DATA REPOSITORY ITEM DR-1, ^{40}AR/^{39}AR ANALYTICAL DATA:

^{40}Ar/^{39}Ar Analytical Procedures

Biotite and sanidine concentrates were obtained using standard mineral-separation techniques, including crushing, grinding, Frantz magnetic separation, and heavy liquids. Basaltic groundmass concentrates were obtained from the 100–250 μm fraction that behaved magnetically at 0.5 A with a 15° forward slope and a 10° side slope and nonmagnetically at 0.1 A with the same parameters. All samples were rinsed ultrasonically with acetone and deionized water to remove surface contaminants. Final mineral separates were hand-picked under a binocular microscope to remove any impurities and composite or altered mineral grains. Samples were loaded in 99.99% copper foil packets and packets were stacked single-file in quartz vials with flux monitors between every five samples. Sanidine from the Taylor Creek Rhyolite (standard TCR-2) with an assumed age of 27.92 ± 0.05 Ma (Duffield and Dalrymple, 1990) was used as a flux monitor. Samples were irradiated at the Oregon State University TRIGA reactor for 2 hours in the cadmium-shielded CLICLIT facility.

All samples were analyzed at the Stanford University Noble Gas Geochronology Laboratory. *J*-values of unknowns were interpolated from weighted-mean *J*-values calculated from multi-grain laser-fusion analyses of each monitor. Step heating experiments were carried out using a Staudacher-type double-vacuum resistance furnace, and multi-grain laser fusion experiments (sanidine and anorthoclase) were carried out using a 10W Spectra Physics argon ion laser. Extracted gas was purified using SAES getters for 5 minutes and analyzed for 10 minutes in a MAP 216 noble-gas mass spectrometer with a Johnston MM1 electron multiplier and a Baur-Signer ion source. Mass spectrometer sensitivity for typical gain values is ~5.21 X 10^{-13} mol·volt^{-1} and mass discrimination is ~286.0 ± 0.5 based on air analyses. Mass spectrometer dynamic blanks for ^{40}Ar were ~3 X 10^{-17} moles and for ^{36}Ar were ~9 X 10^{-19} moles. Resistance furnace static blanks for ^{40}Ar ranged from ~8 X 10^{-16} moles at 700 °C to 4 X 10^{-15} moles at 1200 °C. Laser blanks for ^{40}Ar were typically ~8 X 10^{-16} moles.

Raw data were trimmed and regressed to inlet time using in-house LabView® software written by M. McWilliams, and measured isotopic ratios were corrected for machine blanks, decay, and interfering reactions using an Excel® routine written by M. McWilliams. Interference correction factors are: $(^{36}Ar/^{37}Ar)_{Ca}$ = 2.24 X 10^{-4}; $(^{39}Ar/^{37}Ar)_{Ca}$ = 8.1 X 10^{-4}; $(^{40}Ar/^{39}Ar)_{K}$ = 3.0 X 10^{-2}. Isochron plots and ages, release spectra, and plateau ages were produced using the IsoPlot 3.0 program written by K. Ludwig. All data reduction assumed a ^{40}K decay constant of 5.543 X 10^{-10} yr^{-1} (Steiger and Jäger, 1977).

Plateau ages meet the following criteria: (1) The plateau consists of 3 or more contiguous steps that comprise >60% of the total ^{39}Ar released (2) Steps are concordant at the 95% confidence interval (3) There is no resolvable slope on the plateau (4) There are no trends or outliers on the upper and lower steps. The inverse-isochron plot provides a critical test for the assumption that trapped argon gas has an atmospheric composition ($^{40}Ar/^{36}Ar$ = 295.5). Concordance of inverse-isochron ages defined by isochronous (low MSWD) data is the final criteria for defining a "true plateau" age (McDougall and Harrison, 1999). IsoPlot calculates inverse isochrons using the York (1969) regression.

We quote plateau ages in the text for step-heated samples that meet the above criteria. For samples that fail the test for a true plateau, we quote either the inverse-isochron age (for samples with low radiogenic yields), or a weighted-mean age (weighted by data point errors) on contiguous steps that come closest to the plateau criterion (for steps with high radiogenic yields). For laser-fusion analyses, we calculate weighted-mean ages (weighted by data point errors) of 4–5 multi-grain aliquots. For all samples, the total fusion age is a weighted-mean of all heating steps or laser analyses, weighted by the percent of ^{39}Ar released for each step. All quoted uncertainties are 2-sigma.

References:

Duffield, W.A. and Dalrymple, G.B., 1990, The Taylor Creek Rhyolite of New Mexico; a rapidly emplaced field of lava domes and flows: Bulletin of Volcanology, v. 52, p. 475–487.

McDougall, I., and Harrison, T.M., 1999, Geochronology and thermochronology by ^{40}Ar/^{39}Ar method: Oxford University Press, 269 p.

Steiger, R.H., and Jäger, E., 1977, Convention on the use of decay constants in geo- and cosmochronology. Earth Planetary Science Letters, v. 36, p. 359–362.

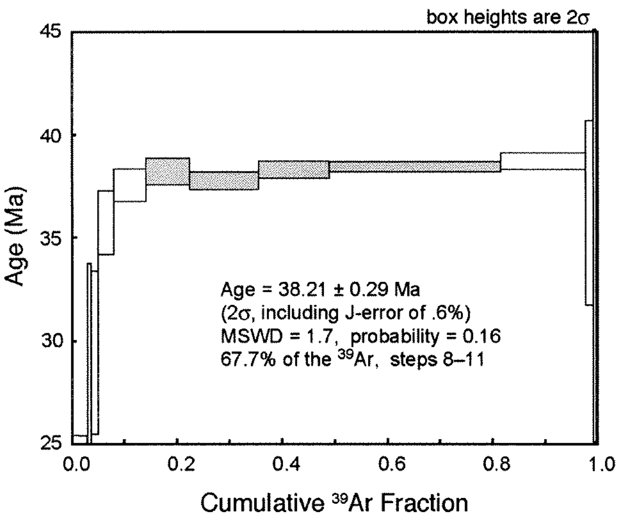
York, 1969, Least-squares fitting of a straight line with correlated errors; Earth and Planetary Science Letters, v. 5, p. 320–324.

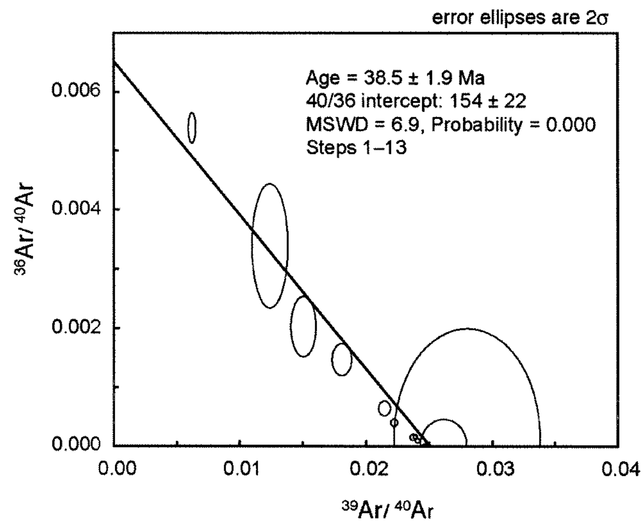
Key to data tables for individual samples:

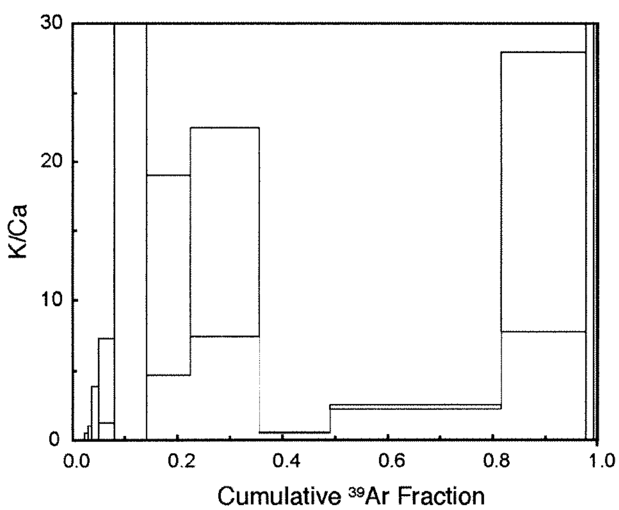
Step	Heating step or laser analysis number
Temp	Furnace temperature (°C)
Laser #	Laser analysis number
^{40}Ar/^{39}Ar	^{40}Ar/^{39}Ar ratio, corrected for blanks, decay, and mass discrimination
^{37}Ar/^{39}Ar	^{37}Ar/^{39}Ar ratio, corrected for blanks, decay, and mass discrimination
^{36}Ar/^{39}Ar	^{36}Ar/^{39}Ar ratio, corrected for blanks, decay, and mass discrimination
$^{39}Ar_K$	Moles of ^{39}Ar produced from ^{39}K (x 10^{-15} mol)
K/Ca	K/Ca ratio calculated from production of ^{37}Ar
^{40}Ar*	Radiogenic ^{40}Ar (%)
Age	Age of each heating step or laser analysis (Ma ± 1σ)

