Data Repository: Section 1 – Samples, Locations, and Types of Analyses

Sample #	Map unit, geographic locality and sequence number	Coordinates	**^{40}Ar/^{39}Ar Date**	Geochem-istry	Modal Analysis
SBDCP45	Red Lake Peak block-and-ash-flow tuff (Tbat); **6a**	38°42’50.6’’, 119°59’14.8’’		X	X
SBDCP64	Andesite block (from dome?) in (Tvdf2); **6a**	38°42’56.8’’, 120°01’25.0			X
SBDCP63	Block-and-ash-flow tuff in Little Round Top volcanic debris flow deposits (Tvdf2); **6a**	38°42’52.9’’, 120°01’25.7		X	X
SBDCP62	Red Lake Peak basalt lava flow (Tbl); **6a**	38°42’36.3’’, 120°01’07.2’’	X	X	
SBDCP19	Sentinels block-and-ash-flow tuff, E. Kirkwood (Taba3); **6b**			X	X
SBDCP16a	Sentinels block-and-ash-flow tuff, Melissa Coray Pk. (Taba3); **6b**			X	X
SBDCP49	Sentinels block-and-ash-flow tuff, Carson Spur (Taba3); **6b**	38°42’06.9’’, 120°05’43.9’’			X
SBDCP75	Sentinels block-and-ash-flow tuff, lower Thunder Mt. Trail (Taba3); **6b**	38°42’06.6’’, 120°06’13.4’’		X	
SBDCP61	Andesite block-and-ash-flow tuff W. Kirkwood (Taba3); **6b**	38°41’52.6’’, 120°05’19.5’’	X	X	X
SBDCP48	Andesite plug W. Kirkwood (Tap); **5**	38°40’13.5’’, 120°03’50.3’’			X
SBDCP 20	Andesite dike with peperite margins, E. Kirkwood; **5**	38°41’07.7’’, 120°03’42.2’’	X		X
SBDCP21	Andesite lava dome W. Kirkwood (Tad1); **5**	38°40’39.4’’, 120°04’23.3’’			X
SBDCP74	Andesite lava dome W. Kirkwood (Tad1); **5**	38°40’38.4’’, 120°04’26.2’’			X
SBDCP22	Andesite lava dome W. Kirkwood (Tad2); **5**	38°40’34.7’’, 120°04’25.9’’		X	X
SBDCP27	Andesite block and ash flow, E. Kirkwood (Taba2); **4**	38°41’18.0’’, 120°03’38.2’’		X	X
SBDCP-29	Reworked pumice lapilli tuff (Trt); **3**	38°42’46.1’’, 120°01’55.4’’	X		X
SBDCP23	Basaltic andesite intrusion Round Top (Tbai); **2**	38°40’03.2’’, 120°00’05.9’’		X	X
SBDCP-30	Red Lake Pk. Andesite block and ash flow tuff (Taba1); **2**	38°42’08.4’’, 120°00’01.8’’	X		X
SBDCP46	Trachyandesite block and ash flow of Carson Pass (Taba1); **2**	38°42’17.6’’, 119°59’36.5’’		X	X
SBDCP67	Basaltic andesite clast from debris flow in Tfdf; **2**	38°42’25.3’’, 120°06’20.9’’		X	
SBDCP33	Andesite block-and-ash-flow tuff Black Butte (Tabu); **n/a**	38°40’59.0’’, 120°01’23.6’’			X

Data Repository Section 2

Preliminary Geochemical Data from the Carson Pass – Kirkwood Area

After sample preparation by DeOreo, whole rock major oxide XRF analyses were conducted in Professor Keith Putirka's laboratory at California State University, Fresno. The X-ray fluorescence instrument is a PANalytical MagiX Pro, with a 4 kW X-ray tube. For analysis of the major oxides (SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MgO, MnO, CaO, Na_2O, K_2O and P_2O_5) fused glass beads are prepared. Powders are calcined overnight at 1000 ^oC (850-950 ^oC for granites and rhyolites), then ground again in an agate mortar and pestle. Fused beads are prepared from calcined powders using a 'pre-fused' flux from Claisse, with composition of 35% Li-tetraborate + 65% Li-metaborate and a sample:flux ratio of 1:6, and then fused into glass beads using the Claisse Fluxy fusion machine; LiI is used as a release agent.

Calibrations are based on U.S.G.S. rock powders: AGV-2 (andesite of Guano Valley), RGM-1 (Rhyolite of Glass Mountain), STM-1 (Syenite of Table Mtn.), SDC-1 (Mica Schist from Washington D.C. area), BHVO-2 (Hawaiian Basalt), BCR-2 (Columbia River basalt), W-2 (Diabase form VA), QLO-1 (Quartz latite of OR), GSP-2 (Silver Plume granodiorite, CO), and DTS-2 (Twin Sisters Dunite), and synthetic standards comprised of various proportions of the following oxides: consisting of Al_2O_3, SiO_2, Fe_2O_3, MgO and $NaH_2PO_4(H_2O)$ and KH_2PO_4. Pressed powder pellets are used for the analysis of the following trace elements: V, Cr, Co, Ni, Zn, Rb, Sr, Zr, Nb, Ba, La, Sm, Hf, Sc.

Major oxide data from three samples in sequence 2, two samples in sequence 4, three samples from sequence 6a, and four samples in sequence 6b are summarized in Table 1. All volcanic rock names are assigned based on the Le Bas et al. (1986) classification scheme (Fig. 1).

Several lines of geochemical evidence indicate that the Carson Pass / Kirkwood volcanics were erupted in a continental arc volcanic setting. According to the Le Bas classification scheme, some samples are somewhat trachytic (Fig. 1), but all rock types ranging from basalt to high silica andesite plot below the Irvine and Baragar (1971) alkali-silica curve (Fig. 2), indicating that they are subalkalic. It is therefore valid to plot these data on an AFM diagram (Fig. 2), which shows that the Carson Pass / Kirkwood volcanic fall on the calc-alkaline trend - typical of continental arc volcanic rocks. It is also evident in total alkali vs. silica space that all the Carson Pass / Kirkwood volcanics fall within the compositional boundaries established by Bullen and Clynne (1990) for Lassen Peak, which is a known continental arc volcano. Finally, on a K20 vs. silica diagram (Fig. 1), the Carson Pass / Kirkwood volcanics plot in the medium- to high-potassium fields of Gill (1981), which is comparable to continental arc volcanics from Lassen Peak (Bullen and Clynne, 1990) and Sonora Pass (Rood et al., in prep), and well below the values of younger, ultrapotassic volcanic rocks in the southern Sierra Nevada (Farmer et al., 2002; Feldstein and Lange, 1999).

Major element data suggest that the continental arc magmas of the Carson Pass / Kirkwood area matured to silicic compositions through a combination of fractional crystallization and crustal assimilation. On a total alkali vs. silica diagram, the data form a single, positively-sloping linear trend, where progressively more silicic rocks are increasingly enriched in alkalis. This is a general indicator of fractional crystallization and / or crustal assimilation (Busby et al., in press).

Harker diagrams of individual major element oxides vs. silica (Figs. 3, 4) also indicate fractional crystallization as a probable mode for magmatic evolution in the Carson Pass / Kirkwood area. Elements such as Fe, Ca, Mg, Ti, Mn, and Cr all decrease with increasing silica content (Fig. 3). This is interpreted to indicate fractional crystallization because these elements may be partitioned into mafic minerals such as olivine or clinopyroxene and removed from the system by a physical process such as density driven settling. Specifically, for this magmatic system, decrease of Fe and Ti with increasing silica indicates fractionation of magnetite (or a similar Fe-Ti oxide), and decrease of the Ca/Al ratio with increasing silica (Fig. 3) indicates fractionation of calcic clinopyroxene such as augite. As expected, the alkalis (Na and K) increase with increased silica content (Fig. 4) and are partitioned into later crystallizing phases such as sodic plagioclase and potassium feldspar.

These data offer conclusive evidence for fractional crystallization in the Carson Pass / Kirkwood magmatic system. Trace element and radiogenic isotope data are needed to quantify the contribution of crustal assimilation to the maturation of this magmatic system.

Conclusions

Preliminary whole rock major oxide analyses indicate that Miocene volcanic rocks of in the Carson Pass / Kirkwood area are subalkalic and follow the calc-alkaline trend, which is consistent with magmas formed in a continental volcanic arc setting. This is illustrated further by the similarity of the Carson Pass / Kirkwood volcanics to the volcanic rocks at Lassen Peak – a known continental arc stratovolcano. Magmas in the Carson Pass / Kirkwood area appear to have been isolated from any mantle source, and appear to have matured via fractional crystallization and crustal assimilation, but both trace element and radiogenic isotope data will be necessary to quantify the relative contribution of each of these processes.

References

Bullen, T.D., and Clynne, M.A., 1990, Trace element and isotopic constraints on magmatic evolution at Lassen volcanic center: Journal of Geophysical Research, B, Solid Earth and Planets, v. 95, p. 19,671-19,691.

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Feldstein, S.N., and Lange, R.A., 1999, Pliocene potassic magmas from the King's River region, Sierra Nevada, California: evidence of melting of a subduction-modified mantle: Journal of Petrology, v. 40, p. 1301-1320.

Gill, J., 1981, Orogenic andesites and plate tectonics: New York, NY, Springer-Verlag, 390 p.

Irvine, T.N., and Baragar, W.R., 1971, A guide to the chemical classification of the common volcanic rocks: Canadian Journal of Earth Science, v. 8, p. 523-548.

Le Bas, M.J., R.W., L.M., Streckeisen, A., and Zanettin, B., 1986, A chemical classification of volcanic rocks based on the total alkali-silica diagram: Journal of Petrology, v. 27, p. 745-750.

