

Appendix A: $^{40}\text{Ar}/^{39}\text{Ar}$ data tables, age spectra and inverse isochron plots.

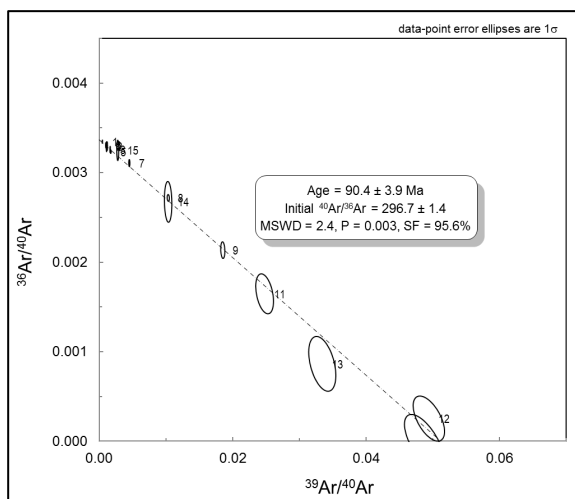
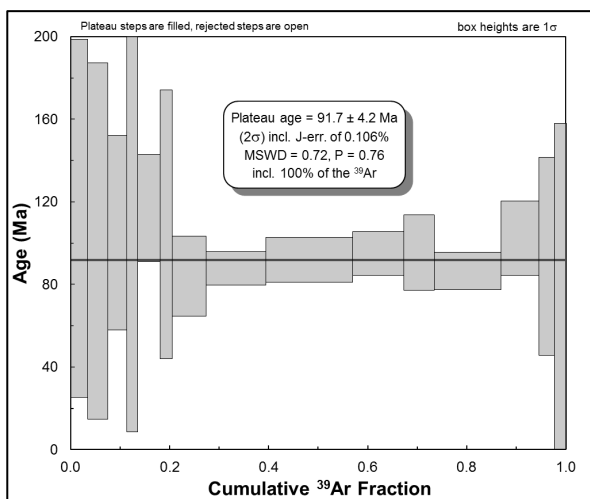
Sample #: M81-217-6 plagioclase											
Step #	Laser power (W)	Fraction					Age (Ma)	$\pm 2\sigma$ (Ma)	$^{36}\text{Ar}/^{37}\text{Ar}$ AI		
		$^{40}\text{Ar}/^{39}\text{Ar}$	$^{37}\text{Ar}/^{39}\text{Ar}$	$^{36}\text{Ar}/^{39}\text{Ar}$	$^{39}\text{Ar}_K$ (moles)	Ca/K				$\%^{40}\text{Ar}_{\text{atmos.}}$	$^{39}\text{Ar}_K$
1	0.3	1980.7	113.6	6.6575	2.42E-17	241.93	98.87	0.03	112.27	86.62	0.0153440
2	0.4	775.5	108.1	2.5850	2.91E-17	229.13	97.38	0.07	101.28	86.31	0.0062221
3	0.5	564.0	114.0	1.8682	2.78E-17	242.76	96.27	0.11	105.31	47.05	0.0042409
4	0.6	825.8	143.1	2.7552	1.57E-17	311.72	97.21	0.13	117.76	109.02	0.0049936
5	0.8	528.6	129.0	1.7448	3.26E-17	277.92	95.60	0.18	117.40	25.91	0.0034873
6	1.0	916.7	139.8	3.0675	1.76E-17	303.65	97.66	0.20	109.32	65.09	0.0057025
7	1.2	204.1	114.9	0.6651	4.97E-17	244.85	91.80	0.27	84.35	19.33	0.0014520
8	1.5	88.7	118.1	0.2730	8.71E-17	252.22	80.32	0.39	88.12	8.06	0.0005373
9	2.0	49.4	123.2	0.1387	1.26E-16	264.16	63.09	0.57	92.25	10.90	0.0002252
10	2.5	18.7	127.3	0.0342	7.44E-17	273.93	-0.34	0.67	95.24	10.61	-0.0000004
11	3.0	36.4	141.7	0.0981	4.48E-17	308.19	48.66	0.73	95.75	18.19	0.0001112
12	4.0	18.5	126.2	0.0388	9.68E-17	271.34	7.49	0.87	86.79	9.15	<i>0.0000098</i>
13	5.0	27.1	132.6	0.0593	5.47E-17	286.44	25.56	0.94	102.74	18.02	<i>0.0000466</i>
14	6.0	87.8	134.6	0.2710	2.29E-17	291.12	79.03	0.98	93.94	47.96	0.0004589
15	8.0	323.9	147.0	1.0923	1.13E-17	321.11	96.02	1.00	66.91	91.46	0.0018840

