



New Mexico Bureau of Geology and Mineral Resources
A division of
New Mexico Institute of Mining and Technology

$^{40}\text{Ar} / ^{39}\text{Ar}$ Data Repository for the Geology, geochronology, and geochemistry of basaltic flows of the Cat Hills, Cat Mesa, Wind Mesa, Cerro Verde, and Mesita Negra, central New Mexico

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Table 1. Summary of $^{40}\text{Ar}/^{39}\text{Ar}$ results and analytical methods

Sample	Lab #	Irradiation	mineral	age analysis	steps	Age	$\pm 2\sigma$	MSWD	$^{40}\text{Ar}/^{36}\text{Ar}$ intercept	comments
CH-21	7396	NM-61	groundmass concentrate	furnace step-heat	8	0.11	0.03	1.76		
CH3	8408	NM-78	groundmass concentrate	furnace step-heat	9	0.91	0.03	1.80	303.4 \pm 2.1	isochron age
CM-1	6700	NM-51	groundmass concentrate	furnace step-heat	3	3.00	0.10	0.63		
WM-1	6699	NM-51	groundmass concentrate	furnace step-heat	12	4.01	0.16	1.00	299.4 \pm 2.2	isochron age
LMN	8388	NM-77	groundmass concentrate	furnace step-heat	5	8.11	0.05	2.76		

Analytical methods and parameters:

Mineral separation methods	heavy liquid (lithium metatungstate), magnetic (Franz), hand-picking
Irradiation geometry	alternating samples and monitors in machined Al discs
Irradiation facility	D-3 position, Nuclear Science Center, College Station, TX
Irradiation batches	NM-51 (2 hours), NM-61 (1 hours), NM-77 (7 hours), NM-78 (1 hour)
Neutron flux monitor	Fish Canyon Tuff sanidine (FC-1) @ 27.84 (Deino and Potts, 1990)
Lab	New Mexico Geochronology Research Laboratory, New Mexico Tech, Socorro, NM
Spectrometer	Mass Analyzer Products 215-50
Extraction system	automated, all-metal
Furnace	double vacuum Mo resistance furnace
Heating procedures	seven minutes
Gas cleanup	two SAES GP-50 getters @ ~450°C
Gas cleanup times	7 minutes during heating, additional 5 minutes after heating
Electron multiplier sensitivity	3.0x 10 ¹⁷ moles/pA
Total system blank average	570, 4.0, 0.3, 0.8, 2.69 x 10 ⁻¹⁸ moles @ masses 40, 39, 38, 37 and 36
J-factor determination	CO ₂ laser-fusion of 4 single crystals from each of 6 radial positions around irradiation tray
J-factor precision	$\pm 0.2\%$
Correction factor monitors	K-glass and CaF ₂
Correction factors NM-51	$(^{40}\text{Ar}/^{39}\text{Ar})_k = 0.0002 \pm 0.0003$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.00026 \pm 0.00002$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.0007 \pm 0.00005$
Correction factors NM-61	$(^{40}\text{Ar}/^{39}\text{Ar})_k = 0.00026 \pm 0.00002$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.00026 \pm 0.00002$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.0007 \pm 0.00005$
Correction factors NM-77	$(^{40}\text{Ar}/^{39}\text{Ar})_k = 0.0002 \pm 0.0003$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.00028 \pm 0.00002$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.0007 \pm 0.00003$
Correction factors NM-78	$(^{40}\text{Ar}/^{39}\text{Ar})_k = 0.0002 \pm 0.0003$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.00028 \pm 0.00002$; $(^{40}\text{Ar}/^{39}\text{Ar})_{ca} = 0.0007 \pm 0.00005$
Decay constants and isotopic abundances	after Steiger and Jaeger (1977).
Isotopic ratio corrections	blank, radioactive decay, mass discrimination (not corrected for interfering reactions)
Individual analysis errors	analytical error only (uncertainties in interfering reactions and J factors excluded)
Mean age	weighted mean age of Taylor (1982)
Mean age error calculation	weighted error of the mean (Taylor, 1982), multiplied by root of MSWD where MSWD > 1
Mean age errors	uncertainties in interfering reactions and J factors included

Table 2. $^{40}\text{Ar}/^{39}\text{Ar}$ analytical data.