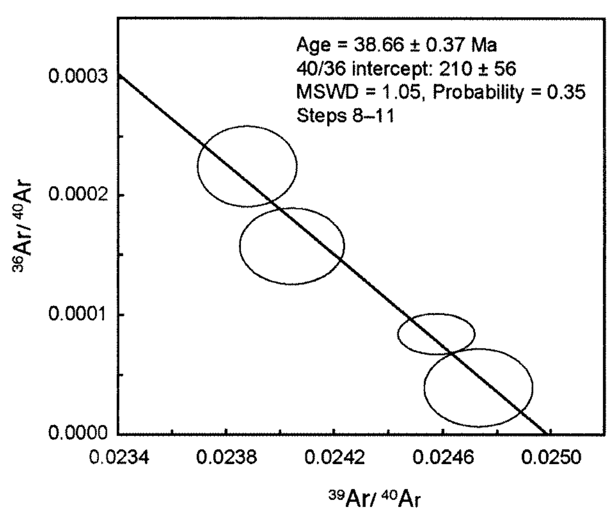
JC02-PF42 biotite Mass: 2.6 mg Total Fusion Age: 36.82 ± 0.67 Ma J = 0.0005413 ± 0.3%

Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	750	163.84	5.6394	0.8835	0.2175	0.0918	-59.6%	2.0%	-97.64	8.09
2	800	81.33	1.1485	0.2781	0.0708	0.4523	-1.2%	2.6%	-0.78	11.12
3	850	66.81	0.6599	0.1382	0.0818	0.7876	38.8%	3.4%	25.22	4.30
4	900	55.49	0.2871	0.0845	0.1413	1.8111	54.9%	4.6%	29.57	1.95
5	950	46.72	0.1156	0.0329	0.3396	4.4962	79.1%	7.7%	35.77	0.77
6	1000	45.09	0.0164	0.0209	0.6752	31.7413	86.2%	13.9%	37.57	0.39
7	1050	42.23	0.0435	0.0090	0.9205	11.9667	93.6%	22.2%	38.22	0.32
8	1100	41.92	0.0345	0.0095	1.4498	15.0737	93.3%	35.4%	37.79	0.21
9	1150	41.61	0.6311	0.0067	1.4862	0.8236	95.0%	48.8%	38.31	0.20
10	1200	40.72	0.1967	0.0036	3.6100	2.6425	97.3%	81.6%	38.32	0.12
11	1233	40.47	0.0290	0.0017	1.7859	17.9263	98.7%	97.8%	38.58	0.20
12	1266	38.38	0.0533	0.0033	0.1579	9.7571	97.4%	99.2%	36.13	2.20
13	1300	35.78	0.0267	0.0082	0.0632	19.5021	93.1%	99.8%	32.24	8.03
14	1400	2.50	2.9692	0.0246	0.0212	0.1747	-199.2%	100.0%	-4.50	48.54



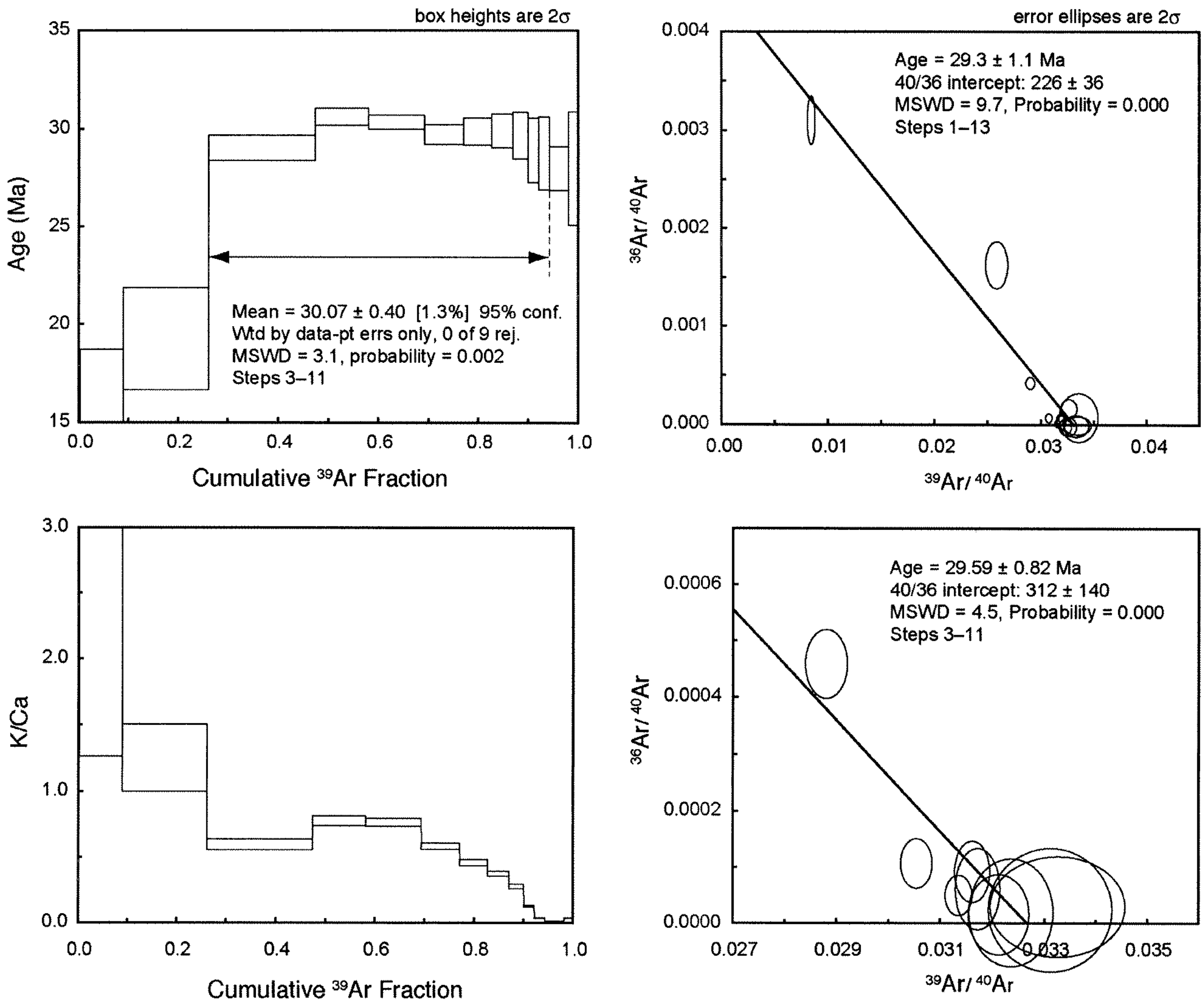






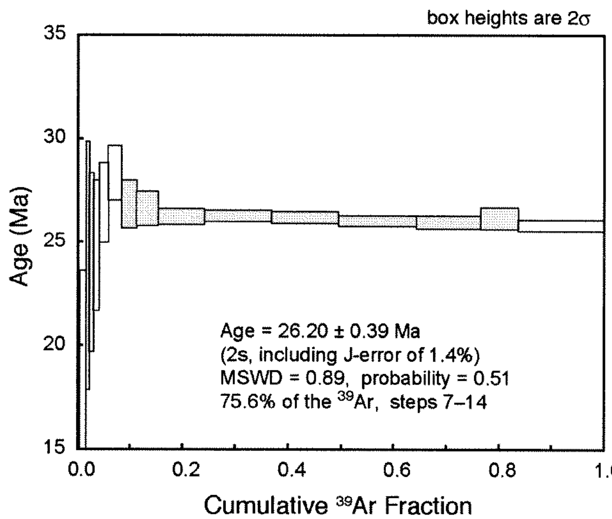
JC02-PF27 basalt Mass: 13.5 mg Total Fusion Age: 26.10 ± 0.92 Ma J = 0.0005402 ± 0.3%

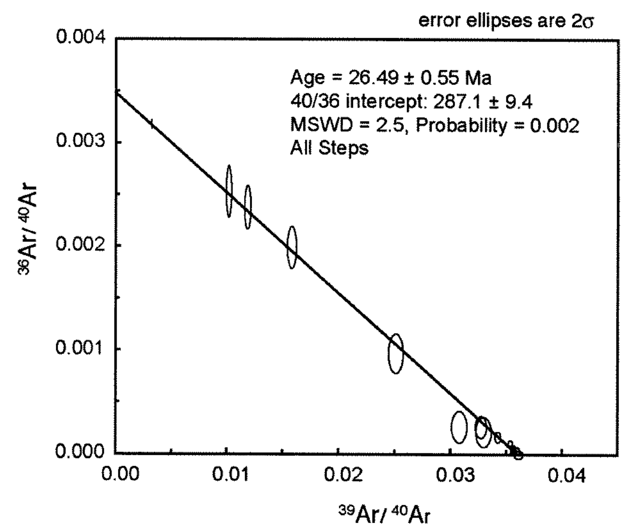
Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	600	122.48	0.1730	0.3805	1.2792	3.0048	8.2%	8.7%	9.74	4.56
2	750	39.02	0.4096	0.0644	2.5374	1.2690	51.1%	26.0%	19.38	1.29
3	900	34.77	0.8329	0.0161	3.1352	0.6239	86.0%	47.3%	29.04	0.31
4	950	32.78	0.6488	0.0038	1.5719	0.8010	96.3%	58.0%	30.61	0.21
5	1000	31.92	0.6571	0.0019	1.6482	0.7909	98.0%	69.2%	30.33	0.18
6	1033	31.65	0.8528	0.0033	1.1400	0.6093	96.7%	77.0%	29.71	0.25
7	1066	31.54	1.0662	0.0024	0.8343	0.4873	97.5%	82.7%	29.88	0.34
8	1100	31.14	1.2945	0.0010	0.6333	0.4013	98.7%	87.0%	29.90	0.43
9	1133	30.90	1.6948	0.0012	0.4461	0.3064	98.4%	90.0%	29.65	0.59
10	1166	30.15	3.3310	0.0017	0.3129	0.1557	97.5%	92.1%	28.94	0.81
11	1200	29.91	7.5121	0.0027	0.3108	0.0688	95.5%	94.3%	28.76	0.92
12	1250	30.56	12.1985	0.0090	0.5703	0.0422	88.6%	98.2%	28.01	0.56
13	1300	29.83	7.5631	0.0051	0.2641	0.0683	93.2%	100.0%	28.01	1.42