J value $\pm 2\sigma$ Mass (mg)
 0.002631 0.106 2.615

Plateau steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.03



Sample #: M81-223-1 plagioclase

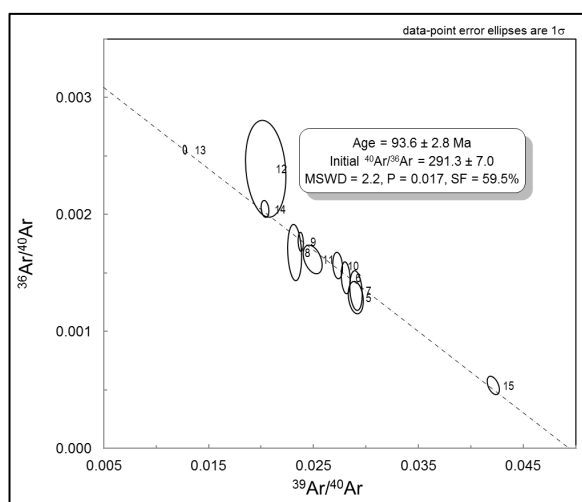
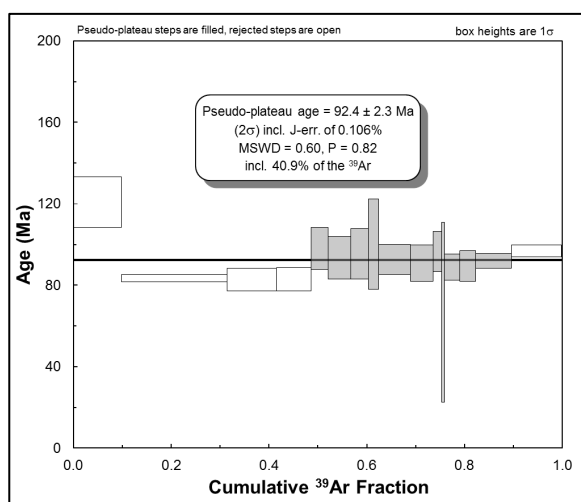
Step #	Laser power (W)	Fraction					Ca/K	% ⁴⁰ Ar _{atmos.}	³⁹ Ar _K	Age (Ma)	± 2σ (Ma)	³⁶ Ar/ ³⁷ Ar AI
		⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar	³⁹ Ar _K (moles)	³⁹ Ar _K						
1	0.2	341.3	25.47	1.0741	2.55E-16	50.82	92.40	0.10	121.11	12.28	0.011025	
2	0.3	78.3	17.21	0.2093	5.63E-16	34.14	77.22	0.31	83.77	1.73	0.003130	
3	0.4	54.6	26.42	0.1326	2.60E-16	52.75	67.87	0.41	82.96	5.61	0.001250	
4	0.5	26.8	19.45	0.0362	1.86E-16	38.65	34.13	0.49	83.09	5.74	0.000419	
5	0.6	34.0	20.55	0.0493	9.21E-17	40.87	38.12	0.52	98.44	10.24	0.000561	
6	0.8	35.1	21.79	0.0571	1.19E-16	43.38	43.10	0.57	93.73	10.38	0.000618	
7	1.0	34.0	16.68	0.0504	9.35E-17	33.09	39.88	0.60	95.65	12.43	0.000724	
8	1.2	42.4	22.20	0.0771	5.42E-17	44.20	49.48	0.62	100.51	22.20	0.000842	
9	1.5	41.2	28.94	0.0806	1.69E-16	57.90	52.21	0.69	92.96	7.44	0.000662	
10	2.0	35.7	38.27	0.0661	1.21E-16	77.07	46.22	0.73	91.17	8.93	0.000383	
11	2.5	38.0	77.53	0.0822	4.69E-17	160.66	47.75	0.75	96.87	9.88	0.000208	
12	3.0	44.4	131.35	0.1417	1.50E-17	283.48	70.64	0.76	66.93	44.18	0.000213	
13	4.0	77.2	24.83	0.2039	8.14E-17	49.53	75.46	0.79	89.27	6.41	0.002089	
14	5.0	48.6	13.68	0.1032	8.33E-17	27.06	60.51	0.82	89.75	7.64	0.001915	
15	6.0	23.6	5.36	0.0142	1.91E-16	10.55	15.94	0.89	92.29	3.63	0.000626	
16	8.0	32.5	9.36	0.0416	2.62E-16	18.46	35.61	1.00	97.18	2.98	0.001100	

