UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Compilation of revised ages of volcanic units in the San Juan Mountains, Colorado: Recalculated K-Ar age determinations using IUGS constants

By

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Open-File Report 83-668

1983

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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Abstract

Previously published K-Ar age determinations for the middle to late Tertiary San Juan volcanic field have been recalculated using the 1977 IUGS constants. Revised ages, original analytical data, and brief sample descriptions are presented in table 2 for all available dated volcanic units. A generalized stratigraphic column is also included to facilitate comparison of the ages of major volcanic events among more recent publications and previously published papers. No attempt has been made to assess the validity of individual K-Ar ages and, for the purpose of interpretation, the reader is referred to the original source.

Introduction

A number of significant studies outlining the geochronologic history of the San Juan volcanic field were published between 1967 and 1976 (Steven and others, 1967; Lipman and others, 1970; Mehnert and others, 1973a, 1973b; Lipman and Mehnert, 1975; Lipman and others, 1976). Most of the ages reported were determined by the potassium-argon (K-Ar) method by H. H. Mehnert, although some of the K-Ar determinations were done by R. L. Armstrong (University of British Colombia), R. F. Marvin (U.S. Geological Survey), F. W. McDowell (University of Texas), J. D. Obradovich (U.S. Geological Survey), and M. A. Lanphere (U.S. Geological Survey).

More recently, K-Ar determinations on rocks from the San Juan Mountains have been reported by Mehnert and others (1979), Naeser and others (1980) and Jackson and others (1980). In addition, a significant number of fission-track ages (zircon, apatite, and sphene) are included in the papers by Lipman and others (1976) and Naeser and others (1980), however, these ages are not included in this report.

Discussion of revised K-Ar determinations

Compiled in this report are all of the available K-Ar ages reported from the San Juan volcanic field prior to 1977, at which time the IUGS adopted new decay and atomic abundance constants for the calculation of K-Ar ages (Steiger and Jager, 1977). The use of the "new" IUGS constants by most geochronology laboratories makes recent K-Ar determintions of late to middle Tertiary aged units, such as those in the San Juan volcanic field, appear 0.5 m.y. to 1 m.y. older than previously published K-Ar ages using the "old" constants. This discrepancy between "old" and "new" K-Ar ages requires that the "older" K-Ar ages be recalculated using the IUGS constants to make them consistent with K-Ar data published after 1977.

Recalculated K-Ar ages along with original analytical data and brief sample descriptions are presented in table 2 for all previously dated volcanic units in the San Juan Mountains. Most ages were converted using a programmable calculator, and the equations used are listed in Appendix 1. Where the original analytical data were not readily available (for a few of the published dates noted in table 2), these ages were converted by the method of Dalrymple (1979). A generalized stratigraphic column (modified from Lipman and others, 1970; 1978) is also presented as table 1 and lists both the recalculated and previously published ages of major volcanic units of the San Juan Mountains. Other than table 1, no attempt has been made to interpret or assess the validity of specific K-Ar age determinations and for accepted interpretations the reader is referred to the original source (listed in table 2). Frequently, data originally presented in one paper was reinterpreted later as the complex stratigraphy of the San Juan volcanic field became better understood. Where major revisions were made in later publications, the source of the revision is also listed. An excellent overview of the volcanic history is presented in Steven and Lipman (1976). Only brief descriptions of the samples with their field numbers have been included in table 2 and, again, the reader is referred to the original source for more accurate descriptions and locations.

K-Ar decay constants

The decay constants, recommended by the IUGS (Table 1, Steiger and Jager, 1977) and used to recalculate K-Ar ages are: atomic abundance $^{40}K/K = 1.167 \times 10^{-4}$ mol/mol, $\lambda_{\beta} = 4.962 \times 10^{-10}\ yr^{-1}$, and $\lambda_{\varepsilon} + \lambda_{\varepsilon}' = .581 \times 10^{-10}\ yr^{-1}$. The old constants used in all the previously published papers [1] are: atomic abundance $^{40}K/K = 1.19 \times 10^{-4}$ mol/mol, $\lambda_{\beta} = 4.72 \times 10^{-10}\ yr^{-1}$, and $\lambda_{\varepsilon} = 0.585 \times 10^{-10}\ yr^{-1}$.

