	3515.0	45.03	± 0.18
G	1050	8.4	98.3	3.19E-13	6.542	0.39	3238.0	45.58	± 0.11
H	1150	15.2	97.7	5.79E-13	6.390	0.37	1516.0	44.53	± 0.07
I	1450	19.4	91.1	7.40E-13	5.873	0.06	191.0	40.97	± 0.17
	Total Gas	100.0	92.2	3.81E-12	6.426	0.36	2326.2	44.78	
	73.7% of $^{39}Ar_K$ gas released in steps 850 through 1150						Average Age =	45.47	± 0.19

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)	Error (Ma)
01AWS-67B	*plagioclase*	*J = 0.003909 ± 0.35%*			*wt = 262.0mg*	*#77KD25*			
A	850	2.7	97.0	8.94E-14	6.634	2.20	813.0	46.19	± 0.32
B	950	7.3	97.8	2.40E-13	6.653	0.87	2302.0	46.32	± 0.10
C	1000	5.8	97.4	1.91E-13	6.474	0.57	1636.0	45.09	± 0.16
D	1050	7.5	98.2	2.47E-13	6.486	0.49	2811.0	45.17	± 0.17
E	1100	9.6	98.7	3.16E-13	6.501	0.46	4158.0	45.27	± 0.08
F	1150	11.5	98.6	3.75E-13	6.464	0.44	3964.0	45.02	± 0.10
G	1200	12.7	98.7	4.17E-13	6.467	0.44	3678.0	45.04	± 0.08
H	1250	12.2	98.9	3.98E-13	6.467	0.45	132.0	45.04	± 0.10
I	1300	10.6	98.8	3.47E-13	6.462	0.45	2027.0	45.01	± 0.09
J	1350	7.4	98.1	2.43E-13	6.423	0.41	1428.0	44.73	± 0.16
K	1400	5.1	97.3	1.67E-13	6.420	0.38	929.0	44.71	± 0.15
L	1450	4.0	98.1	1.31E-13	6.507	0.43	1828.0	45.31	± 0.22
M	1500	2.2	97.2	7.22E-14	6.462	0.44	1671.0	45.01	± 0.44
N	1550	1.2	97.8	4.03E-14	6.630	0.45	1063.0	46.16	± 0.67
	Total Gas	100.0	98.3	3.27E-12	6.487	0.53	2329.4	45.18	
	70.0% of $^{39}Ar_K$ gas released in steps 1000 through 1300						**Plateau Age =**	**45.1**	**± 0.19**
01AWS-78	*biotite (total fusion)*	*J = 0.003850 ± 0.35%*			*wt = 3.8mg*	*#38KD25*			
A	1450	100	96.4	3.76E-13	8.918	142.7	13.0	**60.90**	**± 0.04**
01AWS-80	*biotite (total fusion)*	*J = 0.003860 ± 0.35%*			*wt = 4.5mg*	*#48KD25*			
A	1450	100	96.9	4.42E-13	9.003	52.25	17.0	**61.63**	**± 0.05**
99AM-309C	*biotite (total fusion)*	*J = 0.003871 ± 0.35%*			*wt = 4.3mg*	*#60KD25*			
A	1450	100	93.9	4.07E-13	10.043	48.74	23.0	**68.80**	**± 0.07**
99AWS-17	*biotite (total fusion)*	*J = 0.003752 ± 0.35%*			*wt = 4.9mg*	*#11KD25*			
A	1450	100	90.4	4.21E-13	10.191	37.19	17.0	**67.69**	**± 0.04**
AL00	*plagioclase*	*J = 0.003911 ± 0.35%*			*wt = 204.7mg*	*#79KD25*			
A	950	5.6	94.2	8.28E-14	6.149	0.27	798.0	42.87	± 0.32
B	1000	9.2	97.0	1.35E-13	6.055	0.24	2864.0	42.22	± 0.23
C	1050	10.9	96.3	1.59E-13	5.943	0.21	2445.0	41.45	± 0.11
D	1100	12.4	96.8	1.82E-13	5.920	0.19	2714.0	41.30	± 0.10
E	1150	13.7	93.8	2.01E-13	6.000	0.17	1106.0	41.85	± 0.10
F	1200	13.9	97.6	2.03E-13	6.022	0.17	1587.0	42.00	± 0.14
G	1250	9.7	96.4	1.42E-13	6.004	0.18	64.0	41.87	± 0.15
H	1300	4.4	91.7	6.45E-14	5.973	0.20	201.0	41.66	± 0.41
I	1350	1.8	86.0	2.61E-14	5.891	0.17	126.0	41.10	± 0.77
J	1400	4.1	89.0	5.95E-14	5.982	0.15	565.0	41.72	± 0.49
K	1450	5.2	86.6	7.61E-14	5.933	0.14	877.0	41.38	± 0.17
L	1500	4.1	85.4	6.03E-14	5.944	0.14	694.0	41.46	± 0.51
M	1550	2.9	81.7	4.19E-14	5.999	0.14	475.0	41.84	± 0.58
N	1600	2.3	81.7	3.40E-14	6.033	0.14	503.0	42.07	± 0.67
	Total Gas	100.0	93.8	1.47E-12	5.992	0.19	1420.6	41.79	
	85.2% of $^{39}Ar_K$ gas released in steps 1050 through 1600						**Average Age =**	**41.62**	**± 0.18**
KEMUK	*biotite*	*J = 0.003783 ± 0.35%*			*wt = 10.5mg*	*#21KD25*			
A	950	1.9	93.7	2.13E-14	13.581	180.9	143.0	90.38	± 0.87
B	1000	7.4	95.6	8.23E-14	13.481	608.1	169.0	89.73	± 0.30
C	1050	13.8	98.4	1.54E-13	13.240	932.2	184.0	88.17	± 0.13
D	1100	14.6	98.7	1.64E-13	13.162	934.6	183.0	87.66	± 0.11
E	1150	14.8	98.2	1.66E-13	13.035	648.5	181.0	86.83	± 0.15
F	1200	15.6	97.8	1.75E-13	12.942	1024.9	181.0	86.23	± 0.16
G	1250	19.9	97.7	2.22E-13	12.903	972.4	73.0	85.98	± 0.13
H	1350	12.1	97.5	1.35E-13	12.970	722.8	172.0	86.41	± 0.18
	Total Gas	100.0	97.8	1.12E-12	13.077	849.7	157.4	87.10	
	62.3% of $^{39}Ar_K$ gas released in steps 1150 through 1350						Average Age =	86.32	± 0.36

Table 2. $^{40}Ar/^{39}Ar$ geochronology data for igneous rocks in SW Alaska (continued).

Step	Temp. °C	%^{39}Ar of total	Radiogenic Yield (%)	$^{39}Ar_k$ (Moles)	$^{40}Ar^*/^{39}Ar_k$	Apparent K/Ca	Apparent K/Cl	Apparent Age (Ma)		Error (Ma)
KEMUK	*biotite (total fusion)*	*J = 0.003784 ± 0.35%*		*wt = 5.1mg*	*#20KD25*					
A	1450	100	96.0	5.27E-13	12.913	554.3	93.0	**86.05**	±	**0.08**

Ages calculated assuming an initial $^{40}Ar/^{36}Ar$ = 295.5± 0.
All precision estimates are at the one sigma level of precision.
Ages of individual steps do not include error in the irradiation parameter J.
No error is calculated for the total gas age.