J value ± % 2σ Mass (mg)
 0.002631 0.106 1.111

Pseudo-plateau steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.28



Sample #: M81-229-1 plagioclase

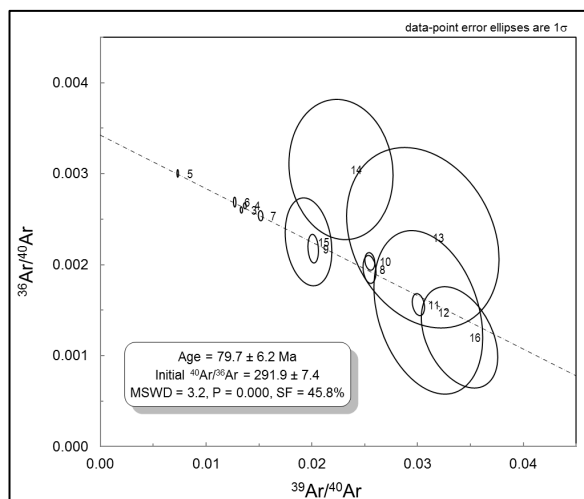
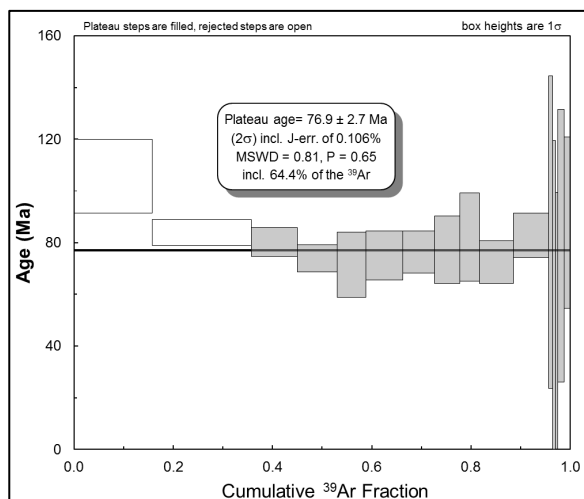
Step #	Laser power (W)	Fraction					Ca/K	% ⁴⁰ Ar _{atmos.}	³⁹ Ar _K	Age (Ma)	± 2σ (Ma)	³⁶ Ar/ ³⁷ Ar AI
		⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar	³⁹ Ar _K (moles)	³⁹ Ar _K						
1	0.2	571.38	15.65	1.8609	2.98E-16	31.01	96.02	0.16	105.93	14.33	0.03122	
2	0.3	130.97	13.26	0.3860	3.77E-16	26.24	86.28	0.36	84.12	5.00	0.00758	
3	0.4	74.02	19.28	0.1978	1.75E-16	38.30	76.87	0.45	80.55	5.55	0.00263	
4	0.5	72.41	15.19	0.1958	1.52E-16	30.09	78.23	0.53	74.09	5.23	0.00332	
5	0.6	135.47	14.15	0.4106	1.10E-16	28.01	88.73	0.59	71.77	12.61	0.00756	
6	0.8	77.68	19.58	0.2141	1.41E-16	38.92	79.44	0.66	75.27	9.44	0.00281	
7	1.0	64.36	35.41	0.1729	1.22E-16	71.16	75.00	0.73	76.66	8.12	0.00121	
8	1.2	38.59	25.66	0.0821	9.52E-17	51.21	57.57	0.78	77.44	13.06	0.00077	
9	1.5	48.48	35.14	0.1150	7.42E-17	70.61	64.29	0.82	82.33	17.01	0.00079	
10	2.0	38.02	44.65	0.0895	1.31E-16	90.33	60.17	0.88	72.71	8.26	0.00046	
11	2.5	31.99	54.83	0.0647	1.33E-16	111.74	46.14	0.95	83.08	8.53	0.00024	
12	3.0	30.31	86.00	0.0680	1.62E-17	179.35	43.63	0.96	84.28	60.43	0.00014	
13	4.0	30.04	120.38	0.1015	1.08E-17	257.62	67.86	0.97	49.36	70.45	0.00015	
14	5.0	39.51	145.13	0.1595	9.05E-18	316.58	90.00	0.97	20.75	76.52	0.00022	
15	12.0	48.79	57.11	0.1252	1.58E-17	116.58	66.51	0.99	79.02	52.78	0.00051	
16	15.0	28.57	42.85	0.0459	2.67E-17	86.59	35.50	1.00	87.98	33.04	0.00021	