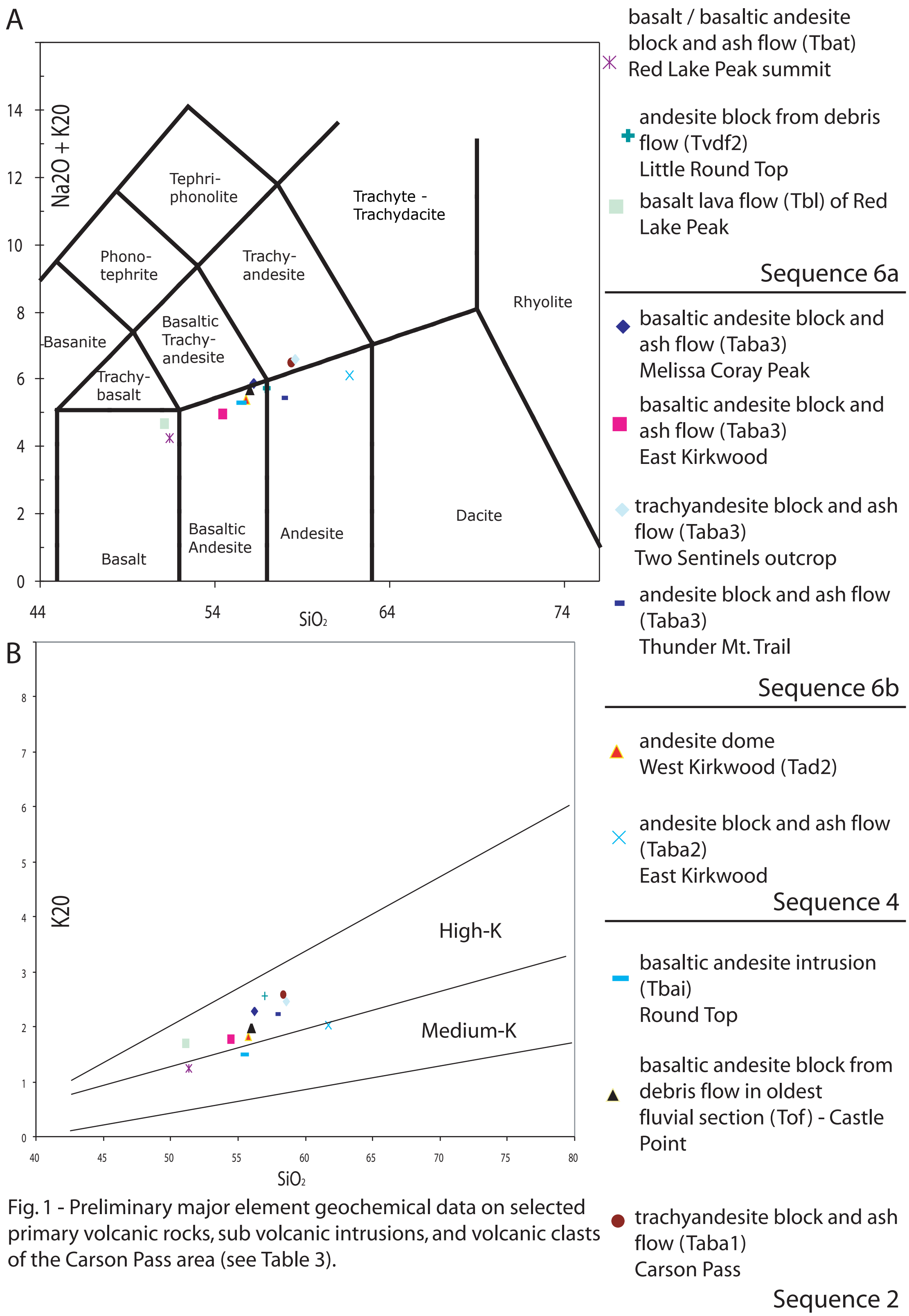


Fig. 1 - Preliminary major element geochemical data on selected primary volcanic rocks, sub volcanic intrusions, and volcanic clasts of the Carson Pass area (see Table 3).

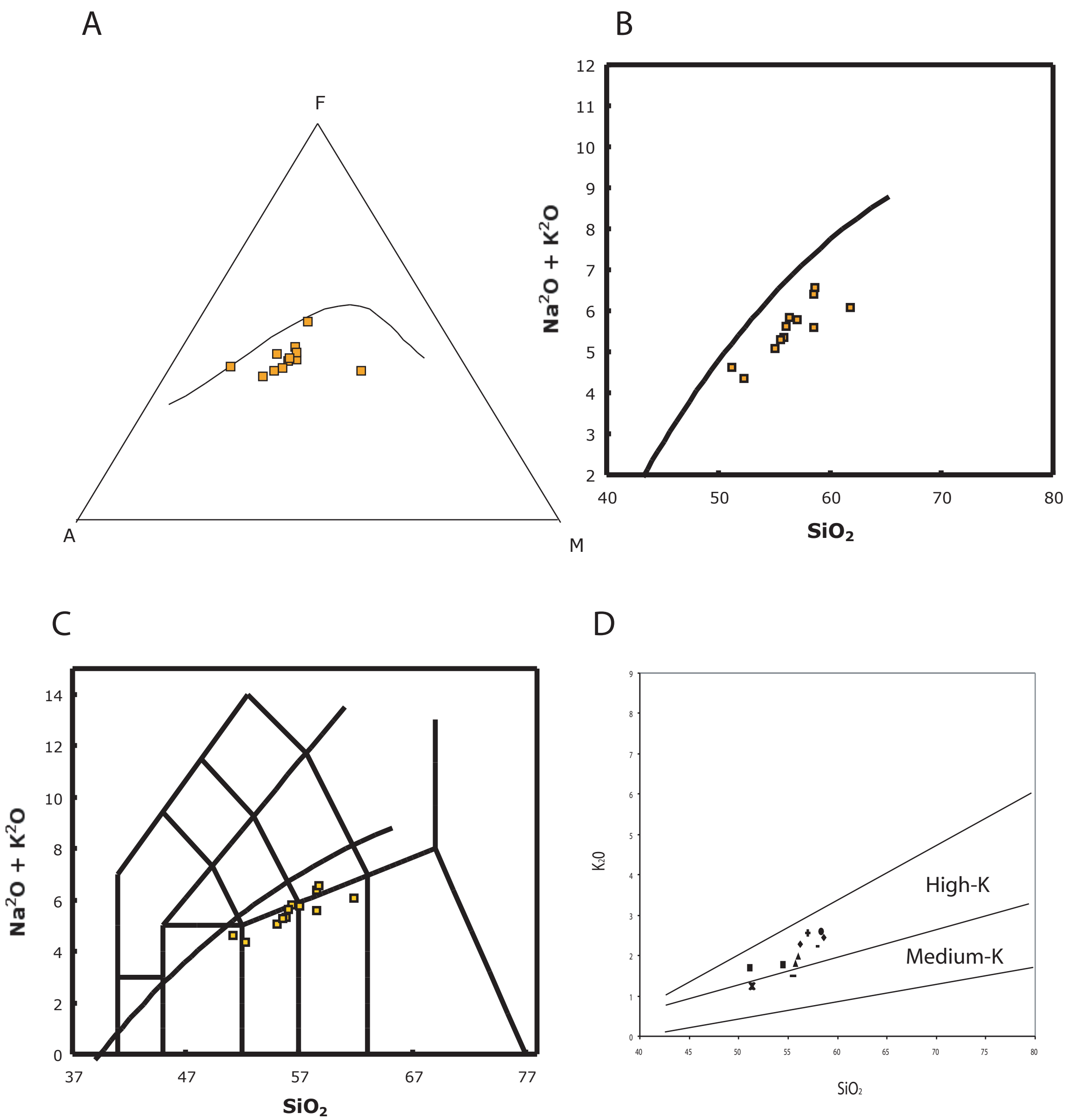
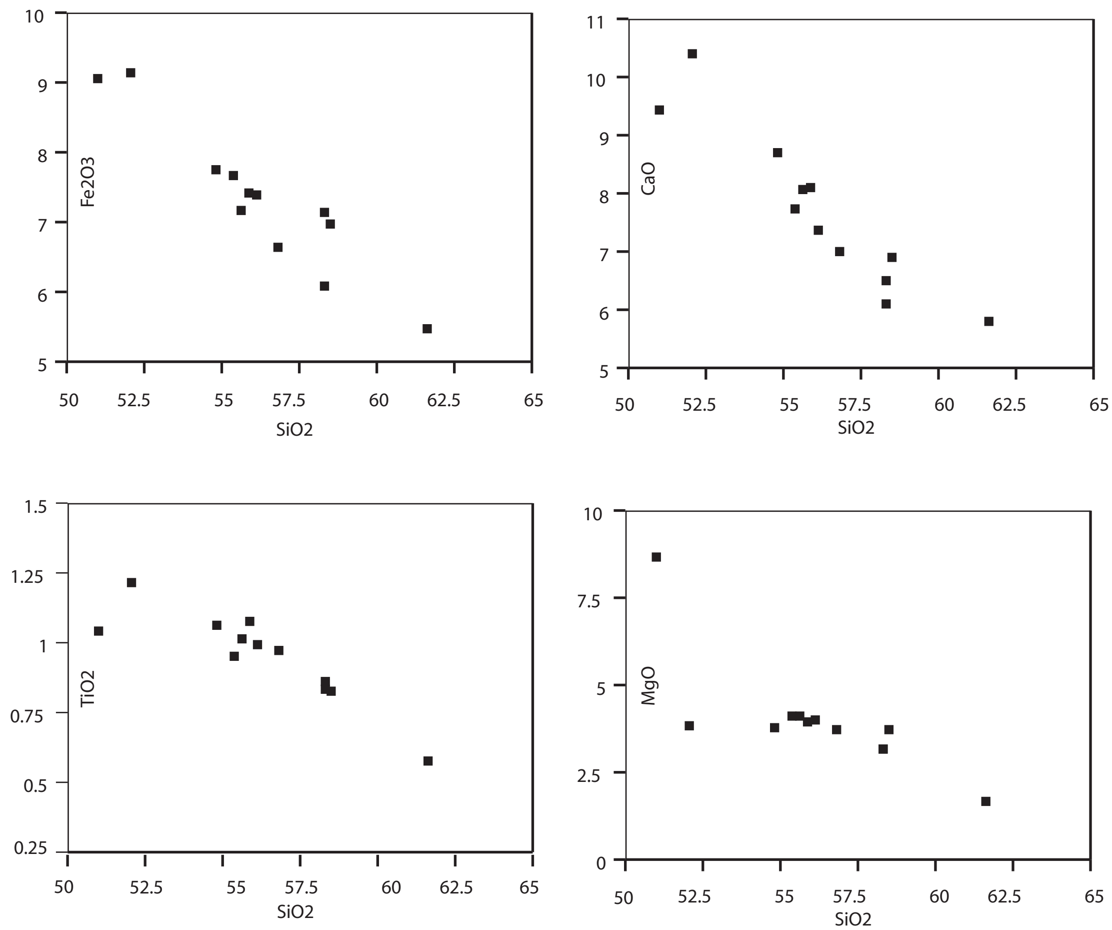