ID	Power (° C)	$^{40}\text{Ar}/^{39}\text{Ar}$	$^{37}\text{Ar}/^{39}\text{Ar}$	$^{36}\text{Ar}/^{39}\text{Ar}$ ($\times 10^{-3}$)	$^{39}\text{Ar}_k$ ($\times 10^{-15}$ mol)	K/Ca	$^{40}\text{Ar}^*$ (%)	^{39}Ar (%)	Age (Ma)	$\pm 1\sigma$ (Ma)
CH-21 , 109.53 mg groundmass concentrate, J=0.0002346, D=1.00719, NM-61, Lab#=7396-01										
A	625	159.6	2.992	533.4	3.1	0.17	1.4	11.7	0.94	0.47
B	700	4.723	2.546	15.89	5.1	0.20	4.7	30.7	0.10	0.02
C	750	3.326	1.321	10.43	3.1	0.39	10.4	42.4	0.15	0.02
D	800	2.795	1.097	9.030	3.6	0.47	7.5	55.9	0.09	0.02
E	875	3.217	1.247	10.35	3.6	0.41	7.9	69.2	0.11	0.02
F	975	6.642	1.893	21.45	2.1	0.27	6.8	77.2	0.19	0.04
G	1075	15.07	2.605	50.67	1.6	0.20	2.0	83.0	0.12	0.07
H	1250	24.64	13.70	86.47	4.3	0.037	0.6	98.9	0.06	0.08
# I	1650	51.52	19.25	171.9	0.30	0.027	4.2	100.0	0.94	0.35
Integrated age $\pm 2\sigma$			n=9		26.8		K2O=0.40 %		0.21	0.16
Plateau $\pm 2\sigma$		steps A-H	n=8	MSWD=1.76	26.5	0.26		98.9	0.11	0.03
Isochron $\pm 2\sigma$		steps A-I	n=9	MSWD =1.6			$^{40}\text{Ar}/^{36}\text{Ar}=298.6\pm 4.8$		0.09	0.03
CH-3 , C5:78, 167.60 mg Groundmass, J=0.0001217, D=1.00963, NM-78, Lab#=8408-02										
# A	625	2233.1	2.922	7310.2	21.7	0.17	3.3	5.4	16.0	2.1
# B	700	36.32	2.498	119.3	64.6	0.20	3.5	21.4	0.28	0.04
# C	750	20.40	1.927	66.06	58.6	0.26	5.0	36.0	0.23	0.03
D	800	10.16	1.307	32.14	71.5	0.39	7.5	53.8	0.17	0.01
E	875	7.027	1.168	22.07	67.0	0.44	8.5	70.4	0.13	0.01
F	975	8.735	1.384	28.20	49.4	0.37	5.8	82.7	0.11	0.02
G	1075	16.28	1.667	52.99	26.5	0.31	4.6	89.2	0.17	0.03
# H	1250	81.98	17.86	276.6	35.6	0.029	2.0	98.1	0.36	0.09
# I	1650	192.0	18.33	635.3	7.74	0.028	3.0	100.0	1.27	0.25
Integrated age $\pm 2\sigma$			n=9		402.8		0.38 \pm 0.11 K2O=7.59%		1.08	0.27
Plateau $\pm 2\sigma$		steps D-G	n=4	MSWD=2.47	214.5		0.38 \pm 0.11		53.3	0.14
Isochron $\pm 2\sigma$		steps A-I	n=9	MSWD=1.8			$^{40}\text{Ar}/^{36}\text{Ar}=303.4\pm 2.1$		0.09	0.03
WM-1; 74.03 mg groundmass concentrate, J=0.0001175, D=1.0083, NM-51, Lab#=6699-01										
A	550	38900.0	-0.4000	131000.0	0.011	-	0.9	0.1	70.00	58.00
B	650	618.3	1.131	2008.0	0.37	0.45	4.0	2.5	5.29	0.95
C	750	210.8	1.180	635.0	0.28	0.43	11.1	4.3	4.94	0.38
D	825	64.10	1.310	149.0	4.4	0.39	31.5	32.7	4.27	0.08
E	875	53.06	1.152	114.1	2.6	0.44	36.6	49.5	4.11	0.07
F	950	48.92	0.8847	100.7	3.0	0.58	39.3	69.2	4.08	0.06
G	1000	69.86	0.7990	170.9	1.4	0.64	27.8	78.5	4.12	0.10
H	1050	97.32	0.9320	265.4	0.68	0.55	19.5	82.9	4.02	0.16
I	1100	112.2	1.195	314.8	0.8	0.43	17.2	88.2	4.08	0.16
J	1200	202.9	3.980	616.1	0.50	0.13	10.4	91.4	4.49	0.30
K	1300	140.1	13.93	405.8	0.8	0.037	15.2	96.6	4.54	0.22
# L	1650	269.3	16.37	833.2	0.52	0.031	9.0	100.0	5.21	0.42
Integrated age $\pm 2\sigma$			n=12		15.4				4.31	0.35
Plateau $\pm 2\sigma$		steps A-K	n=11	MSWD=1.69	14.9	0.44		96.6	4.15	0.17
Isochron $\pm 2\sigma$		steps A-L	n=12	MSWD =1			$^{40}\text{Ar}/^{36}\text{Ar}=299.4\pm 2.2$		4.01	0.16