J value ± % 2σ Mass (mg)
 0.002631 0.106 1.398

Plateau steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.16



Sample #: M81-229-14 plagioclase

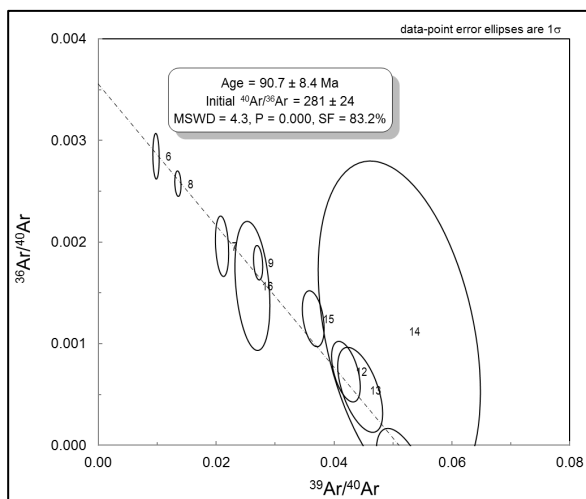
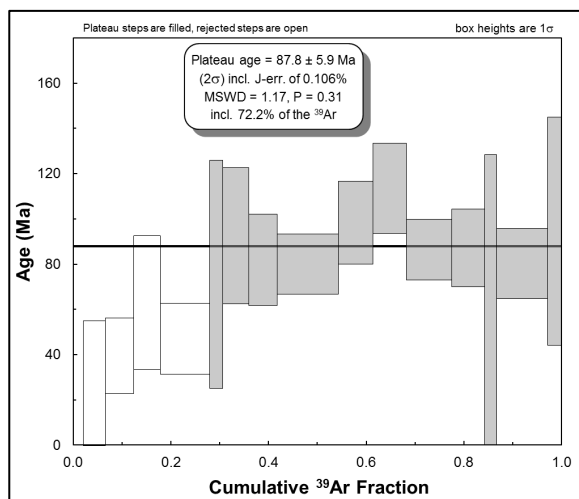
Step #	Laser power (W)	Fraction					Age (Ma)	± 2σ (Ma)	³⁶ Ar/ ³⁷ Ar AI		
		⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar	³⁹ Ar _K (moles)	Ca/K				% ⁴⁰ Ar _{atmos.}	³⁹ Ar _K
1	0.3	776.47	21.32	2.5921	1.10E-17	42.42	98.43	0.02	57.87	111.44	0.031915
2	0.4	146.24	33.20	0.4978	3.29E-17	66.62	98.77	0.07	8.70	46.53	0.003873
3	0.5	58.66	34.69	0.1799	4.21E-17	69.68	85.90	0.12	39.80	16.68	0.001293
4	0.6	43.53	45.87	0.1153	3.92E-17	92.88	69.88	0.18	63.16	29.55	0.000590
5	0.8	57.60	50.13	0.1755	7.29E-17	101.82	83.07	0.28	47.34	15.74	0.000850
6	1.0	95.84	88.52	0.2965	2.00E-17	184.95	84.06	0.31	75.68	50.38	0.000810
7	1.2	43.25	132.02	0.1204	3.84E-17	285.06	57.89	0.36	92.81	30.13	0.000169
8	1.5	65.54	165.10	0.2133	4.21E-17	365.82	76.08	0.42	82.20	20.26	0.000269
9	2.0	32.60	166.37	0.1035	9.07E-17	369.00	53.10	0.54	80.30	13.33	0.000093
10	2.5	16.27	215.71	0.0520	5.15E-17	497.87	-11.38	0.61	98.56	18.23	-0.000008
11	3.0	15.90	247.76	0.0515	4.90E-17	587.32	-28.57	0.68	113.70	19.99	-0.000016
12	4.0	20.72	185.52	0.0651	6.75E-17	417.80	21.43	0.77	86.65	13.45	0.000021
13	5.0	19.63	183.13	0.0602	4.84E-17	411.63	16.15	0.84	87.43	17.09	0.000015
14	6.0	16.21	246.71	0.0849	1.75E-17	584.31	33.27	0.87	60.98	67.73	0.000019
15	12.0	24.71	141.89	0.0691	6.95E-17	308.72	36.81	0.97	80.45	15.52	0.000057
16	15.0	32.03	232.48	0.1130	2.19E-17	544.08	46.37	1.00	94.83	50.45	0.000057