Figure 2 - Major element geochemical data from Carson Pass - Kirkwood area. A. AFM digram shows samples plot on calc-alkaline trend. B. Samples are sub-alkalic. C. Le Bas diagram showing positively sloping trend indicative of fractional crystallization. D. Samples are predominantly High-K.



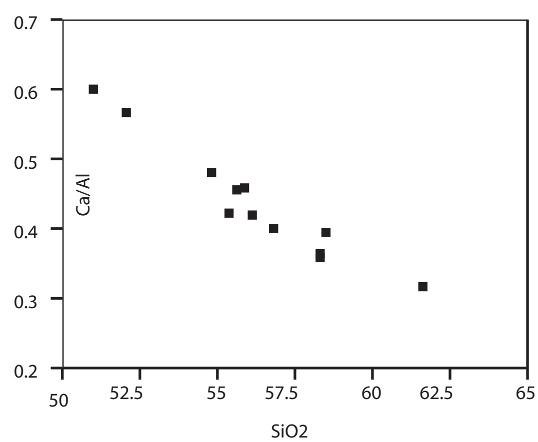


Figure 3 - Harker diagrams. The generally negatively sloping trends are evidence for fractional crystallization and/or crustal assimilation. Specifically, for this magmatic system, decrease of Fe and Ti with increasing silica indicates fractionation of magnetite (or a similar Fe-Ti oxide), and decrease of the Ca/Al ratio with increasing silica indicates fractionation of calcic clinopyroxene such as augite. Radiogenic isotope data would be needed to assess the contribution of crustal assimilation to the evolution of this magmatic system.

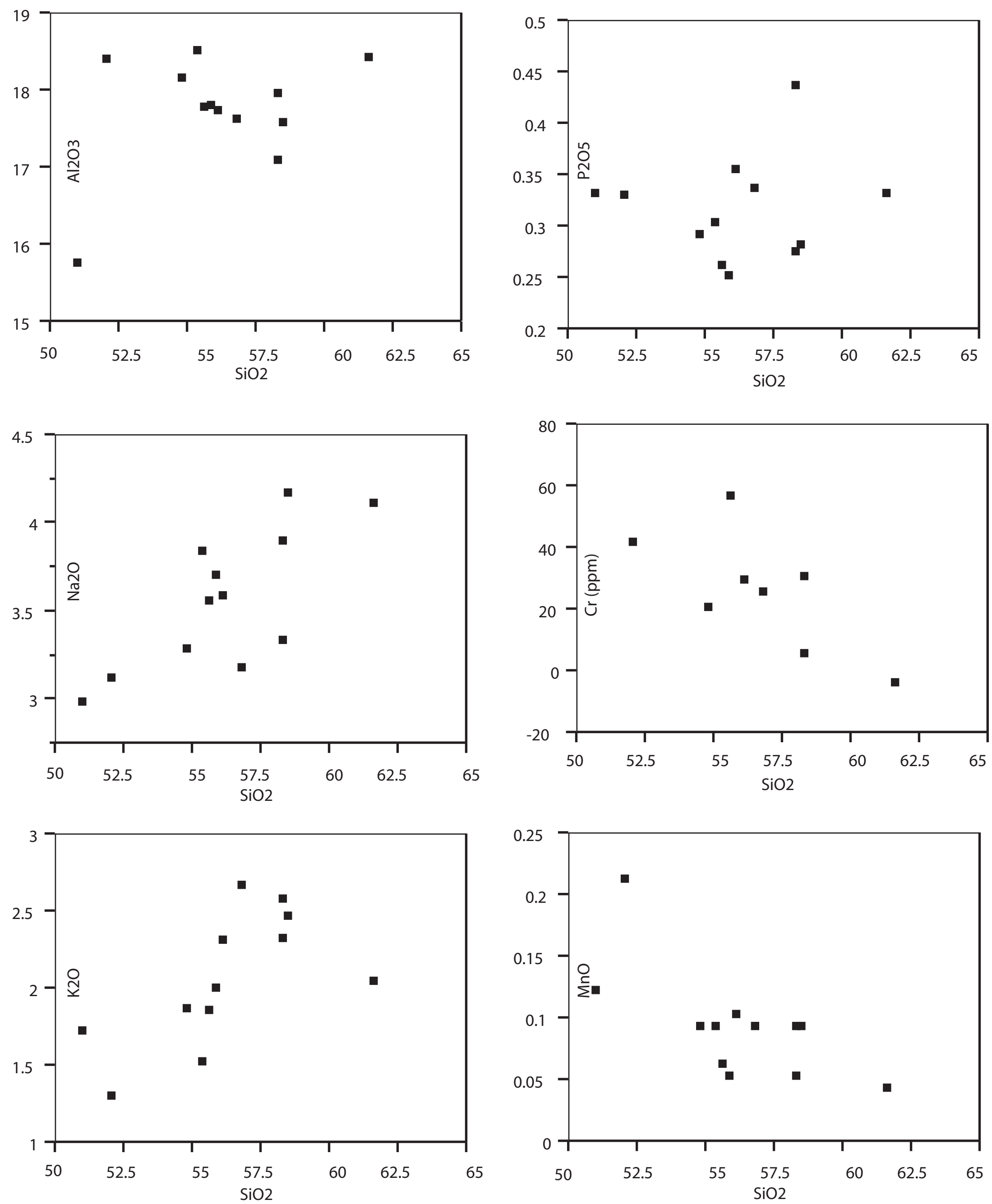


Figure 4

Table 1: Summary of Major Element Geochemistry for Carson Pass

Sample #	Field Name	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	Cr	P2O5	Ttl Alkali
SBDCP45-1	Red Lake Peak block and ash flow (Tbat)	51.38	1.18	18.03	9.01	0.21	3.71	10.29	3.02	1.25	42.4	0.322	4.27
SBDCP45-2		52.18	1.2	18.36	9.09	0.21	3.72	10.32	3.1	1.28	40.7	0.327	4.38
SBDCP63-1	Block and ash flow block in Little Round Top volcanic debris flow deposit (Tvdf2)	56.98	0.98	17.6	6.5	0.08	3.58	6.93	3.15	2.57	21.8	0.334	5.72
SBDCP63-2		56.94	0.96	17.57	6.57	0.09	3.6	6.95	3.16	2.64	24.3	0.334	5.8
SBDCP16a-1	Sentinels block-and-ash flow tuff, Melissa Coray Pk (Taba3)	56.24	0.98	17.69	7.34	0.1	3.87	7.31	3.57	2.29	28.3	0.352	5.86
SBDCP16a-1		56.27	0.98	17.72	7.34	0.1	3.87	7.3	3.56	2.29	26.6	0.356	5.85
SBDCP16a-2		55.88	0.99	17.55	7.47	0.1	3.86	7.25	3.54	2.25	27.9	0.352	5.79
SBDCP19-1	Sentinels block-and-ash flow tuff, East Kirkwood (Taba3)	54.47	1.08	17.88	7.55	0.09	3.62	8.5	3.22	1.77	16.7	0.289	4.99
SBDCP19-2		54.95	1.05	18.12	7.7	0.09	3.69	8.63	3.27	1.85	19.3	0.289	5.12
SBDCP75-1	Sentinels block-and-ash flow, lower Thunder Mt. Trail (Taba3)	57.84	0.83	17.69	6.93	0.09	3.02	6.36	3.24	2.22	6	0.266	5.46
SBDCP75-1		57.78	0.83	17.69	6.94	0.09	3.01	6.37	3.23	2.22	8.5	0.268	5.45
SBDCP75-2		58.44	0.82	17.94	7.07	0.09	3.07	6.44	3.31	2.3	4	0.269	5.61
SBDCP75-2		58.43	0.82	17.91	7.07	0.09	3.07	6.43	3.31	2.3	4.3	0.271	5.61
SBDCP61-1	Sentinels block-and-ash flow tuff, W Kirkwood (Taba3)	58.6	0.81	17.53	6.93	0.09	3.63	6.82	4.15	2.45		0.279	6.6