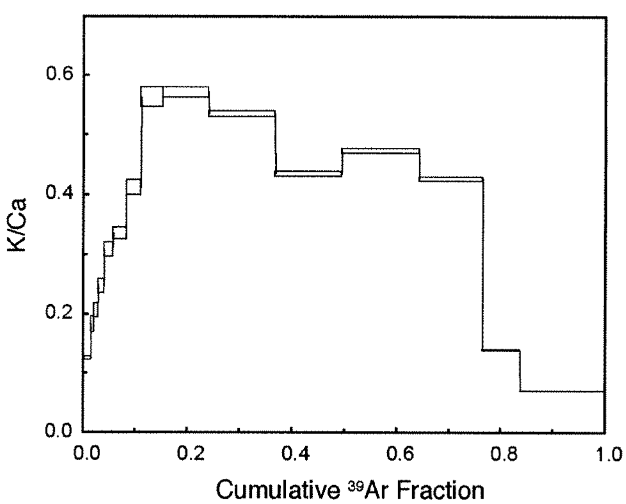


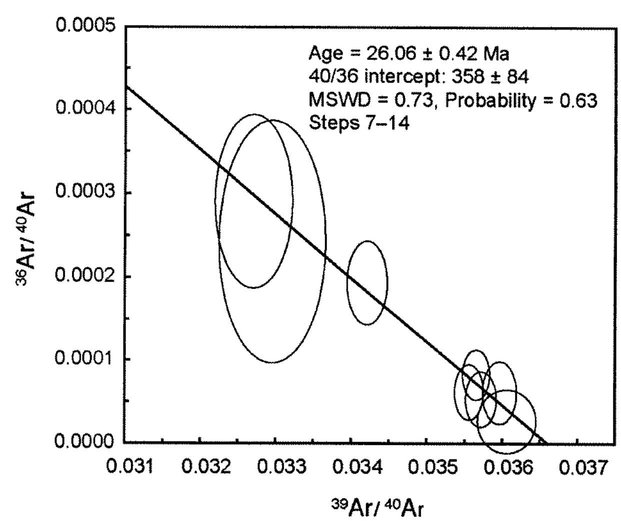
JC02-PF13 basalt   Mass: 22.3 mg   Total Fusion Age: 25.21 ± 0.29 Ma   J = 0.0005326 ± 0.7%

Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	550	324.97	3.9786	1.0327	0.5883	0.1303	-20.9%	1.2%	-65.93	0.78
2	600	99.46	2.7763	0.2525	0.2667	0.1869	3.3%	1.8%	3.59	1.00
3	650	85.11	2.4706	0.2032	0.3768	0.2101	9.0%	2.6%	7.74	0.72
4	700	63.61	2.0681	0.1275	0.5340	0.2510	23.5%	3.7%	14.67	0.52
5	750	39.92	1.6679	0.0399	0.8305	0.3113	61.6%	5.5%	23.78	0.31
6	800	32.54	1.5374	0.0098	1.1934	0.3378	88.1%	8.0%	27.60	0.22
7	850	30.36	1.2557	0.0077	1.3625	0.4137	90.0%	10.9%	26.28	0.19
8	900	30.60	0.9234	0.0091	1.9551	0.5627	88.3%	15.0%	25.95	0.14
9	950	29.25	0.9102	0.0059	4.1789	0.5709	91.9%	23.9%	25.82	0.06
10	1000	28.13	0.9712	0.0021	6.0569	0.5350	96.8%	36.7%	26.16	0.04
11	1050	28.00	1.1916	0.0019	5.9420	0.4360	97.0%	49.3%	26.13	0.05
12	1100	28.06	1.0977	0.0027	7.0706	0.4733	95.9%	64.2%	25.88	0.04
13	1150	27.81	1.2161	0.0021	5.8004	0.4272	96.7%	76.5%	25.87	0.05
14	1200	27.68	3.6040	0.0017	3.3684	0.1439	96.5%	83.6%	26.14	0.09
15	1300	28.16	6.8232	0.0055	7.6932	0.0758	90.4%	100.0%	25.54	0.04



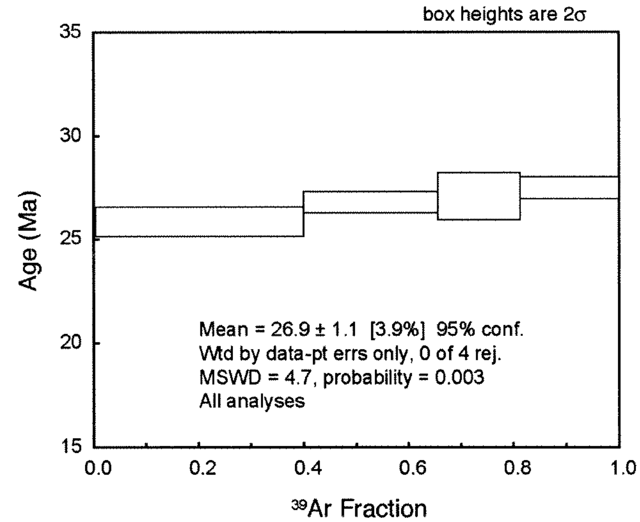


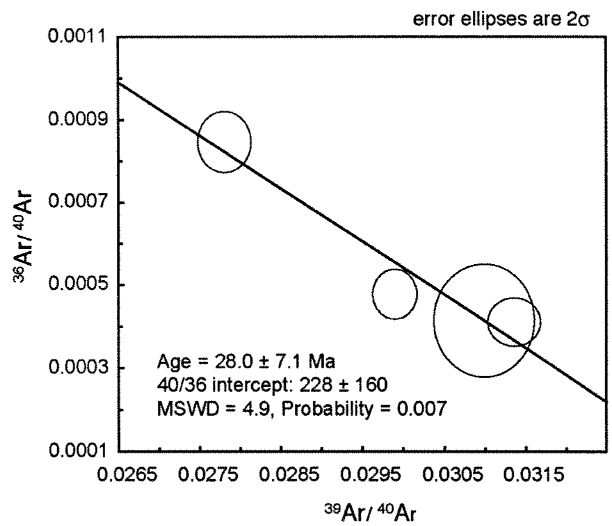




JC02-PF3 anorthoclase Mass: 4.9 mg Total Fusion Age: 26.66 ± 0.36 Ma J = 0.0005360 ± 0.3%

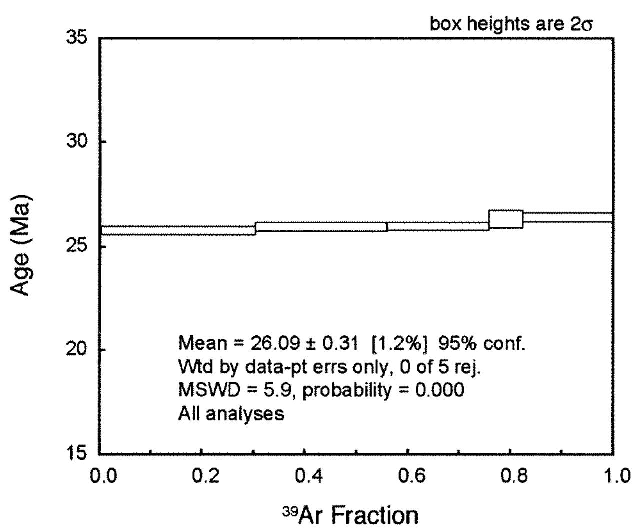
Step	Laser (#)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	1	33.48	0.4651	0.0162	1.1329	1.1175	85.5%	18.8%	27.54	0.26
2	2	36.01	0.5165	0.0306	2.3928	1.0064	74.7%	58.6%	25.92	0.35
3	3	31.91	0.5835	0.0134	1.5490	0.8907	87.4%	84.3%	26.85	0.25
4	4	32.29	0.4806	0.0136	0.9449	1.0815	87.3%	100.0%	27.14	0.56

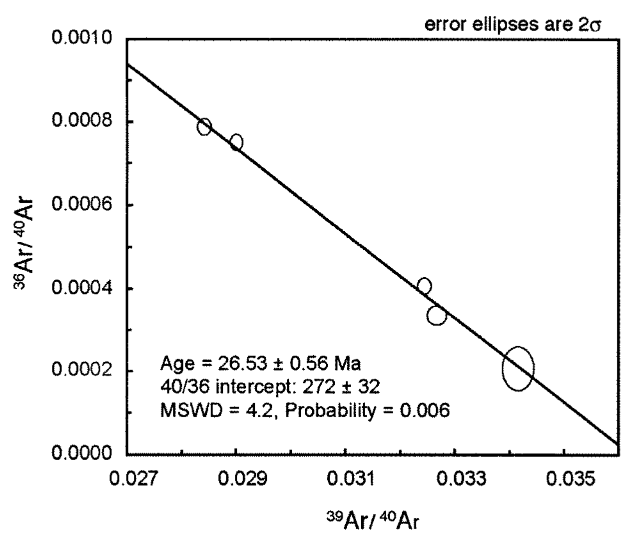




JC02-PF28 sanidine Mass: 6.9 mg Total Fusion Age: 26.08 ± 0.11 Ma J = 0.0005371 ± 0.3%