[1] Except Mehnert and others (1979), Naeser and others (1980), Varga and Smith (1983), Bartlett (1983), and Jackson and others (1980) who used the new IUGS constants. Also note that the atomic abundance $^{40}K/K$ value of 1.22×10^{-4} published in Steven and others (1967) and Mehnert and others (1973a) was a typographic error and the actual value used was 1.19×10^{-4}.

Table 1. GENERALIZED TERTIARY VOLCANIC
STRATIGRAPHY OF SAN JUAN MOUNTAINS, COLORADO
(Recalculated ages listed first; old ages listed second.)

Late basalts and rhyolites

Hinsdale Formation
  Basalt 4.9 to 27.5 m.y. (4.7 to 26.4 m.y.)
  Rhyolite 4.8 to 23.0 m.y (4.8 to 22.4 m.y.)
Sunshine Peak Tuff (ash-flow sheet of Lake City caldera)
  23.0 m.y. (22.4 m.y.)

Main ash-flow tuffs

Snowshoe Mountain Tuff >27.1 m.y. (>26.4 m.y.)
Nelson Mountain Tuff
Rat Creek Tuff
Wason Park Tuff
Mammoth Mountain Tuff 27.4 m.y. (26.7 m.y.)
Carpenter Ridge Tuff
Fish Canyon Tuff 28.5 m.y. (27.8 m.y.)
Masonic Park Tuff 28.9 m.y. (28.2 m.y.)
Sapinero Mesa Tuff
Dillon Mesa Tuff
Blue Mesa Tuff
Tuff of Ute Ridge 29.1 m.y. (28.4 m.y.)
Treasure Mountain Tuff
  Ra Jadero Member
  Ojito Creek Member
  La Jara Canyon Member 30.6 m.y. (29.8 m.y.)
Tuff of Rock Creek
Bonanza Tuff 36 m.y.

Lavas and related rocks erupted concurrently with ash-flow tuffs

Local andesitic-quartz latitic flows and breccias that intertongue with ash-flow sequence in and near their source calderas. Fisher Quartz Latite overlies main ash-flow sequence 27.1 (26.4)

Early intermediate-composition lavas and breccias

Andesitic-quartz latitic rocks of the Conejos Formation and related units 31.9 to 35.6 m.y. (31.1 to 34.7 m.y.)

Note: Modified from Lipman and others (1970, 1978).

Table 2. Recalculated K-Ar ages using IUGS constants for minerals and rocks from Tertiary volcanic units of the San Juan Mountains, Colorado.

Description of Sample	Field no.	Material Analyzed	K_2O%	$*^{40}Ar$ (10^{-10} moles/gram)	%$*^{40}Ar$	Age m.y. ± 2σ	Source
Miocene bimodal basalts and rhyolites (Hinsdale Formation)							
Basalts							
Southeastern San Juan Mountains							
Basalt flow (Beaver Creek)	67L-107B	Whole rock	1.86	0.643	82	23.9±1.0	(Lipman and others 1970)
Basalt flow (La Jara Reservoir area-Ra Jadero Canyon)	66L-26	Whole rock	1.36	0.542	73	27.5±.8	(Lipman and Mehnert, 1975)
Basalt flow (La Jara Reservoir area-Ra Jadero Canyon)	66L-30	Whole rock	2.66	0.963	63	25.0±.8	(Lipman and Mehnert, 1975)
Basalt flow (La Jara Reservoir area-La Jara Creek)	68L-16A	Whole rock	1.52	0.447	81	20.3±.6	(Lipman and Mehnert, 1975)
Basalt flow (La Jara Reservoir area-La Jara Creek)	68L-17	Whole rock	1.43	0.374	26	18.1±1.4	(Lipman and. others, 1970)
Basalt flow (Green Ridge)	66L-98	Whole rock	2.49	0.694	83	19.3±.4	(Lipman and Mehnert, 1975)
Basalt flow (Rio de los Pinos)	68L-15B	Whole rock	0.44	0.097	38	15.3±.8	(Lipman and Mehnert, 1975)
Basalt flow (Los Mogotes)	67L-16	Plagioclase	0.575	0.040	40	4.8±1.4	(Lipman and. others, 1970)
Basalt flow (Los Mogotes)	66L-36	Whole rock	1.24	0.085	38	4.8±.26	(Lipman and Mehnert, 1975)
Basalt flow (Los Mogotes)	68L-134I	Whole rock	1.73	0.111	42	4.5±.22	(Lipman and Mehnert, 1975)
Basalt dike (Los Mogotes)	67L-17-A	Plagioclase	1.15	0.091	56	5.5±.7	(Lipman and others, 1970)