Table 1 Continued

Sample #	Field Name	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	Cr	P2O5	Ttl Alkali
SBDCP62-1	Red Lake Peak basalt lava flow (aphyric) (Tbl)	51.11	1.03	15.71	8.99	0.12	8.58	9.36	2.96	1.7		0.328	4.66
SBDCP22-1	Andesite lava dome (Tad2), W Kirkwood	55.79	1	17.71	7.11	0.06	4	7.99	3.55	1.83	55.2	0.261	5.38
SBDCP22-1		55.77	1	17.73	7.11	0.06	4	8	3.54	1.83	55.7	0.259	5.37
SBDCP27-1	Andesite block and ash flow tuff, E Kirkwood (Taba2)	61.73	0.56	18.37	5.42	0.04	1.58	5.73	4.09	2.02	-4.9	0.329	6.11
SBDCP27-1		61.76	0.56	18.38	5.42	0.04	1.58	5.74	4.03	2.02	-4	0.328	6.05
SBDCP27-2		61.38	0.59	18.29	5.43	0.04	1.58	5.71	4	1.98	2.8	0.327	5.98
SBDCP27-2		61.44	0.59	18.35	5.43	0.04	1.57	5.72	3.99	1.98	3.5	0.327	5.97
SBDCP23-1	Basaltic andesite intrusion, Round Top (Tbai)	55.47	0.94	18.46	7.6	0.09	3.99	7.67	3.82	1.5		0.3	5.32
SBDCP46-1	Trachyandesite block and ash flow of Carson Pass (Taba1)	58.39	0.85	17.06	5.96	0.05	3.07	6.02	3.9	2.58	29.9	0.434	6.48
SBDCP46-1		58.46	0.85	17.06	5.96	0.05	3.06	6.01	3.9	2.57	29	0.434	6.47
SBDCP46-2		58.43	0.85	17.05	6.04	0.05	3.08	6.02	3.88	2.56	29.6	0.433	6.44
SBDCP67-2	Basaltic andesite clast from debris flow in Tfdf	55.98	1.06	17.75	7.36	0.05	3.85	8.05	3.68	1.98		0.248	5.66

Data repository Section 3

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

Tabulated data, age spectra, inverse isochron plots, and K/Ca spectra for $^{40}Ar/^{39}Ar$ geochronology samples

Analytical Methods

Standard density and magnetic separation techniques were used to generate separates. Separates were irradiated in a cadmium-lined tube at the TRIGA reactor at Oregon State. All samples were analyzed in the $^{40}Ar/^{39}Ar$ geochronology laboratory at UC Santa Barbara by heating in a Staudacher-type resistance furnace and isotopic analysis on a MAP 216 mass spectrometer, using the general procedures and system described by Gans (1997). The flux monitor used for all irradiations was Taylor Creek Rhyolite with an assigned age of 27.92 Ma (Dalrymple and Duffield, 1990). For comparison, we obtain an age of 27.60 Ma on Fish Canyon Tuff Sanidine (another widely used standard). All errors given for our estimated (preferred) ages as reported throughout the text and in Table 2 are estimated ± 2 sigma (95% confidence), whereas error bars and uncertainties quoted on the spectra (Figure 9) are 1 sigma.

We measure the calcium derived interfering reactions (39/37Ca) and (36/37Ca) directly by irradiating small splits of optical grade fluorite. We do not directly measure the potassium derived interfering reaction (40/39K) but use an accepted value of 3.7 e-4 based on quoted values from other laboratories - in any case this is a trivial correction except for severely under-irradiated samples. An air pipette attached directly to our line that allows us to regularly check our mass discrimination. Extraction line blanks vary between ~ 0.008 and .020 volts of 40Ar (between 2 and 5 e-16 moles of 40Ar) and are atmospheric. Plateau ages are defined as the weighted mean age calculated from contiguous steps within 2 sigma error of each other. Analyses ranged from total fusion experiments on single grains to 8 to 14 step incremental heating experiments. In many cases, replicate splits and/or multiple minerals were analyzed from the same unit to check for internal consistency and to improve precision. Age's were reduced and spectra generated using Brad Hacker's Eyesorechron program. Complete data tables, age spectra, K/Ca spectra, and inverse isochron plots for each sample follow:

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

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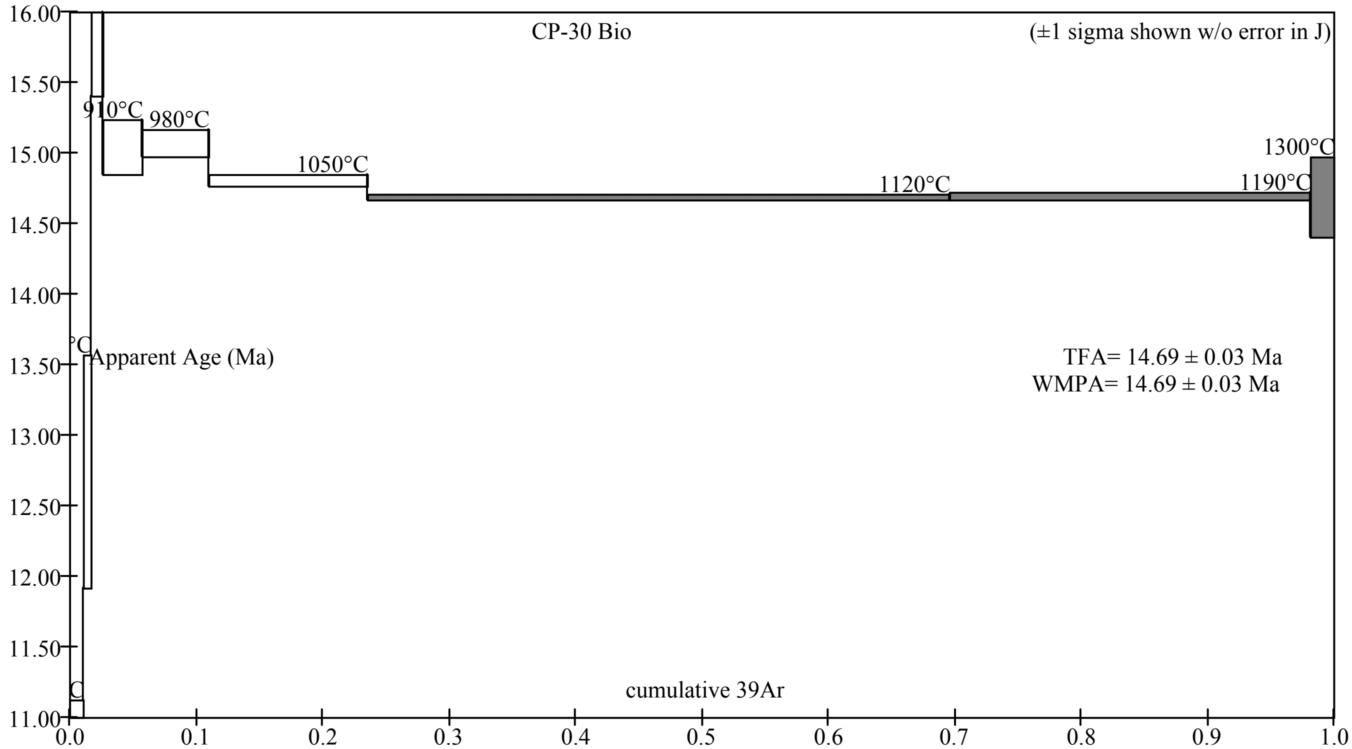
1. Sample: SB51-44 CP-30 Bio J=0.0020734

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
650	13	6.5e-15	15.4954	1.5e-1	0.8588	0.0428	0.57	0.01039	0.183	10.5 ± 0.6
750	13	3.7e-15	13.2766	4.0e-2	0.7135	0.0333	0.69	0.01729	0.258	12.7 ± 0.8
825	13	3.3e-15	8.7786	4.6e-3	0.3769	0.0152	1.3	0.02668	0.489	16.0 ± 0.6
910	13	8.2e-15	6.4824	8.3e-4	0.1071	0.0083	4.6	0.05776	0.623	15.0 ± 0.2
980	13	9.9e-15	4.7033	8.4e-4	0.0498	0.0022	9.8	0.10965	0.860	15.1 ± 0.1
1050	13	2.3e-14	4.4346	6.3e-4	0.0210	0.0016	23	0.23583	0.896	14.8 ± 0.1
1120	13	8.6e-14	4.6010	4.3e-5	0.0173	0.0022	28	0.69663	0.857	14.7 ± 0.0
1190	13	5.3e-14	4.5625	6.9e-4	0.0253	0.0021	19	0.98191	0.865	14.7 ± 0.0
1300	13	3.7e-15	5.1064	0.0e+0	0.1483	0.0039	3.3	1.00000	0.772	14.7 ± 0.3

Total fusion age, TFA= 14.69 ± 0.03 Ma (including J)
Weighted mean plateau age, WMPA= 14.69 ± 0.03 Ma (including J)
Inverse isochron age =14.73 ± 0.31 Ma. (MSWD =0.04; 40Ar/36Ar=291.1 ± 7.7)
Steps used: 1120, 1190, 1300, (7–9/9 or 76% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.