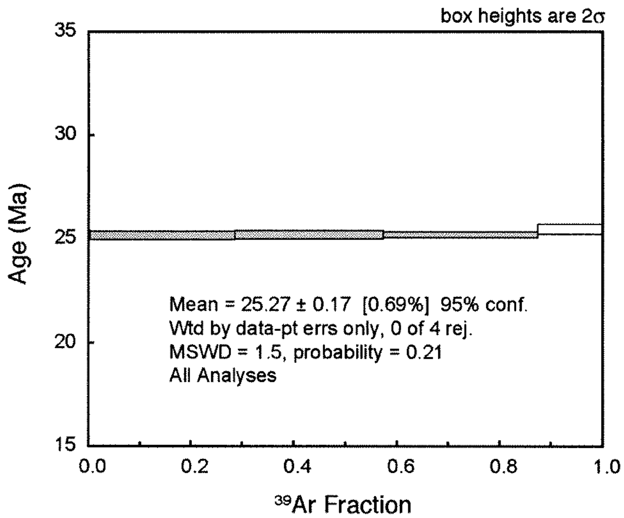
Step	Laser (#)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	1	30.86	0.0221	0.0127	3.6167	23.5528	87.7%	20.0%	26.05	0.08
2	2	34.54	0.0271	0.0259	5.4448	19.2217	77.8%	50.1%	25.85	0.09
3	3	35.26	0.0220	0.0277	4.6360	23.6738	76.7%	75.8%	26.01	0.10
4	4	30.64	0.0145	0.0104	3.1802	35.9229	89.8%	93.4%	26.48	0.10
5	5	29.31	0.0152	0.0062	1.2008	34.3163	93.6%	100.0%	26.39	0.20

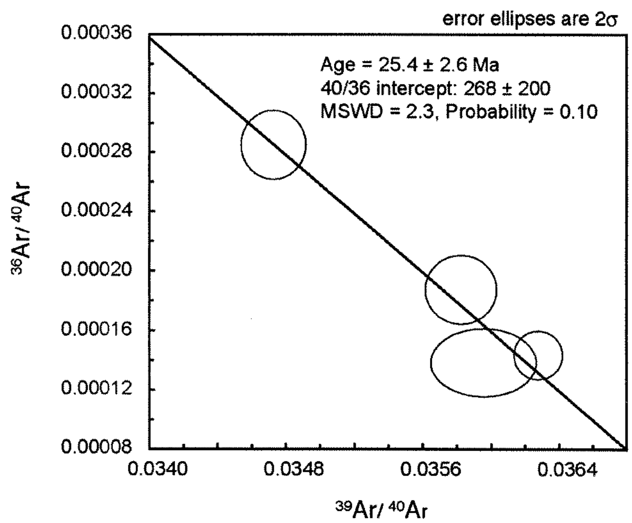




JC02-PF17 sanidine Mass: 4.7 mg Total Fusion Age: 25.26 ± 0.10 Ma J = 0.0005340 ± 0.3%

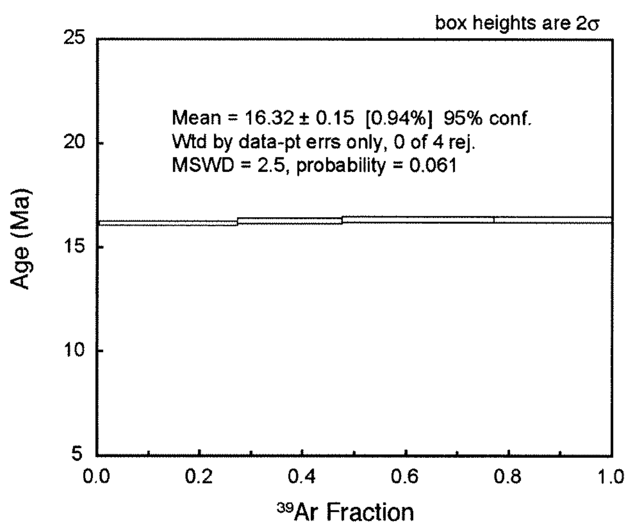
Step	Laser (#)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	1	27.60	0.0103	0.0040	4.3663	50.3039	95.6%	30.2%	25.24	0.07
2	2	27.95	0.0128	0.0053	4.1067	40.5831	94.3%	58.6%	25.22	0.10
3	3	28.84	0.0117	0.0082	4.1722	44.5695	91.5%	87.4%	25.23	0.10
4	4	27.84	0.0038	0.0039	1.8163	136.6201	95.7%	100.0%	25.50	0.12

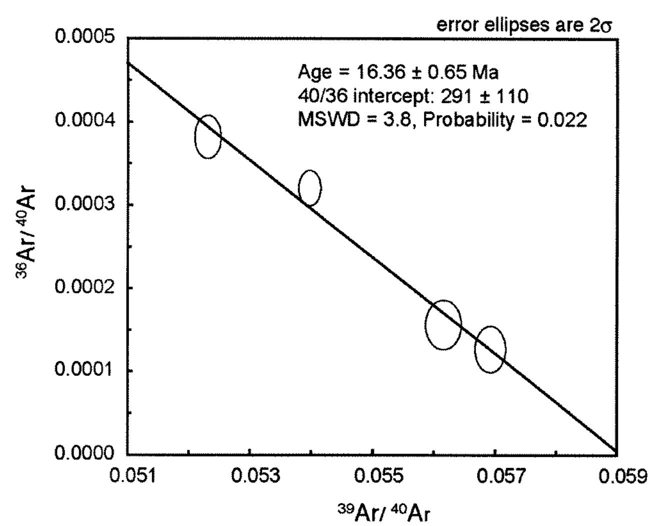




JC02-PF46 sanidine Mass: 5.2 mg Total Fusion Age: 16.33 ± 0.06 Ma J = 0.0005381 ± 0.3%

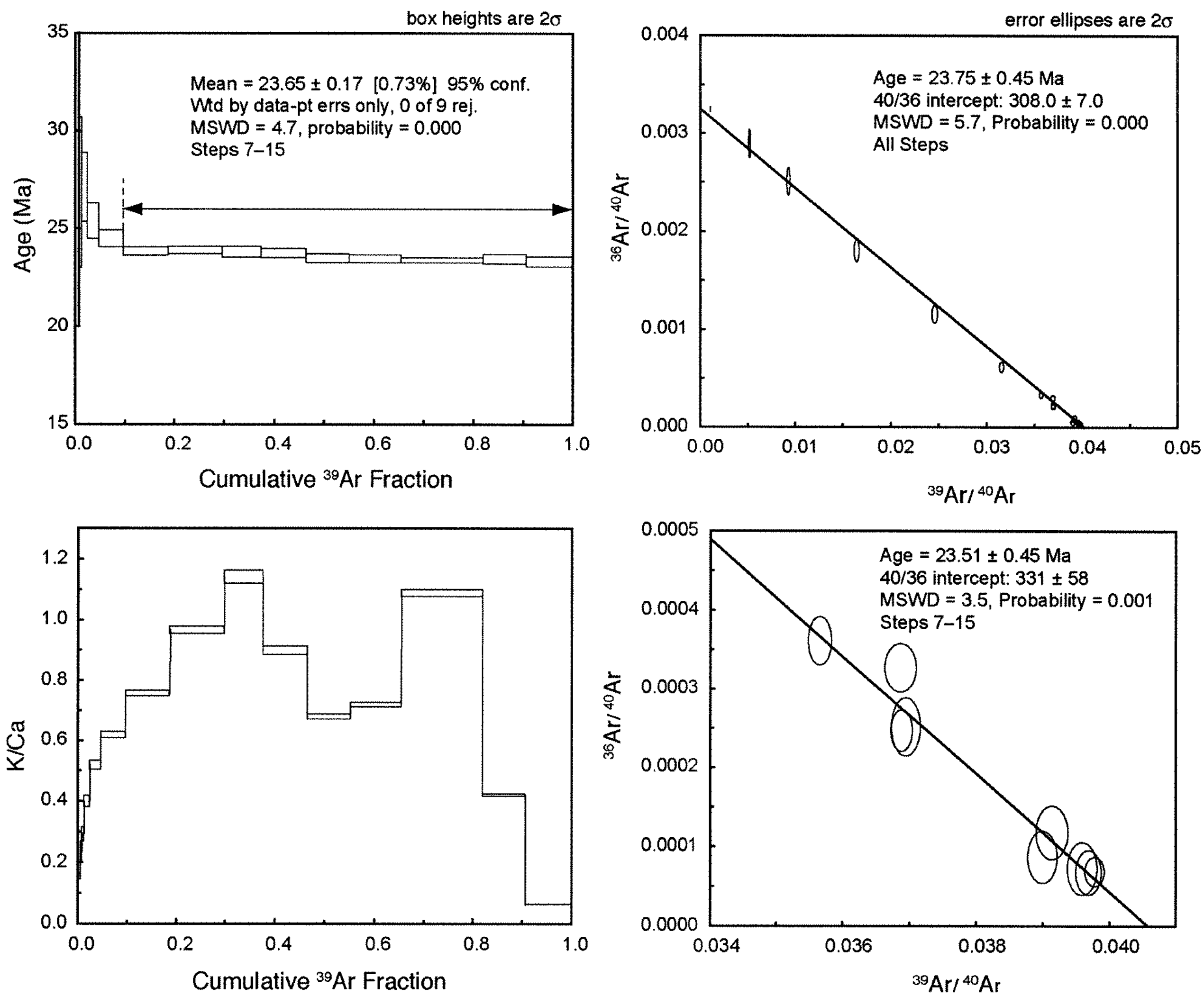
Step	Laser (#)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	1	18.56	0.0056	0.0060	4.8648	93.4830	90.4%	27.1%	16.21	0.05
2	2	17.84	0.0021	0.0028	4.1189	244.1228	95.1%	50.1%	16.40	0.07
3	3	19.16	0.0036	0.0073	5.3026	143.9187	88.6%	79.7%	16.40	0.06
4	4	17.60	0.0043	0.0023	3.6446	120.6767	96.0%	100.0%	16.33	0.06