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Western San Juan Mountains							
Upper basalt flow (Cannibal Mesa)	72L-66B	Whole rock	3.27	0.872	93	18.4±.6	(Lipman and Mehnert, 1975)
Lower basalt flow (Cannibal Mesa)	72L-66H	Whole rock	3.28	0.893	85	18.8±.6	(Lipman and Mehnert, 1975)
Basalt flow (Jarosa Mesa)	Ds-29B	Plagioclase	0.45	0.082	60	12.6±1.3	(Steven and others, 1967)
	Ds-342A	Plagioclase	0.34	0.0787	58	16.0±.9	
Intermediate intrusions							
Red Mountain Pass, western San Juan Mountains							
Andesitic intrusive (National Belle Mine)	Nb-Bi	Sanidine	10.81, 10.76	3.42	88.4	21.9±.6	(Lipman and others, 1976)
		Biotite	8.85, 8.95	3.10	78.4	24.0±.7	
Andesitic intrusive (Corkscrew Gulch)	CS-21	Sanidine	11.41, 11.31	3.80	83.4	23.1±.6	(Lipman and others, 1976)
		Biotite	8.01, 7.98	2.80	74.7	24.2±.7	
Engineer Pass, western San Juan Mountains							
Quartz latite intrusive (north of Engineer Pass)	73L-101	Sanidine	10.01, 10.03	2.16	71.4	14.9±.44	(Lipman and others, 1976)
Andesitic intrusive (Engineer Mountain)	73L-103	Sanidine	9.05, 9.04	3.03	79.6	23.1±.6	(Lipman and others, 1976)
Rico area, western San Juan Mountains							
Calico Peak Porphyry (sill)	Rico 14	Biotite	8.50, 8.53	0.5479	43	4.5±.2	(Naeser and others, 1980)
Summitville, southeastern San Juan Mountains							
Quartz latite of South Mountain	70L-134	Sanidine	9.93	3.38	92	23.5±.6	(Mehnert and others, 1973b)
		Biotite	8.52	2.88	76	23.3±.6	

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Rhyolite lavas and intrusives							
Southeastern San Juan Mountains							
Rhyolite of Cropsy Mountain	Ds 29c	Sanidine	9.70	2.77	93	19.7±.8	(Steven and. others, 1967)
		Biotite	8.29	2.50	62	20.8±.8	
		Hornblende	0.81	0.244	74	20.8±.8	
		Plagioclase	0.94	0.292	75	21.5±.8	
Rhyolite obsidian (Beaver Creek)	66L-161A	Obsidian	4.83	1.57	82	22.4±.9	(Lipman and others, 1970)
Western San Juan Mountains							
Rhyolite plug - (east Nellie Creek)	72L-47	Sanidine	8.82	2.44	67.9	19.1±.5	(Lipman and others, 1976)
		Biotite	9.11	2.50	71.6	19.0±.4	
Lake City Caldera, western San Juan Mountains							
Outflow Sunshine Peak Tuff (Jarosa Mesa)	Ds 342B	Sanidine	7.26	2.33	95	22.2±.6	(Steven and others, 1967)
		Sanidine	7.54	2.46	94	22.5±.6	(Mehnert and others, 1973a)
Intracaldera Sunshine Peak Tuff (Bent Creek)	Ds-445	Sanidine	8.29	2.77	87	23.1±.6	(Mehnert and others, 1973a)
		Biotite	8.62	2.90	82	23.2±.6	
Quartz latite of Grassy Mountain (Williams Creek)	Ds-442	Sanidine	8.80	2.97	83	23.3±.6	(Mehnert and others, 1973a)
		Biotite	8.36	2.84	86	23.5±.6	
Intermediate - composition plutons emplaced after the main ash-flow tuffs							
Porphyritic quartz latite dike (Summitville area, southeastern San Juan Mountains)	68L-107	Biotite	8.82	3.35	90	26.2±1.0	(Lipman and others, 1970) (Lipman, 1975)
Quartz monzonite stock - Sultan Mountain (Silverton, western San Juan Mountains)	L-1126*	Biotite				27.6±.8	(Lipman and others, 1970)
	L-942*	Hornblende				24.7±.8	(McDowell, 1966)
Quartz monzonite stock - Capital City (western San Juan Mountains)	*	Biotite				26.4±1.1	(Slack, 1979)