J value ± % 2σ Mass (mg)
 0.002631 0.106 2.512

Plateau steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.04



Sample #: M81-276-8 plagioclase

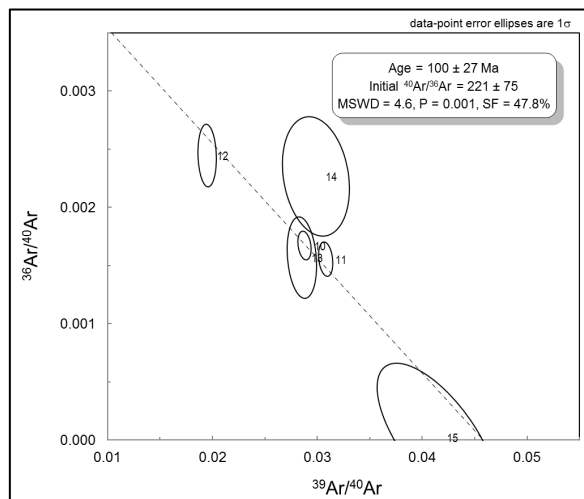
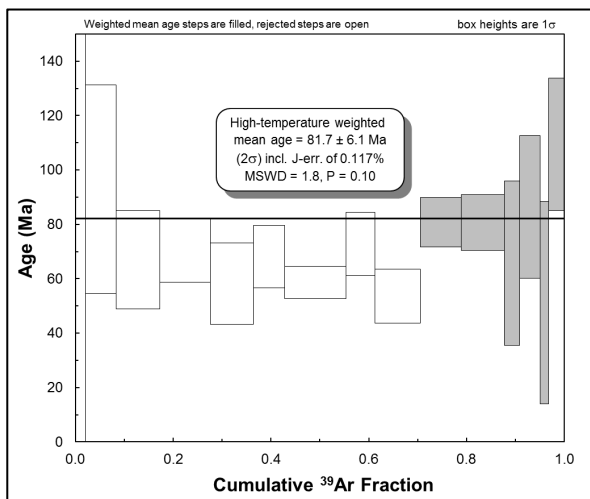
Step #	Laser power (W)	Fraction					Age (Ma)	± 2σ (Ma)	³⁶ Ar/ ³⁷ Ar AI		
		⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar	³⁹ Ar _K (moles)	Ca/K				% ⁴⁰ Ar _{atmos.}	³⁹ Ar _K
1	0.13	3665.04	62.02	12.3290	2.02E-17	127.06	99.27	0.02	127.43	137.17	0.0519165
2	0.20	642.43	70.75	2.1280	6.38E-17	145.88	97.00	0.08	93.12	38.42	0.0077951
3	0.30	215.62	84.17	0.7061	9.16E-17	175.29	93.66	0.17	67.26	18.08	0.0021231
4	0.40	75.42	69.75	0.2249	1.05E-16	143.73	80.75	0.27	70.60	11.61	0.0007726
5	0.50	77.33	66.92	0.2392	9.07E-17	137.60	84.50	0.36	58.37	14.92	0.0008641
6	0.60	38.81	74.62	0.1041	6.53E-17	154.31	63.94	0.43	68.34	11.55	0.0002942
7	0.80	30.64	47.26	0.0750	1.28E-16	95.80	60.00	0.55	58.83	5.96	0.0003442
8	1.00	40.52	97.59	0.1137	6.15E-17	205.28	63.67	0.61	73.01	11.58	0.0002339
9	1.20	28.03	61.11	0.0738	9.43E-17	125.13	60.39	0.70	53.89	9.91	0.0002451
10	1.50	30.09	192.21	0.1022	8.56E-17	435.21	49.44	0.79	81.05	9.07	0.0000685
11	2.00	29.51	131.05	0.0813	8.97E-17	282.75	45.98	0.88	80.92	10.19	0.0000916
12	2.50	42.87	235.12	0.1683	3.23E-17	551.47	72.28	0.91	65.86	30.21	0.0001166
13	4.00	29.76	216.50	0.1052	3.91E-17	500.02	46.37	0.95	86.61	26.19	<i>0.0000564</i>
14	5.00	26.56	296.20	0.1402	1.77E-17	732.12	67.00	0.97	51.40	37.27	<i>0.0000532</i>
15	6.00	18.92	309.91	0.0841	1.85E-17	775.40	0.72	1.00	109.70	24.37	<i>0.0000004</i>