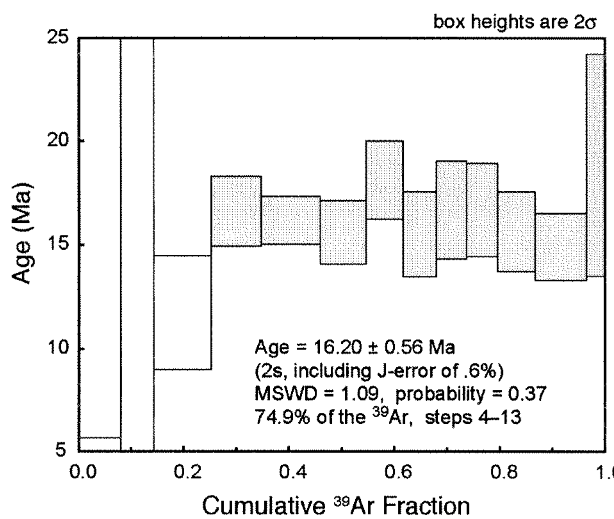
JC02-PF21 basalt Mass: 23.3 mg Total Fusion Age: 23.89 ± 0.19 Ma J = 0.0005324 ± 0.7%

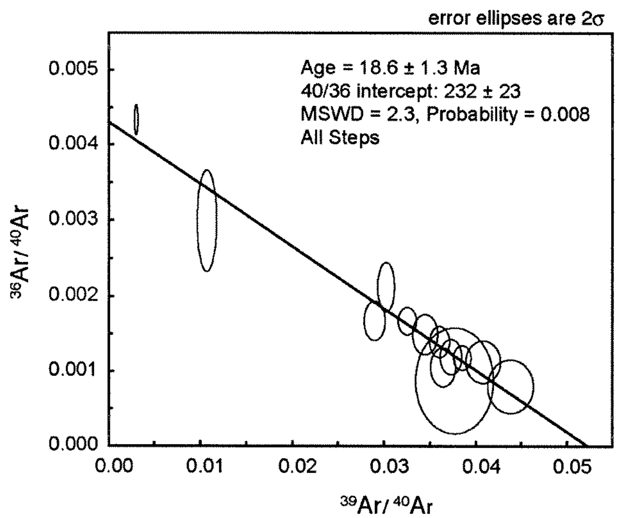
Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	550	1152.98	3.1109	3.7350	0.2800	0.1667	4.3%	0.3%	47.00	9.94
2	600	198.95	2.1078	0.5758	0.1812	0.2463	14.4%	0.6%	27.61	3.68
3	650	109.46	1.7197	0.2754	0.3926	0.3020	25.5%	1.1%	26.88	1.90
4	700	61.33	1.2772	0.1115	0.8880	0.4067	46.1%	2.1%	27.14	0.87
5	750	40.86	0.9910	0.0482	1.8505	0.5243	64.9%	4.4%	25.43	0.45
6	800	31.78	0.8355	0.0206	4.0739	0.6220	80.6%	9.4%	24.55	0.21
7	850	28.08	0.6842	0.0103	7.3814	0.7596	88.9%	18.5%	23.92	0.11
8	900	27.14	0.5380	0.0069	8.9497	0.9662	92.3%	29.5%	23.98	0.09
9	950	27.10	0.4565	0.0070	6.3759	1.1387	92.2%	37.3%	23.90	0.13
10	1000	25.66	0.5775	0.0024	7.2459	0.9000	96.9%	46.3%	23.82	0.11
11	1050	25.27	0.7604	0.0021	7.1001	0.6835	97.2%	55.0%	23.56	0.12
12	1100	25.21	0.7185	0.0020	8.4712	0.7234	97.4%	65.4%	23.54	0.10
13	1150	25.16	0.4785	0.0019	13.4379	1.0864	97.5%	81.9%	23.47	0.07
14	1200	25.56	1.2171	0.0034	7.0932	0.4268	95.7%	90.6%	23.51	0.12
15	1300	27.02	6.7612	0.0104	7.5713	0.0765	86.9%	100.0%	23.39	0.13

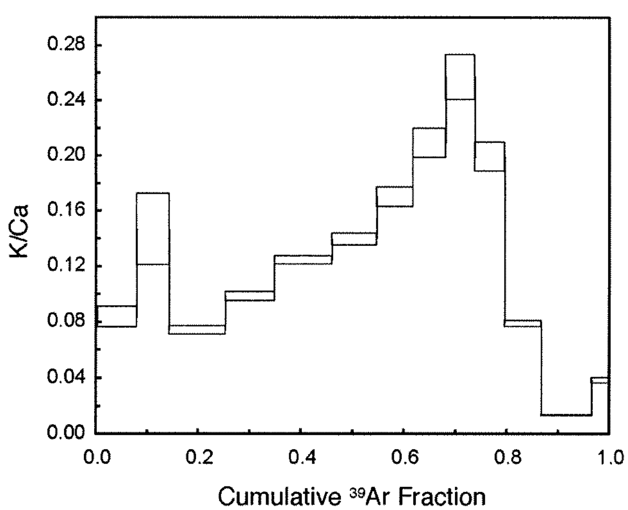


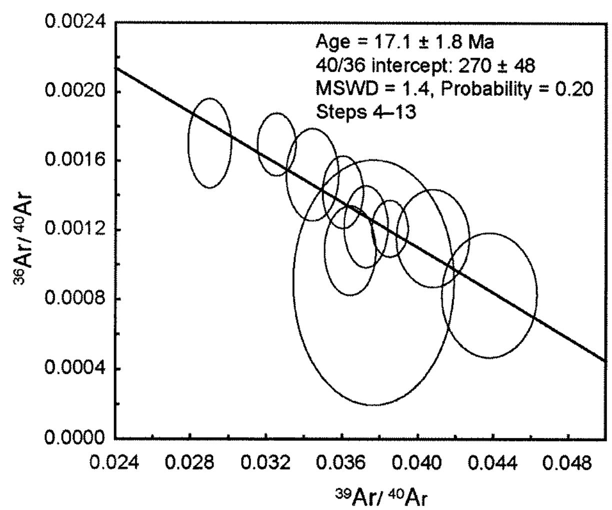
JC02-PF24 basalt   Mass: 10.7 mg   Total Fusion Age: 14.19 ± 3.00 Ma   J = 0.0005416 ± 0.3%

Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar(%) (%)	Age (Ma)	± 1σ
1	600	356.03	6.0624	1.5427	0.3173	0.0854	-28.2%	7.7%	-100.42	20.50
2	750	94.66	3.5101	0.2850	0.2608	0.1477	10.7%	14.1%	10.39	8.94
3	900	33.00	6.7915	0.0723	0.4513	0.0761	33.8%	25.1%	11.82	1.36
4	950	26.79	5.1736	0.0340	0.3945	0.1001	61.1%	34.7%	16.65	0.82
5	1000	25.93	4.1247	0.0324	0.4596	0.1256	61.9%	45.9%	16.21	0.56
6	1033	27.74	3.6850	0.0403	0.3572	0.1407	56.1%	54.5%	15.65	0.75
7	1066	27.46	3.0353	0.0306	0.2894	0.1709	66.3%	61.6%	18.13	0.93
8	1100	29.07	2.4787	0.0448	0.2636	0.2094	53.8%	68.0%	15.56	1.00
9	1133	34.59	2.0211	0.0593	0.2370	0.2569	48.8%	73.7%	16.72	1.16
10	1166	22.82	2.5992	0.0197	0.2398	0.1996	73.6%	79.6%	16.71	1.10
11	1200	24.44	6.3979	0.0298	0.2925	0.0809	62.2%	86.7%	15.69	0.94
12	1250	30.06	31.5565	0.0580	0.3984	0.0161	35.9%	96.6%	14.96	0.79
13	1300	26.34	12.6574	0.0268	0.1386	0.0407	66.6%	100.0%	18.88	2.65