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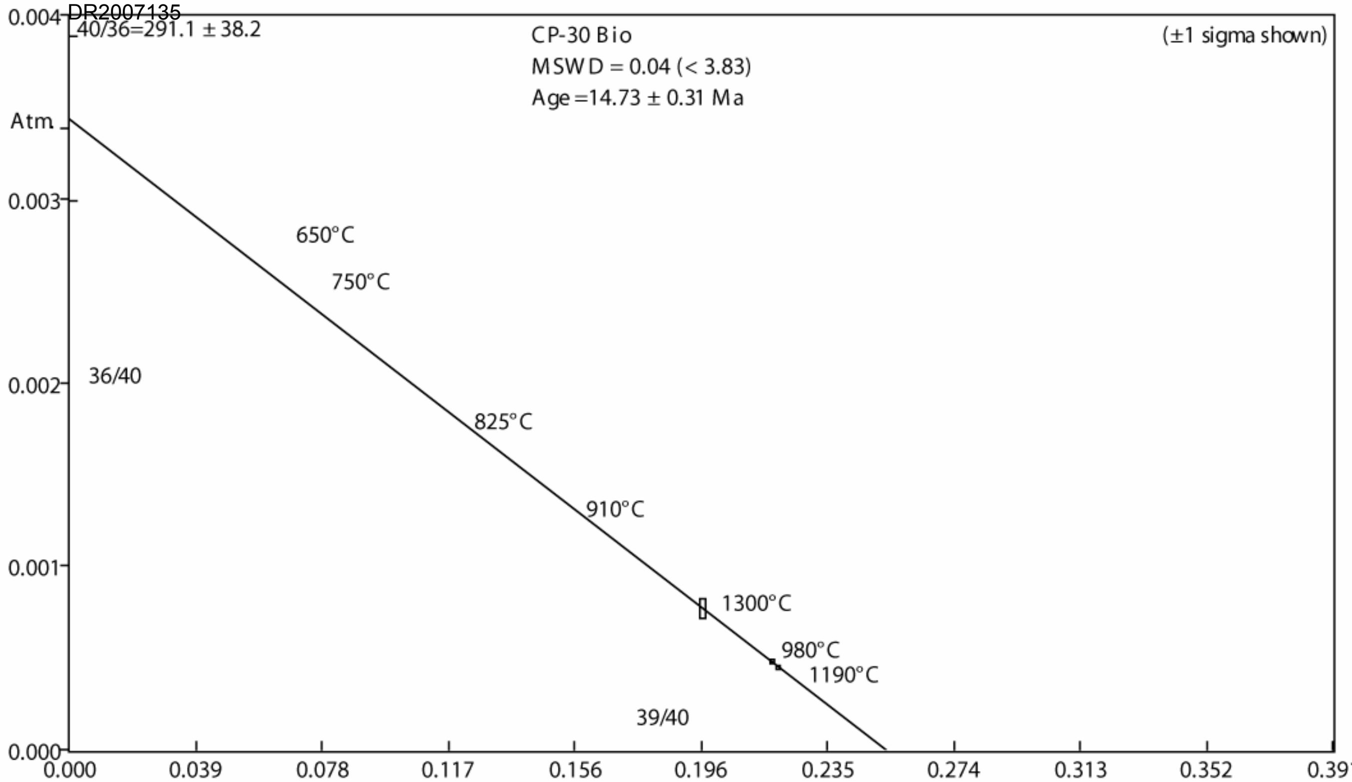
40/36=291.1 ± 38.2
CP-30 Bio
MSWD = 0.04 (< 3.83)
Age =14.73 ± 0.31 Ma
(±1 sigma shown)
Atm.
36/40
39/40
650°C
750°C
825°C
910°C
1300°C
980°C
1190°C
0.004
0.003
0.002
0.001
0.000
0.000
0.039
0.078
0.117
0.156
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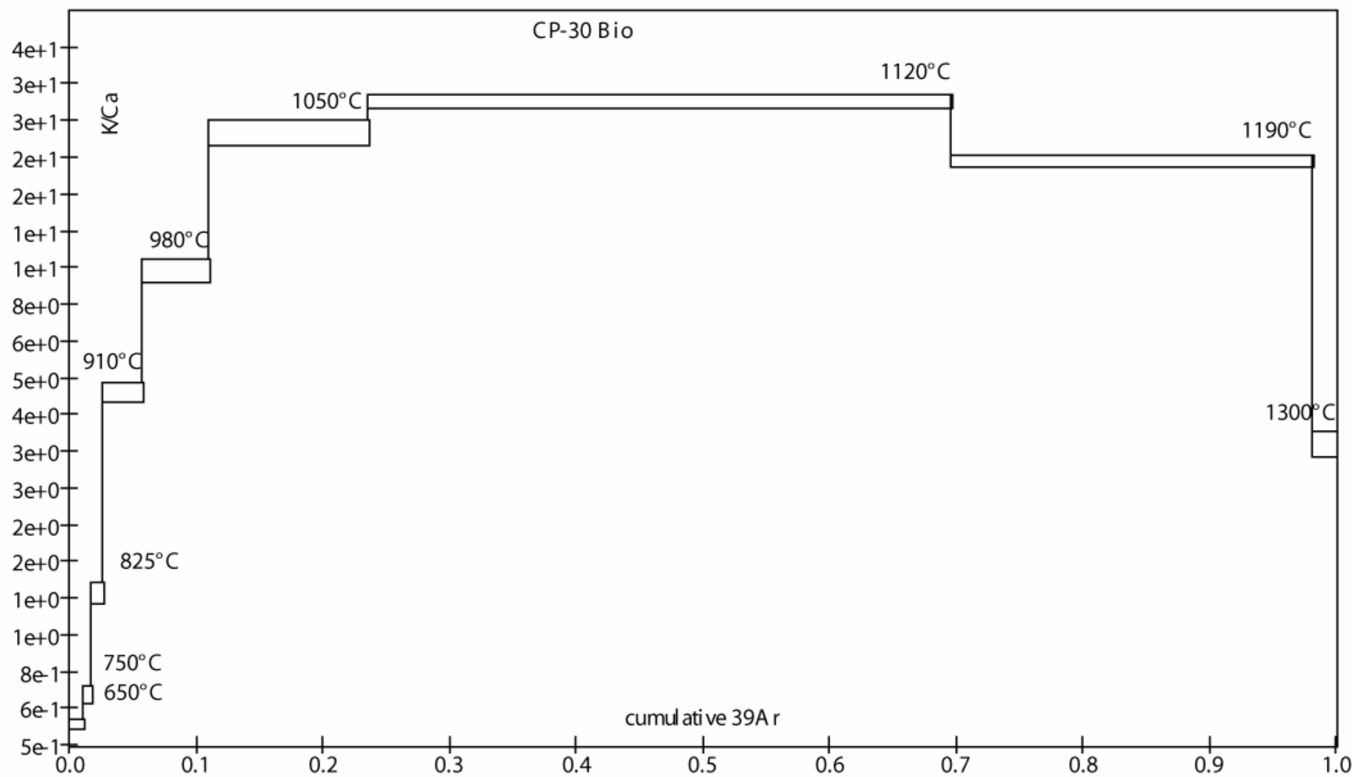
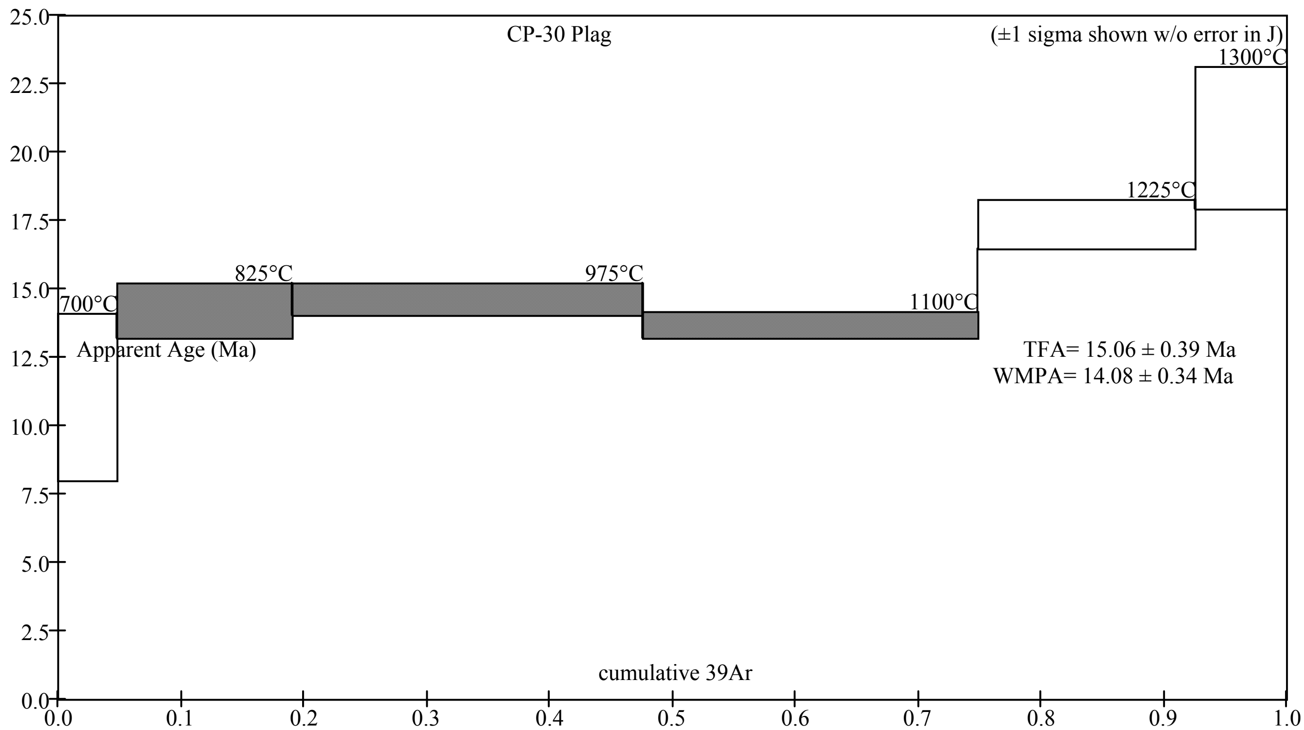
0.313
0.352
0.391