ID	Power (° C)	⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar (x 10 ⁻³)	³⁹ Ar _K (x 10 ⁻¹⁵ mol)	K/Ca	⁴⁰ Ar* (%)	³⁹ Ar (%)	Age (Ma)	±1σ (Ma)
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CM-1; 69.87 mg groundmass concentrate, J=0.0001178, D=1.0083, NM-51, Lab#=6700-01

# A	550	30600.0	0.8300	101000.0	0.013	0.61	2.2	0.1	139.00	44.00
# B	650	128.7	2.964	362.7	0.32	0.17	16.9	3.6	4.62	0.23
# C	750	28.64	2.390	44.48	0.66	0.21	54.8	10.7	3.34	0.05
D	825	16.09	1.803	7.150	2.7	0.28	87.7	39.7	3.00	0.01
E	875	14.99	0.9284	3.020	1.5	0.55	94.5	56.2	3.01	0.02
F	950	15.11	0.7068	3.800	1.3	0.72	92.9	70.7	2.98	0.02
# G	1000	15.59	0.7050	9.260	0.42	0.72	82.8	75.3	2.74	0.05
# H	1050	16.21	0.7860	8.320	0.47	0.65	85.2	80.3	2.93	0.05
# I	1100	19.45	1.236	22.50	0.43	0.41	66.3	84.9	2.74	0.06
# J	1200	25.74	6.231	42.40	0.26	0.082	53.1	87.7	2.92	0.10
# K	1300	30.29	19.81	65.14	0.58	0.026	41.5	94.0	2.71	0.07
# L	1650	41.02	21.21	100.6	0.56	0.024	31.5	100.0	2.79	0.09
Integrated age ± 2σ			n=12		9.3				3.21	0.19
Plateau ± 2σ		steps D-F	n=3	MSWD=0.63	6.2	0.44		67.1	3.01	0.12
Isochron ± 2σ		steps A-F	n=6	MSWD =6.2		⁴⁰ Ar/ ³⁶ Ar=309±5			2.99	0.25

LMN, G2:77, 32.81 mg wholerock, J=0.000799±0.10%, D=1.0057±0.00152, NM-77, Lab#=8388-01

# A	625	14.15	1.125	35.32	13.4	0.45	26.9	1.5	5.49	0.25
# B	700	6.422	0.9403	3.786	40.2	0.54	83.8	5.9	7.746	0.063
C	750	6.266	0.8970	2.590	54.3	0.57	89.0	11.8	8.023	0.052
D	800	6.055	0.9822	1.694	217.7	0.52	93.1	35.7	8.111	0.022
E	875	5.748	0.8674	0.5011	277.4	0.59	98.7	66.1	8.163	0.019
F	975	5.715	0.7380	0.5059	193.9	0.69	98.5	87.3	8.096	0.019
G	1075	5.505	1.104	-0.0139	31.2	0.46	101.7	90.7	8.062	0.062
# H	1250	6.845	6.561	6.873	61.8	0.078	78.3	97.5	7.741	0.077
# I	1650	13.36	8.008	9.780	22.7	0.064	83.3	100.0	16.06	0.14
Integrated age ± 2σ			n=9		912.7		K2O=13.37%		8.23	0.05
Plateau ± 2σ		steps C-G	n=5	MSWD=2.76	774.6	0.57 ±0.17	84.9		8.11	0.05
Isochron±2σ		steps C-G	n=5	MSWD=3.1		⁴⁰ Ar/ ³⁶ Ar=280±42			8.13	0.06

Notes:

symbol preceding sample ID denotes analyses excluded from mean age calculations.

J = J-factor ± 1σ, D = discrimination ± 1σ, K/Ca calculated from measured (³⁷Ar/³⁹Ar)_K

NM- followed by a number indicates the irradiation batch, and Lab# is a unique laboratory identifier for the analysis.

Following the individual analyses for each sample, n=number of analyses used in the mean age calculation,

MSWD is mean of standard weighted deviates, and mean K/Ca is arithmetic mean and standard deviation of Kea determinations.

Integrated age is volume-weighted mean of all steps.

Integrated age calculated by recombining isotopic measurements of all steps.

Integrated age error calculated by recombining errors of isotopic measurements of all steps.