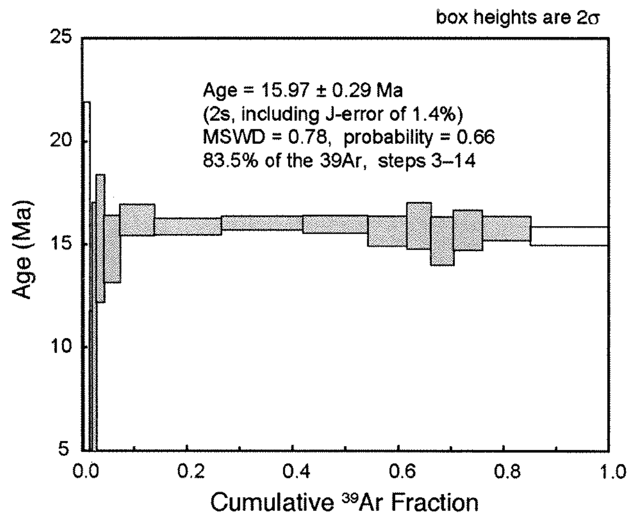


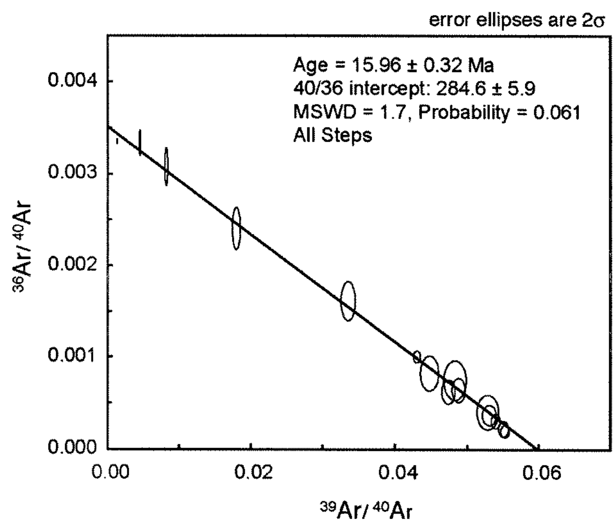


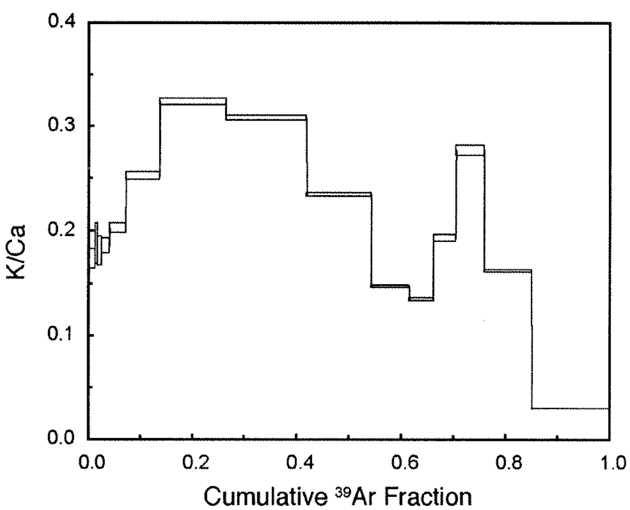


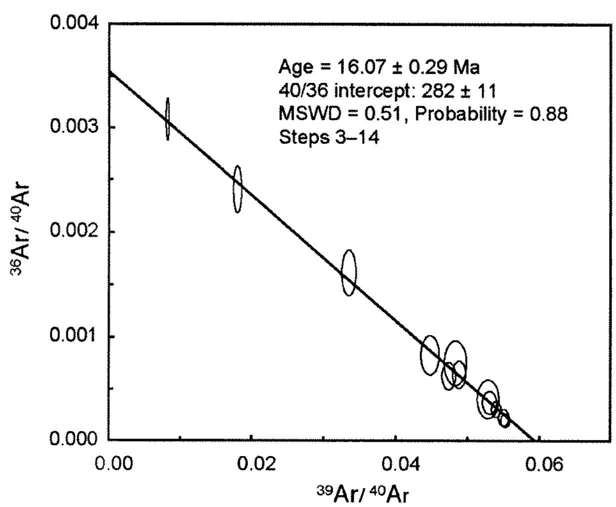
JC02-PF23 basalt Mass: 15.1 mg Total Fusion Age: 15.65 ± 0.45 Ma J = 0.0005315 ± 0.7%

Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	550	941.30	2.9596	3.1543	0.3354	0.1753	1.0%	1.0%	8.99	6.45
2	600	234.56	2.7378	0.7831	0.1874	0.1895	1.3%	1.6%	3.16	4.36
3	650	126.05	2.8467	0.3887	0.2459	0.1822	8.7%	2.4%	10.88	3.10
4	700	56.06	2.7673	0.1359	0.4977	0.1875	28.0%	3.9%	15.37	1.52
5	750	30.00	2.5417	0.0494	0.9881	0.2042	50.7%	7.0%	14.86	0.80
6	800	21.13	2.0515	0.0143	2.1178	0.2531	79.2%	13.5%	16.27	0.37
7	850	18.56	1.6048	0.0066	4.1281	0.3236	88.7%	26.3%	15.94	0.19
8	900	18.12	1.6849	0.0046	5.0221	0.3082	91.8%	41.8%	16.11	0.16
9	950	18.20	2.2078	0.0052	4.0016	0.2351	90.6%	54.1%	16.05	0.21
10	1000	20.50	3.4792	0.0145	2.3738	0.1490	77.9%	61.5%	15.73	0.36
11	1050	22.34	3.7772	0.0198	1.4710	0.1372	72.5%	66.0%	15.99	0.55
12	1100	20.73	2.6639	0.0167	1.4085	0.1948	75.2%	70.4%	15.26	0.58
13	1150	18.95	1.8728	0.0086	1.7577	0.2772	85.7%	75.8%	15.76	0.48
14	1200	18.85	3.1624	0.0083	2.9986	0.1640	85.8%	85.1%	15.87	0.29
15	1300	23.05	15.3376	0.0271	4.7767	0.0335	60.7%	100.0%	15.49	0.21



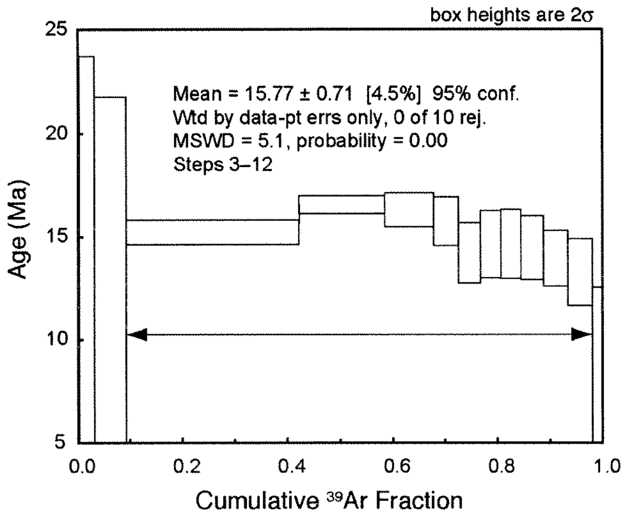


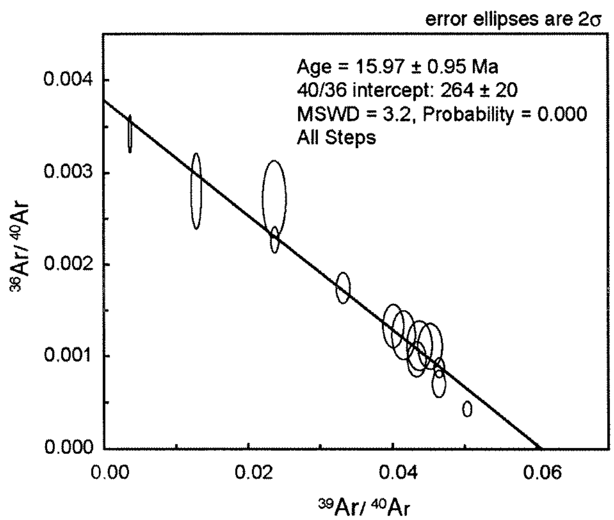


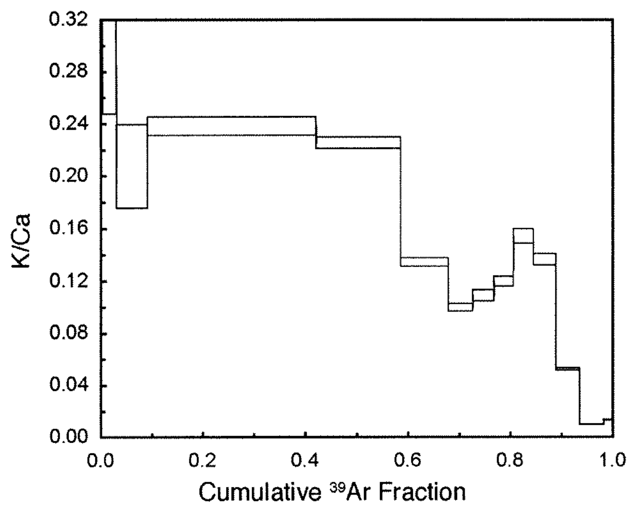


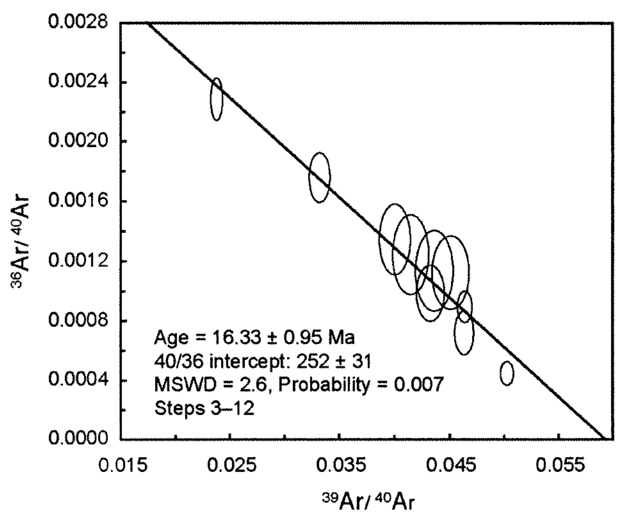
JC02-PF25 basalt Mass: 25.1 mg Total Fusion Age: 14.65 ± 1.13 Ma J = 0.0005393 ± 0.3%