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Monzonite stock (Ophir, western San Juan Mountains)	L-1036*	Biotite				26.1±.8	(Lipman and others, 1970) (McDowell, 1966)
Quartz monzonite stock - Sultan Mountain (Silverton, western San Juan Mountains)		Biotites (2)				25.7 (average of 2 analyses)	(Jackson and others, 1980)
Monzonite stock (Ophir, western San Juan Mountains)		Biotites (2)				25.9 (average of 2 analyses)	(Jackson and others, 1980)
Intermediate composition lavas erupted after the main ash-flow tuffs							
Fisher Quartz Latite (central San Juan Mountains)							
Copper Mountain Flow	S333	Sanidine	6.22	2.48	20	27.5±1.4	(Steven and
Fisher Mountain Flow	S332	Sanidine	9.38	3.70	49	27.2±1.0	others, 1967)
	Ds10	Sanidine	8.60	3.49	95	28.0±.8	
	Ds10	Biotite	5.66	2.21	80	26.9±.8	
	Ds10	Hornblende	0.87	0.334	68	26.5±1.8	
	Ds10	Plagioclase	0.89	0.344	88	26.7±1.8	
		Glass	5.54	2.03	90	25.3±.7	
Wagon Wheel Gap Flow	736+	Biotite	4.12, 4.12	1.62	64	27.1±1.6	(Armstrong, 1969) (Lipman and others, 1970)
Main ash-flow tuffs							
Mammoth Mountain Rhyolite (Wagon Wheel Gap, central San Juan Mountains)	737+	Biotite	6.63, 6.60	2.63	68	27.4±1.5	(Armstrong, 1969) (Lipman and others, 1970)
Fish Canyon Tuff (central San Juan Mountains)	S292	Sanidine	9.54	3.96	63	28.6±.8	(Steven and
	S318	Sanidine	10.06	4.15	81	28.4±.8	others, 1967)

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. $\pm 2\sigma$	Source
Fish Canyon Tuff (Agua Ramon Mountain, central San Juans)	Ds28	Sanidine	11.3	4.68	95	28.5±.8	(Steven and others, 1967)
		Biotite	8.31	3.42	73	28.4±.8	
		Hornblende	0.89	0.351	68	27.2±1.9	
		Plagioclase	0.82	0.334	86	28.1±1.9	
	Bc5793	Biotite	8.40	3.35	72	27.5±2.7	
Masonic Park Tuff (South Fork, eastern San Juan Mountains)	735+	Biotite	6.13, 6.27	2.60	78	28.9±1.3	(Armstrong, 1969) (Lipman and others, 1970)
Ute Ridge Tuff (Storm King Peak, northwestern San Juan Mountains)	RD-1901-57*	Biotite				30.1±1.2	(Lipman and others, 1970)
		Sanidine				28.1±.8	
Treasure Mountain Tuff - La Jara Canyon Member (southeastern San Juan Mountains)	65L-132	Biotite	8.34	3.67	85	30.3±1.2	(Lipman and others, 1970)
		Plagioclase	0.96	0.431	69	30.9±2.2	
Treasure Mountain Tuff - intracaldera facies (Platoro caldera, southeastern San Juan Mountains)	65L-231	Biotite	8.32	3.42	82	28.3±1.1	(Lipman and others, 1970)
		Plagioclase	1.98	0.795	91	27.7±1.2	
	67L-124	Biotite	6.76	2.86	68	29.2±1.4	
Bonanza Tuff						36	(Varga and Smith, 1983)
Lavas and related rocks erupted concurrently with ash-flow tuffs							
Green Ridge lavas - Cat Creek volcano (southeastern San Juan Mountains)							
Lower flow	67L-109	Biotite	7.84	3.31	82	29.1±1.2	(Lipman and others, 1970)
		Plagioclase	0.71	0.284	44	27.6±2.3	
		Hornblende	0.86	0.407	84	32.6±2.3	
		Hornblende	0.86	0.405	81	32.4±2.3	
Upper flow	66L-101B	Biotite	8.74	3.73	88	29.4±1.1	(Lipman and others, 1970)
		Plagioclase	0.80	0.311	43	26.8±2.2	