J value ± % 2σ Mass (mg)
 0.002615 0.117 2.452

High-temperature weighted mean age steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.05



Sample #: M81-279-1 plagioclase

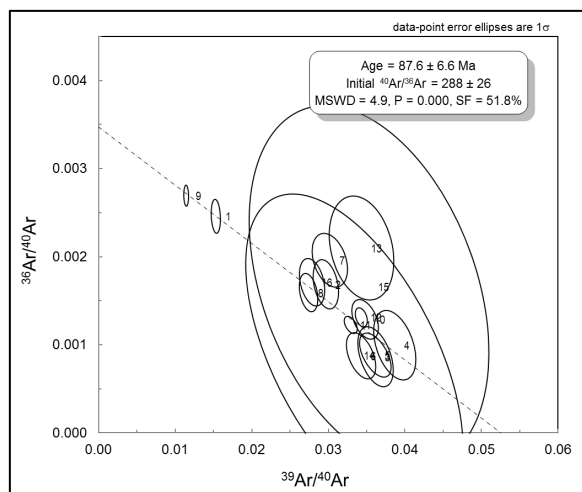
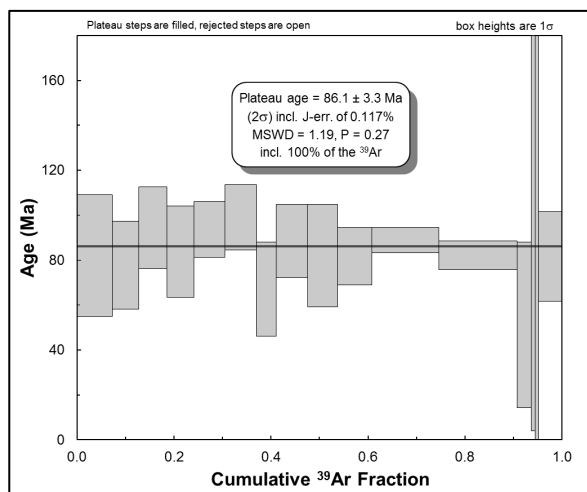
Step #	Laser power (W)	Fraction					Ca/K	% ⁴⁰ Ar _{atmos.}	³⁹ Ar _K	Age (Ma)	± 2σ (Ma)	³⁶ Ar/ ³⁷ Ar AI
		⁴⁰ Ar/ ³⁹ Ar	³⁷ Ar/ ³⁹ Ar	³⁶ Ar/ ³⁹ Ar	³⁹ Ar _K (moles)	³⁹ Ar _K						
1	0.6	65.30	1.76	0.1611	3.66E-17	3.46	72.68	0.07	82.35	27.07	0.02384	
2	0.8	33.61	3.96	0.0578	4.97E-17	7.78	49.85	0.13	78.00	19.52	0.00375	
3	1.0	27.58	3.95	0.0249	5.22E-17	7.77	25.55	0.18	94.60	18.18	0.00158	
4	1.2	25.71	8.52	0.0279	5.03E-17	16.80	29.42	0.24	84.11	20.27	0.00079	
5	1.5	27.45	11.88	0.0274	5.80E-17	23.48	26.09	0.30	94.00	12.47	0.00053	
6	2.0	28.78	19.81	0.0305	5.90E-17	39.38	25.87	0.37	99.25	14.57	0.00033	
7	2.5	32.50	27.29	0.0711	3.69E-17	54.54	57.91	0.41	64.60	20.96	0.00061	
8	3.0	35.28	47.39	0.0690	5.89E-17	96.06	47.07	0.47	88.87	16.30	0.00031	
9	4.0	83.36	67.05	0.2426	5.49E-17	137.88	79.57	0.54	82.36	22.83	0.00088	
10	5.0	27.91	41.11	0.0471	6.50E-17	82.96	38.09	0.61	82.02	12.68	0.00023	
11	6.0	29.64	34.57	0.0457	1.24E-16	69.44	36.24	0.74	89.12	5.66	0.00027	
12	8.0	28.88	13.45	0.0415	1.46E-16	26.61	38.78	0.91	82.29	6.41	0.00074	
13	10.0	27.90	60.45	0.0749	2.58E-17	123.71	62.04	0.93	51.41	36.80	0.00025	
14	12.0	28.87	51.39	0.0392	7.19E-18	104.48	25.96	0.94	101.67	97.41	0.00013	
15	15.0	27.76	28.53	0.0538	7.28E-18	57.05	49.11	0.95	66.73	118.94	0.00042	
16	20.0	35.26	24.85	0.0670	4.46E-17	49.57	50.53	1.00	81.84	19.88	0.00063	