Step	Temp (°C)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$ x 10^{-15} mol	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	± 1σ
1	600	288.57	1.7178	0.9876	0.2611	0.3023	-1.2%	2.8%	-3.10	13.39
2	750	78.78	2.5682	0.2220	0.5660	0.2021	16.5%	9.0%	12.94	4.41
3	900	21.57	2.1421	0.0201	3.0452	0.2423	71.7%	42.1%	15.28	0.30
4	950	19.90	2.3223	0.0098	1.4993	0.2235	84.5%	58.4%	16.61	0.22
5	1000	21.55	3.7514	0.0167	0.8624	0.1382	75.8%	67.8%	16.36	0.41
6	1033	23.07	5.1665	0.0242	0.4410	0.1002	67.4%	72.6%	15.79	0.59
7	1066	22.12	4.7316	0.0262	0.3849	0.1095	63.5%	76.8%	14.27	0.73
8	1100	22.89	4.2941	0.0272	0.3534	0.1207	63.5%	80.6%	14.70	0.81
9	1133	24.10	3.2856	0.0309	0.3583	0.1578	61.1%	84.5%	14.72	0.83
10	1166	24.95	3.7456	0.0346	0.4001	0.1384	57.9%	88.8%	14.53	0.76
11	1200	30.02	9.3815	0.0550	0.4305	0.0550	43.7%	93.6%	14.02	0.67
12	1250	41.02	39.3824	0.1024	0.4146	0.0128	19.8%	98.2%	13.36	0.80
13	1300	41.44	30.6974	0.1196	0.1617	0.0165	9.7%	100.0%	8.06	2.29









DATA REPOSITORY ITEM DR-2, FISSION-TRACK LENGTH DATA

Fission-Track Analytical Procedures

The following is a summary of key laboratory procedures. Apatites were etched for 20 s in 5N nitric acid at room temperature. Grains were dated by external detector method with muscovite detectors. Samples were irradiated in well thermalized positions of Oregon State University TRIGA reactor. CN5 dosimetry glasses with muscovite external detectors were used as neutron flux monitors. External detectors were etched in 48% HF. Tracks counted with Zeiss Axioskop microscope with 100x air objective, 1.25x tube factor, 10x eyepieces, transmitted light with supplementary reflected light as needed; external detector prints were located with Kinetek automated scanning stage (Dumitru, 1993). Only grains with c axes subparallel to slide plane were dated. Ages calculated using zeta calibration factor of 367.6 ± 5.0. Ages reported are the fission-track central age of Galbraith and Laslett (1993). Confined tracks lengths were measured only in apatite grains with c axes subparallel to slide plane; only horizontal tracks measured (within ±≈5-10°), following protocols of Laslett and others (1982). Lengths were measured with computer digitizing tablet and drawing tube, calibrated against stage micrometer (Dumitru, 1993). Confined track lengths were measured along with angles of tracks to the grains' c-axes and the Dpar track entrance diameter, following protocols of Ketcham and others (1999, 2000); confined tracks hosted by surface tracks and by cleavage surfaces were both measured. Age calculations were done with Microsoft Excel® program by J. Colgan.

References

Dumitru, T.A., 1993, A new computer-automated microscope stage system for fission-track analysis: Nuclear Tracks and Radiation Measurements, v. 21, p. 575-580.

Galbraith, R.F., 1981, On statistical models for mixed fission-track ages: Nuclear Tracks and Radiation Measurements, v. 5, p. 471-478.

Galbraith, R.F., and Laslett, G.M., 1993, Statistical models for mixed fission-track ages: Nuclear Tracks and Radiation Measurements, v. 21, p. 459-470.

Green, P.F., 1981, A new look at statistics in fission-track dating: Nuclear Tracks and Radiation Measurements, v. 5, p. 77-86.

Hurford, A.J., and Green, P.F., 1983, The zeta age calibration in fission-track dating: Chemical Geology, v. 41, p. 285-317.

Ketcham, R.A., Donelick, R.A., and Carlson, W.D., 1999, Variability of apatite fission-track annealing kinetics. 3. Extrapolation to geological time scales: American Mineralogist, v. 84, p. 1235-1255.

Ketcham, R.A., Donelick, R.A., and Donelick, M.B., 2000, AFTSolve: A program for multi-kinetic modeling of apatite fission-track data: Geological Materials Research, v. 2, p. 1-32 (an entirely electronic journal at http://gmr.minsocam.org/papers/v2/2n1/v2n1abs.html).

Laslett, G.M., Kendall, W.S., Gleadow, A.J.W., and Duddy, I.R., 1982, Bias in the measurements of fission-track length distributions: Nuclear Tracks and Radiation Measurements, v. 6, p. 79-85.