CP-30 Bio
K/Ca
cumulative 39Ar
1050°C
1120°C
1190°C
980°C
910°C
1300°C
825°C
750°C
650°C
4e+1
3e+1
3e+1
2e+1
2e+1
1e+1
1e+1
8e+0
6e+0
5e+0
4e+0
3e+0
3e+0
2e+0
2e+0
1e+0
1e+0
8e-1
6e-1
5e-1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

2. Sample: SB51-43 CP-30 Plag J=0.0020750

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
700	12	3.2e-15	34.9130	5.0e-2	26.5735	0.1081	0.018	0.04774	0.085	11.1 ± 3.1
825	12	5.3e-15	19.2683	3.8e-3	6.1321	0.0523	0.080	0.19081	0.198	14.2 ± 1.0
975	12	8.4e-15	15.3367	0.0e+0	5.0176	0.0386	0.098	0.47560	0.256	14.6 ± 0.6
1100	12	4.7e-15	8.8266	1.7e-3	4.5502	0.0175	0.11	0.74846	0.415	13.7 ± 0.5
1225	12	9.1e-15	26.4614	1.5e-3	4.0889	0.0738	0.12	0.92566	0.176	17.4 ± 0.9
1300	12	1.1e-14	77.4114	0.0e+0	5.1346	0.2433	0.095	1.00000	0.071	20.5 ± 2.6

Total fusion age, TFA= 15.06 ± 0.39 Ma (including J)
Weighted mean plateau age, WMPA= 14.08 ± 0.34 Ma (including J)
Inverse isochron age =13.26 ± 0.87 Ma. (MSWD =0.52; 40Ar/36Ar=303.1 ± 5.2)
Steps used: 825, 975, 1100, (2–4/6 or 70% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.



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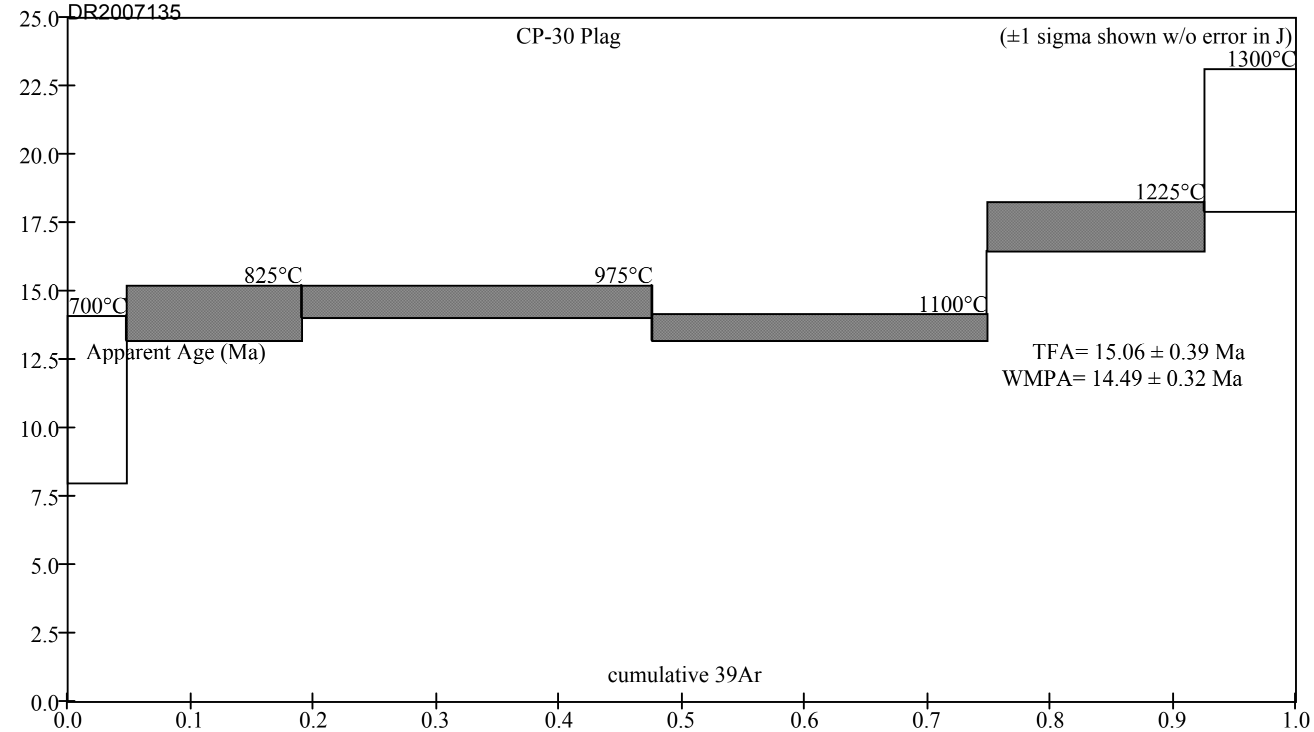
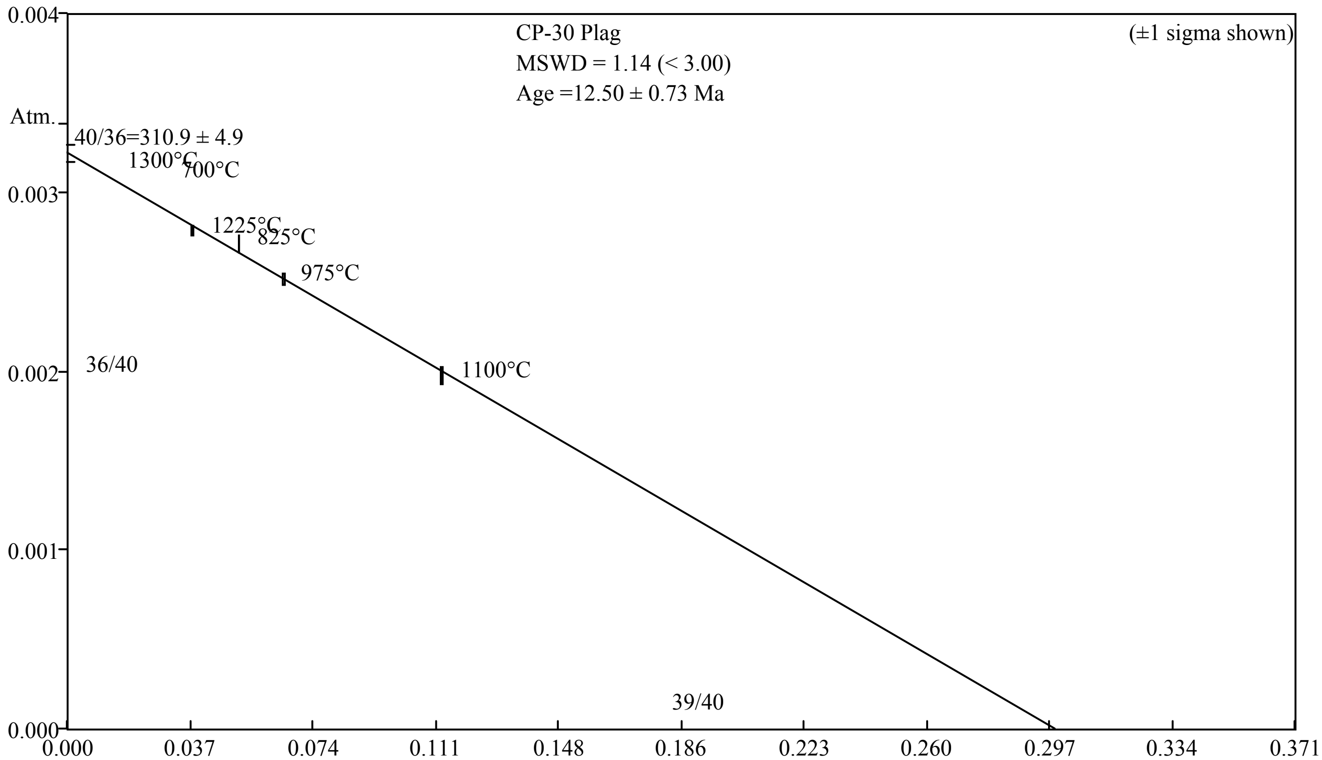
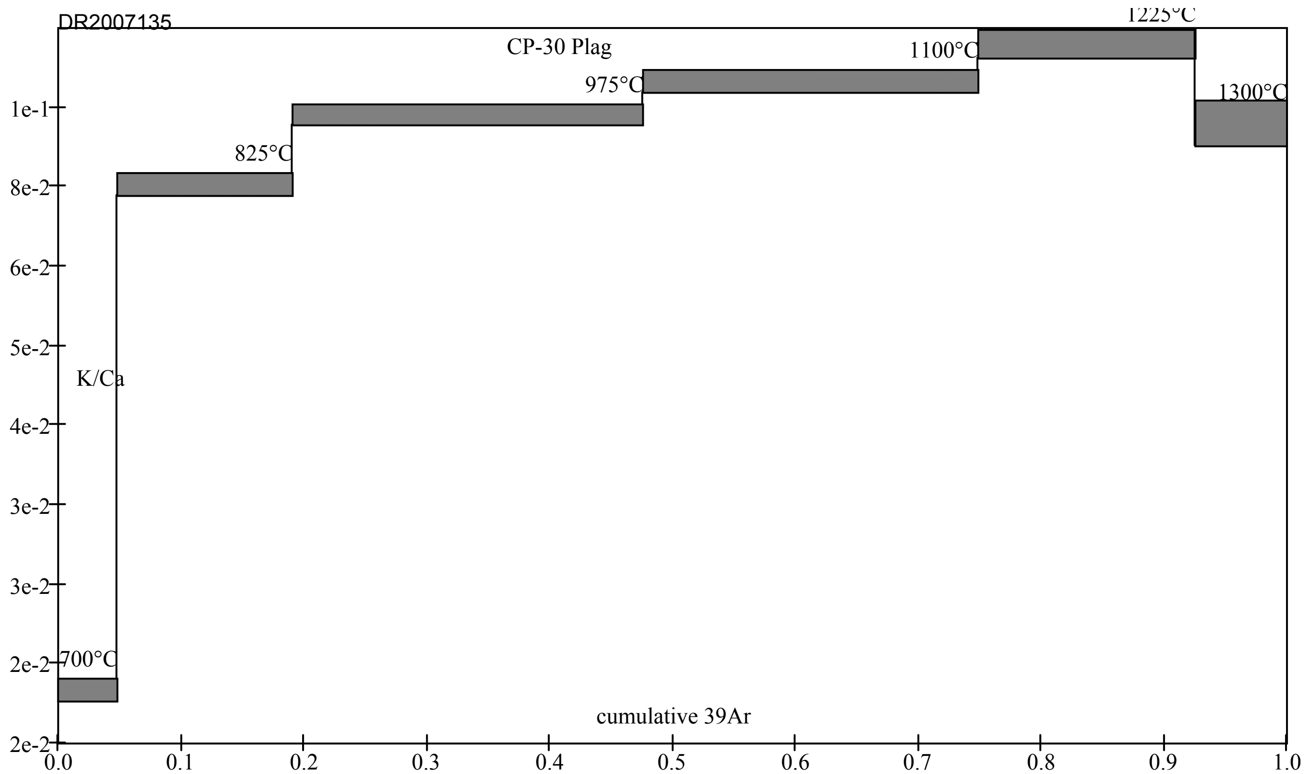