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Los Pinos Formation (northern New Mexico)	*	Sanidine				26.6±1.8	(Lipman and others, 1970) (Bingler, 1968)
Alamosa River stock (near Platoro, southeastern San Juan Mountains	67L-113	Biotite	8.59	3.71	78	29.8±1.2	(Lipman and others, 1970)
Early intermediate - composition lava flows, breccias and intrusions.							
Western San Juan Mountains							
Granodiorite porphyry - Carson center	74L-12	Biotite Hornblende	7.95, 8.01 0.61, 0.60	3.43 0.270	69.3 58.8	29.6±.8 30.7±1.0	(Lipman and others,1976)
Granodiorite porphyry - Sneffels stock	74L-4	Plagioclase	1.34, 1.35	0.638	59.9	32.7±1.0	
Lava flow - Larsen Creek center (Lake fork formation)	*					32.2	(Lipman and others, 1973)
Rhyodacite flow breccia - Cimarron Ridge area (San Juan Formation)	RD-336-68* *	Biotite Hornblende Plagioclase				32.2±1.3 32.9±2.4 33.8±4.3	(Lipman and others, 1970)
Northeastern San Juan Mountains							
Rawley Andesite, Bonanza volcanic center	V-998* V-999*	Biotite Plagioclase Plagioclase				34.1±1.3 34.6±2.1 35.1±1.6	(Lipman and others, 1970)
Eastern and central San Juan Mountains							
Conejos Formation							
Rhyodacite - Beidell volcanic center.	Ds 196	Biotite Hornblende	7.31 0.82	3.72 0.407	86 94	35.0±1.4 34.2±2.2	(Lipman and others, 1970)
Rhyodacite - La Garita Creek	68L-105	Biotite Hornblende	5.82 1.12	2.95 0.566	88 84	34.9±1.4 34.8±1.6	(Lipman and others, 1970)

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Rhyodacite - Navajo Peak	68L-91	Biotite Hornblende	8.42 1.02	4.19 0.474	90 79	34.2±1.3 32.0±1.8	(Lipman and others, 1970)
Andesite - Snowball Park	Ds 141B	Plagioclase	0.55	0.255	56	31.9±2.7	(Lipman and others, 1970)
Summer Coon volcanic center							
Rhyolite	66L-120	Biotite	8.37	4.03	88	33.1±1.3	(Lipman and others, 1970)
Rhyodacite	68L-20	Biotite Hornblende	7.65 0.89	3.92 0.464	79 79	35.3±1.4 35.9±2.4	(Lipman and others, 1970)
Samples of vein minerals and hydrothermally altered minerals							
Rico area, western San Juan Mountains							
vein along Black Hawk fault	57-49I	Sericite	8.44	0.799	64.3	5.45±.2	(Naeser and others, 1980)
vein along Black Hawk fault	57-49II	Sericite	8.34	0.780	56.8	5.39±.2	(Naeser and others, 1980)
Samples of vein minerals and hydrothermally altered minerals							
Silverton - Red Mountain Pass, western San Juan Mountains							
Camp Bird mine (3rd level)	6811	Adularia	12.30, 12.20	1.89	55.6	10.7±.5	(Lipman and others, 1970)
Camp Bird mine (14th level)	CB-17	K-feldspar	15.52, 15.44	2.34	57.4	10.5±.3	(Lipman and others, 1970)
Idarado mine - Argentine vein	IDA-78	K-feldspar Sericite	15.11 6.95	3.81 1.35	74.7 72.0	17.4±.5 13.4±.4	(Lipman and others, 1970)
porphyry - style alteration (associated with the Sultan Mountain and Ophir stocks)		Sericites (5)				24.0-24.8 (range of 5 analyses)	(Jackson and others, 1980)
Engineer Pass, western San Juan Mountains							
alteration associated with breccia pipe north of Engineer Pass		Sericite	7.92	1.423 1.417	63.2 52.1	12.4±.5	(M. A. Lapphere, commun., 1983) (written) (Maher, 1982)