Fission-track Length Data

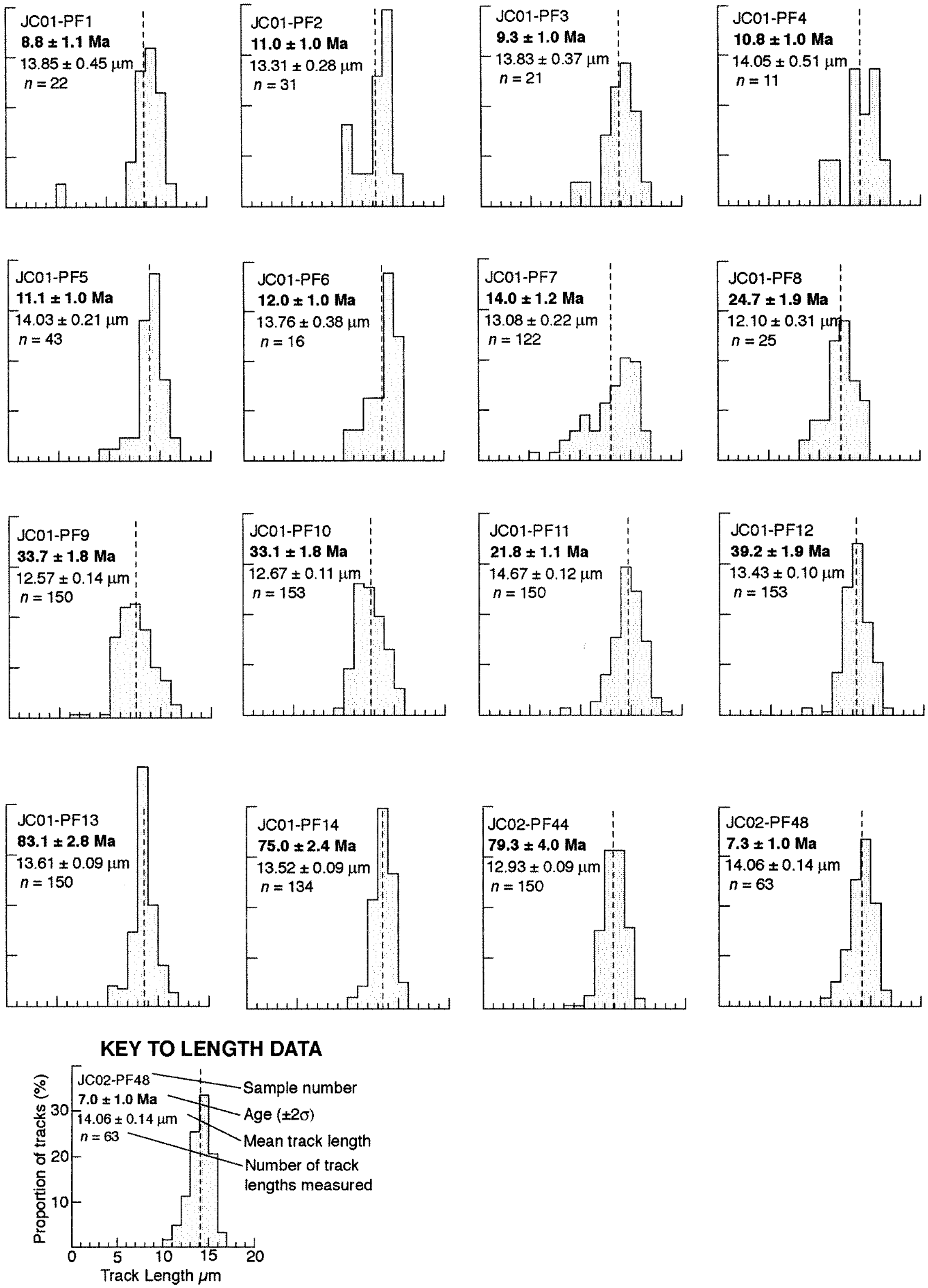


TABLE DR-3. GEOCHEMICAL ANALYSES OF VOLCANIC ROCKS FROM THE PINE FOREST RANGE

Rock Type	Andesite porphyry (Ta)		Basalt Flows (Tob)	Tuff of Alder Creek (Tac)		Ashdown Tuff (Tat)		
Sample #	JC02-PF20	JC02-PF49	JC02-PF27	JC02-PF10	JC02-PF50	JC02-PF28	JC03-PF60A	JC03-PF60B
Lat (°N)	41° 47' 00"	41° 42' 34"	41° 46' 48"	41° 47' 42"	41° 42' 41"	41° 49' 46"	41° 35' 34"	41° 35' 34"
Long (°W)	118° 41' 27"	118° 45' 16"	118° 40' 07"	118° 41' 40"	118° 47' 20"	118° 42' 01"	118° 50' 55"	118° 50' 55"
Unnormalized Major Elements (Weight %):								
SiO2	59.69	61.97	54.53	68.43	67.86	71.02	68.91	70.61
Al2O3	17.94	17.94	16.20	16.46	15.71	14.23	15.53	13.19
TiO2	0.98	0.59	1.09	0.54	0.52	0.42	0.51	0.38
FeO	5.83	3.86	6.83	2.32	2.31	2.29	2.22	1.99
MnO	0.08	0.07	0.11	0.12	0.08	0.07	0.14	0.15
CaO	5.80	4.25	7.23	1.00	1.18	0.31	0.49	0.29
MgO	2.05	1.55	5.66	0.29	0.36	0.24	0.33	0.23
K2O	2.59	2.84	1.94	5.57	5.15	5.47	5.23	6.49
Na2O	4.37	4.72	3.76	5.25	5.18	5.01	5.69	3.89
P2O5	0.49	0.33	0.50	0.03	0.37	0.13	0.12	0.05
XRF Trace Elements (ppm):								
Ni	36	5	116	6	5	7	9	1
Cr	35	5	228	0	0	8	5	0
V	137	63	172	33	19	16	19	16
Ga	21	23	17	19	18	23	18	24
Cu	37	14	62	6	6	3	4	2
Zn	94	85	89	56	53	71	82	106
ICP-MS Trace Elements (ppm):								
Ba	1175.44	1430.57	1049.11	936.44	1099.19	176.85	341.66	13.25
Th	5.40	6.13	5.57	17.95	16.59	15.81	12.51	18.32
Nb	7.98	8.63	8.71	24.98	23.20	42.70	36.23	52.50
Y	15.83	16.19	15.70	30.08	23.69	46.74	39.45	54.05
Hf	3.98	4.61	3.49	10.25	9.74	12.35	10.15	15.21
Ta	0.51	0.50	0.52	1.70	1.61	2.97	2.45	3.60
U	1.53	1.94	1.73	5.88	5.50	5.26	4.26	6.18
Pb	12.38	14.02	10.31	16.76	10.18	16.01	14.69	22.00
Rb	46.57	52.70	48.33	144.33	134.46	142.83	119.74	169.38
Cs	0.73	0.51	2.03	5.27	3.99	3.12	2.87	5.78
Sr	1087.38	1048.75	1021.61	148.70	183.96	44.65	58.99	2.75
Sc	11.05	4.60	20.03	5.83	5.21	7.37	8.66	7.92
Zr	146.21	177.60	130.21	410.80	380.13	480.54	390.33	591.81
La	33.62	39.44	28.92	42.01	37.54	53.97	47.52	63.39
Ce	63.34	72.48	54.78	70.24	69.16	100.34	92.89	119.18
Pr	7.65	8.58	6.52	8.53	7.50	11.27	10.33	13.21
Nd	31.62	33.48	27.41	31.87	27.66	42.54	40.32	48.50
Sm	6.44	6.62	5.77	6.25	5.47	9.13	8.84	10.46
Eu	1.80	1.78	1.68	1.28	1.29	0.86	1.32	0.77
Gd	4.94	4.40	4.51	5.28	4.40	7.83	7.63	8.77
Tb	0.63	0.60	0.61	0.84	0.69	1.33	1.22	1.52
Dy	3.21	3.22	3.22	5.05	4.22	8.18	7.35	9.46
Ho	0.58	0.57	0.59	1.04	0.86	1.67	1.49	1.95
Er	1.41	1.47	1.46	2.96	2.45	4.68	3.98	5.48
Tm	0.19	0.21	0.20	0.46	0.38	0.73	0.61	0.85
Yb	1.16	1.32	1.20	3.05	2.54	4.72	3.76	5.44
Lu	0.18	0.21	0.18	0.50	0.43	0.76	0.61	0.88

TABLE DR-3 (cont.)

Rock Type	Basalt flows in Ts		Steens Basalt (Tsb)		(sills)	Miocene Tuff (Tmt)	
Sample #	JC02-PF21	JC02-PF13	JC02-PF23	JC02-PF25	JC03-PF24	JC02-PF52	JC02-PF45
Lat (°N)	41° 47' 57"	41° 48' 01"	41° 47' 21"	41° 46' 10"	41° 47' 01"	41° 44' 17"	41° 45' 31"
Long (°W)	118° 42' 18"	118° 41' 38"	118° 42' 13"	118° 35' 27"	118° 42' 04"	118° 50' 09"	118° 42' 53"
Unnormalized Major Elements (Weight %):							
SiO2	52.00	49.53	47.12	46.68	48.15	74.19	76.10
Al2O3	16.37	16.70	16.93	15.93	15.59	11.30	11.53
TiO2	1.48	1.70	1.85	1.67	1.34	0.21	0.21
FeO	8.45	9.87	11.82	11.12	10.35	2.88	2.63
MnO	0.10	0.18	0.18	0.19	0.18	0.04	0.04
CaO	7.94	8.60	9.28	9.26	10.74	0.23	0.23
MgO	5.38	7.15	7.69	9.67	8.94	0.16	0.09
K2O	2.41	1.54	0.85	0.70	0.66	5.65	4.68
Na2O	3.29	3.07	2.86	2.63	2.48	2.93	4.40
P2O5	0.64	0.50	0.29	0.26	0.18	0.02	0.04
XRF Trace Elements (ppm):							
Ni	152	97	160	225	172	1	3
Cr	311	156	81	144	332	0	0
V	213	256	294	282	280	3	13
Ga	18	17	19	18	14	22	23
Cu	56	93	†193	†178	139	4	3
Zn	83	90	96	92	72	181	167
ICP-MS Trace Elements (ppm):							
Ba	790.46	552.13	293.17	241.93	217.79	36.28	46.44
Th	3.98	2.44	0.55	0.51	0.61	17.96	17.59
Nb	21.03	7.08	6.85	6.03	4.09	33.01	27.08
Y	21.50	22.83	24.63	22.55	20.87	99.43	89.74
Hf	4.53	2.71	3.05	2.75	2.21	16.77	16.38
Ta	1.24	0.39	0.45	0.39	0.25	2.19	2.14
U	1.02	0.68	0.17	0.18	0.21	6.83	5.91
Pb	4.63	5.20	2.04	1.85	1.64	29.54	25.28
Rb	69.42	17.43	11.81	9.06	9.38	196.36	171.48
Cs	0.80	1.24	0.12	0.11	0.08	5.37	3.72
Sr	785.44	931.37	940.18	434.50	412.54	15.22	10.49
Sc	22.55	30.11	26.54	29.73	38.25	1.33	2.03
Zr	169.07	97.02	109.05	97.11	78.27	625.70	583.95
La	28.50	21.20	10.96	9.32	7.58	68.52	65.12
Ce	55.64	44.08	25.42	21.51	16.87	133.33	122.48
Pr	6.77	5.67	3.52	3.00	2.35	16.29	15.67
Nd	28.62	25.41	16.93	14.51	11.39	67.79	65.03
Sm	6.24	6.00	4.77	4.25	3.50	16.83	15.99
Eu	1.92	1.89	1.70	1.51	1.27	0.76	0.84
Gd	5.31	5.29	5.00	4.54	3.90	16.27	14.91
Tb	0.76	0.77	0.80	0.75	0.65	2.81	2.59
Dy	4.22	4.40	4.80	4.52	4.07	17.63	16.16
Ho	0.79	0.86	0.96	0.91	0.82	3.67	3.29
Er	2.04	2.26	2.45	2.34	2.20	10.27	9.20
Tm	0.28	0.32	0.34	0.32	0.31	1.51	1.39
Yb	1.68	1.92	2.05	1.94	1.83	9.44	8.73
Lu	0.26	0.29	0.31	0.30	0.29	1.47	1.37

TABLE DR-4, RECALCULATED $^{40}Ar/^{39}Ar$ AGES

Reference	Unit	Cited Age	Laboratory	Standard	Age TCs[4] = 27.92
Henry and Castor, 2000	Idaho Canyon Tuff	16.30 ± 0.06	NMT[1]	FCT[3] = 27.84	16.12 ± 0.06
Swisher, 1990	Idaho Canyon Tuff	16.48 ± 0.04	BGC[2]	FCT = 27.84	16.30 ± 0.04
Swisher, 1990	Steens Basalt (top)	16.583 ± 0.048	BGC	FCT = 27.84	16.40 ± 0.05
Swisher, 1990	Steens Basalt	16.589 ± 0.022	BGC	FCT = 27.84	16.41 ± 0.02
Swisher, 1990	Ashdown Tuff	26.55 ± 0.03	BGC	FCT = 27.84	26.26 ± 0.03

[1]New Mexico Tech

[2]Berkeley Geochronology Center

[3]Fish Canyon Tuff

[4]Taylor Creek Rhyolite