J value ± % 2σ Mass (mg)
 0.002615 0.117 4.137

Plateau steps are shown in bold.

AI = Alteration Index cut-off value (Baksi, 2007) = <0.00006 for plagioclase (values in italics = steps from fresh material).

Wt. % K = 0.03



Mass spectrometer sensitivity = $2.70 \times 10^{-10} \text{ cm}^3/\text{V}$ ($1.203 \times 10^{-14} \text{ moles/V}$).

Linear law mass discrimination factor = 1.011.

Interference correction factors: $^{39}\text{Ar}/^{37}\text{Ar}_{\text{Ca}} = 6.99 \times 10^{-4}$, $^{36}\text{Ar}/^{37}\text{Ar}_{\text{Ca}} = 2.70 \times 10^{-4}$, and $^{40}\text{Ar}/^{39}\text{Ar}_{\text{K}} = 1.83 \times 10^{-3}$ (Wijbrans et al., 2007).

The plateau ages, age spectra, and inverse isochron ages and plots were produced using the Isoplot program (v. 4.15) developed by (Ludwig, 2011).

The Spreading Factors (SF) were calculated using the calculations of (Jourdan et al., 2009).

The $^{40}\text{Ar}/^{39}\text{Ar}$ ages were calculated using the ^{40}K decay constants, $^{40}\text{K}/\text{K}$ ratio and $^{40}\text{Ar}/^{36}\text{Ar}$ atmospheric ratio of Steiger and Jäger (1977).

References:

- Baksi, A.K., 2007. A quantitative tool for detecting alteration in undisturbed rocks and minerals—I: Water, chemical weathering, and atmospheric argon, in Foulger, G.R., and Jurdy, D.M., eds., Plates, plumes, and planetary processes. Geological Society of America Special Papers 430, 285–303
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- Ludwig, K.A., 2011. A geochronological toolkit for Microsoft Excel. Berkeley Geochron. Centre Spec. Pub. No. 4, available from www.bgc.org./isoplot_etc/isoplot.html.
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