Description of Sample	Field no.	Material Analyzed	K_2O%	$^{*40}Ar$ (10^{-10} moles/gram)	%$^{*40}Ar$	Age m.y. ± 2σ	Source
Lake City area, western San Juan Mountains							
Ute Ulay mine - Hidden Treasure vein	UHT-555	Sericite	9.24, 9.18	2.77	83.1	20.8±.4	(Lipman and others, 1976)
Red Mountain - altered volcanic dome complex							
Disseminated alunite	DKA3633	Alunite	4.54, 4.55	1.508	38.5	22.9±1.5	(Mehnert and others, 1979)
Vein alunite	DKA3635	Alunite	8.76, 8.79	2.956	60.7	23.3±1.1	
Summitville area, southeastern San Juan Mountains							
Alunitized quartz latite of South Mountain	71L-49	Alunite Alunite	7.49 7.49	2.47 2.49	72 54	22.8±.5 22.9±.5	(Mehnert and others, 1973b)
Creede Area - central San Juans							
OH vein	J47A	Adularia	15.57, 15.57	5.654	73.2	25.1±.6	(Bethke and others, 1976)
OH vein	BA-20065	Sericite	9.11, 9.34	3.432	71.5	25.7±1.2	(Bethke and others, 1976)
OH vein	DM-27967	Sericite	8.29, 8.30	3.065	69.4	25.5±.8	(Bethke and others, 1976)
altered Creede Formation; near the Amethyst vein	KP-55871	Sericite	8.76, 8.76	3.210	43.0	25.3±1.4	(Bethke and others, 1976
Sugarloaf Prospect, southern San Luis Valley							
altered intermediate volcanics, vein alunite		Alunite				23.8±1	(Bartlett, 1983)

* Recalculated age computed using conversion factors listed in Table 2, Dalrymple (1979).

\+ $^{*40}Ar$ (10^{-10} moles/gram sample) was obtained by backcalculating from age given in original paper using old western constants. $^{*40}Ar$ data was given in ccSTP without information on grams of sample (Armstrong, 1969)

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Appendix 1

Equations used to recalculate K-Ar age determinations

I. Determination of moles of ^{40}K

^{40}K mol/gm sample =

$$(\text{wt \% } K_2O/100)\left(\frac{1 \text{ mol } K_2O}{94.203 \text{ gm } K_2O}\right)\left(\frac{2 \text{ mol K}}{1 \text{ mol } K_2O}\right)\left(\frac{.000167 \text{ mol } ^{40}K}{\text{mol K}}\right)$$

II. Calculation of revised K-Ar age:

$$T = \quad 1/\lambda \ln\left[\left(\frac{^{*40}Ar}{^{40}K}\right)\left(\frac{\lambda}{\lambda_\varepsilon + \lambda_\varepsilon'}\right) + 1\right]$$

where $\lambda = \lambda_\beta + \left(\lambda_\varepsilon + \lambda_\varepsilon'\right)$

2 σ uncertainties of the K-Ar age determinations are the uncertainties published with the original ages.

III. Program to recalculate K-Ar ages for Texas Instruments TI-59 or TI-58c programmable calculators.*

```
LRN 2nd Lbl A (CE ÷ 100 ÷ 94.2034 x 2 x RCL 03)
STO 01 R/S
2nd Lbl B STO 02 R/S 2nd Lbl C
((RCL 04 + RCL 05) 1/X) x ((( RCL 02 ÷ RCL 01)
x (( RCL 04 + RCL 05) ÷ RCL 05) + 1) ln x ) = R/S LRN
```

......Enter 1.167×10^{-4} in STO 03

......Enter 4.962×10^{-10} in STO 04

......Enter $.581 \times 10^{-10}$ in STO 05

To recalculate K-Ar ages:

......Enter wt. % K_2O press A

......Enter $^{*40}Ar \times 10^{-10}$ mol/gm press B

.... press C; recalculated K-Ar age is displayed.

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*Mention of a brand name is for identification only and does not imply endorsement by the U.S. Geological Survey.