CP-30 Plag
(±1 sigma shown w/o error in J)
1300°C
1225°C
825°C
975°C
700°C
1100°C
Apparent Age (Ma)
TFA= 15.06 ± 0.39 Ma
WMPA= 14.49 ± 0.32 Ma
cumulative 39Ar
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0



CP-30 Plag
(±1 sigma shown)
MSWD = 1.14 (< 3.00)
Age =12.50 ± 0.73 Ma
Atm.
40/36=310.9 ± 4.9
1300°C
700°C
1225°C
825°C
975°C
1100°C
36/40
39/40
0.004
0.003
0.002
0.001
0.000
0.037
0.074
0.111
0.148
0.186
0.223
0.260
0.297
0.334
0.371

DR2007135

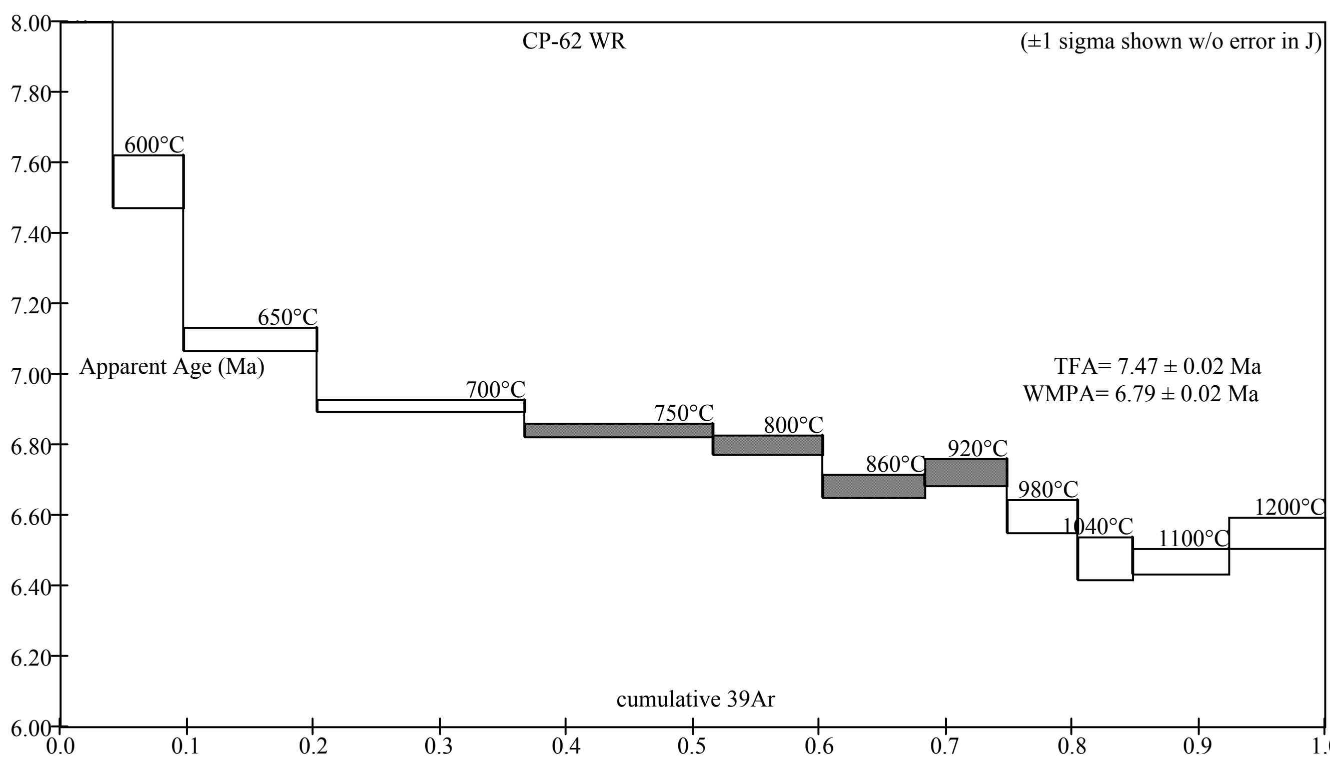


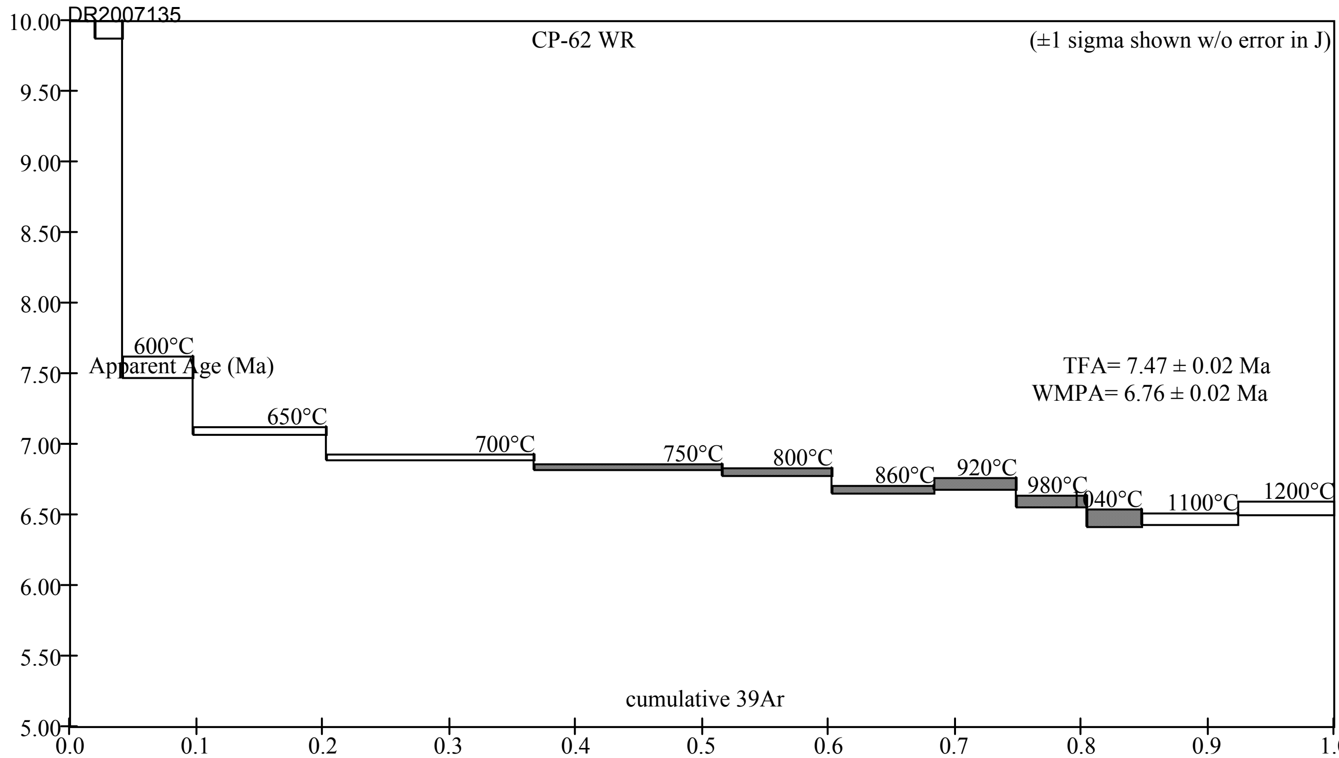
CP-30 Plag
1225°C
1100°C
975°C
1300°C
825°C
700°C
1e-1
8e-2
6e-2
5e-2
4e-2
3e-2
3e-2
2e-2
2e-2
K/Ca
cumulative 39Ar
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

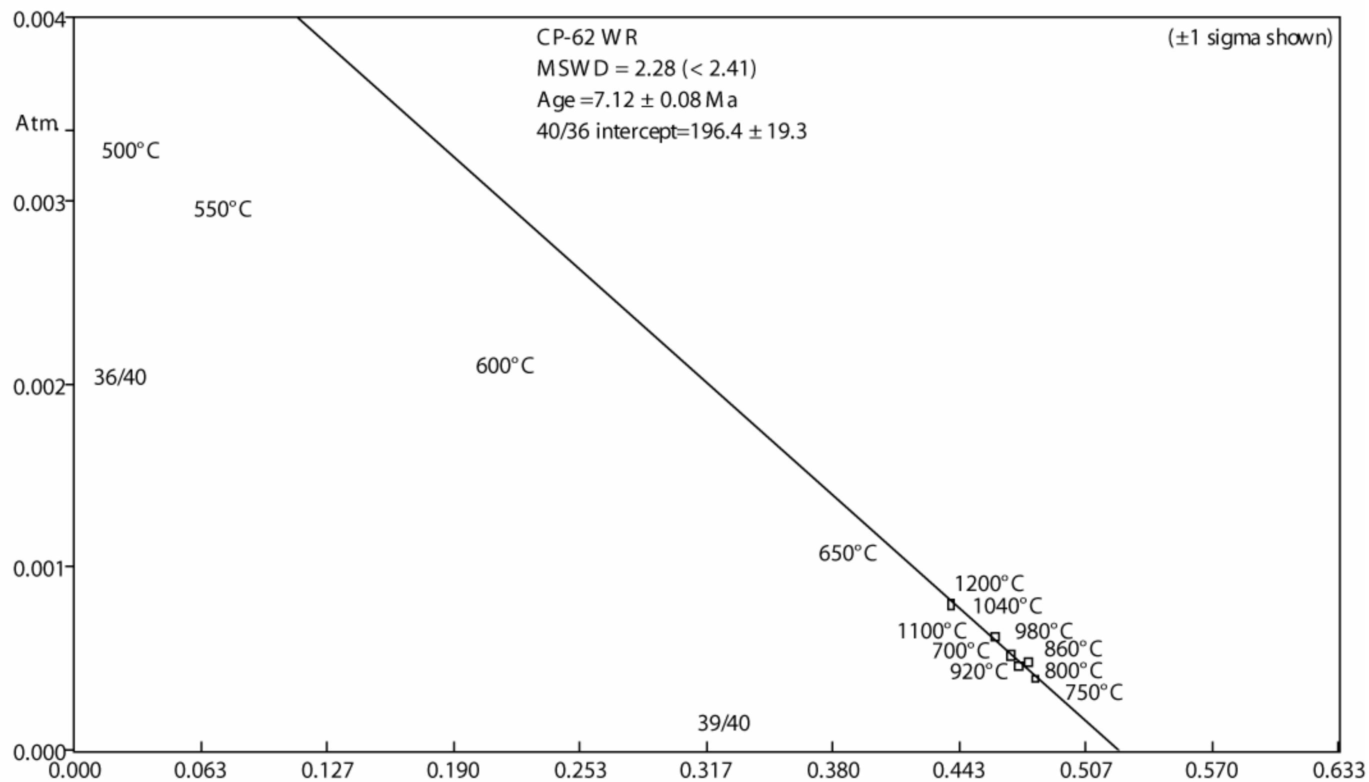
3. Sample: SB51-46 CP-62 WR J=0.0020697

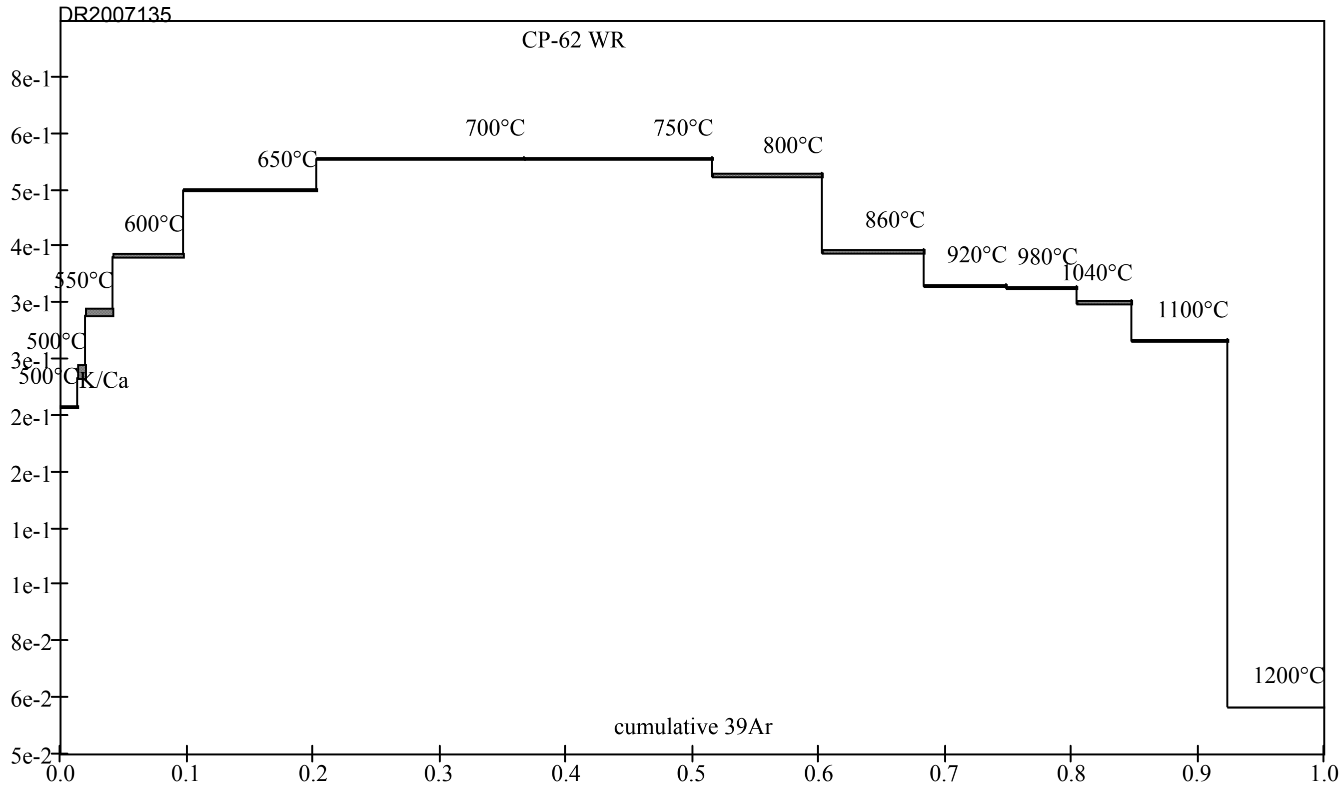
T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
500	12	3.5e-13	274.7631	1.0e-2	2.3870	0.8905	0.21	0.01358	0.042	42.9 ± 0.9
500	12	6.1e-14	94.7846	2.8e-3	2.0624	0.3021	0.24	0.02033	0.058	20.4 ± 1.4
550	12	4.2e-14	19.9952	5.7e-3	1.6154	0.0585	0.30	0.04242	0.136	10.1 ± 0.2
600	12	2.7e-14	5.2099	5.5e-4	1.2795	0.0108	0.38	0.09752	0.389	7.5 ± 0.1
650	12	2.8e-14	2.7548	0.0e+0	0.9794	0.0029	0.50	0.20340	0.692	7.1 ± 0.0
700	12	3.4e-14	2.1881	0.0e+0	0.8665	0.0011	0.57	0.36783	0.848	6.9 ± 0.0
750	12	2.9e-14	2.0787	0.0e+0	0.8626	0.0008	0.57	0.51558	0.883	6.8 ± 0.0
800	12	1.8e-14	2.1149	0.0e+0	0.9253	0.0010	0.53	0.60346	0.863	6.8 ± 0.0
860	12	1.6e-14	2.0915	0.0e+0	1.2603	0.0010	0.39	0.68298	0.857	6.7 ± 0.0
920	12	1.3e-14	2.1329	0.0e+0	1.4521	0.0011	0.34	0.74947	0.845	6.7 ± 0.0
980	12	1.1e-14	2.1682	0.0e+0	1.4642	0.0013	0.33	0.80470	0.816	6.6 ± 0.0
1040	12	9.3e-15	2.2762	6.2e-5	1.5551	0.0018	0.32	0.84765	0.763	6.5 ± 0.1
1100	12	1.6e-14	2.1539	9.5e-4	1.8129	0.0014	0.27	0.92424	0.806	6.5 ± 0.0
1200	12	1.7e-14	2.3218	7.0e-4	8.0823	0.0019	0.061	1.00000	0.757	6.6 ± 0.0

Total fusion age, TFA= 7.47 ± 0.02 Ma (including J)
Weighted mean plateau age, WMPA= 6.79 ± 0.02 Ma (including J)
Inverse isochron age =7.16 ± 0.25 Ma. (MSWD =4.03; 40Ar/36Ar=187.8 ± 68.6)
Steps used: 750, 800, 860, 920, (7–10/14 or 38% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.




DR2007135
CP-62 WR
(±1 sigma shown w/o error in J)
Apparent Age (Ma)
TFA= 7.47 ± 0.02 Ma
WMPA= 6.76 ± 0.02 Ma
600°C
650°C
700°C
750°C
800°C
860°C
920°C
980°C
1040°C
1100°C
1200°C
cumulative 39Ar

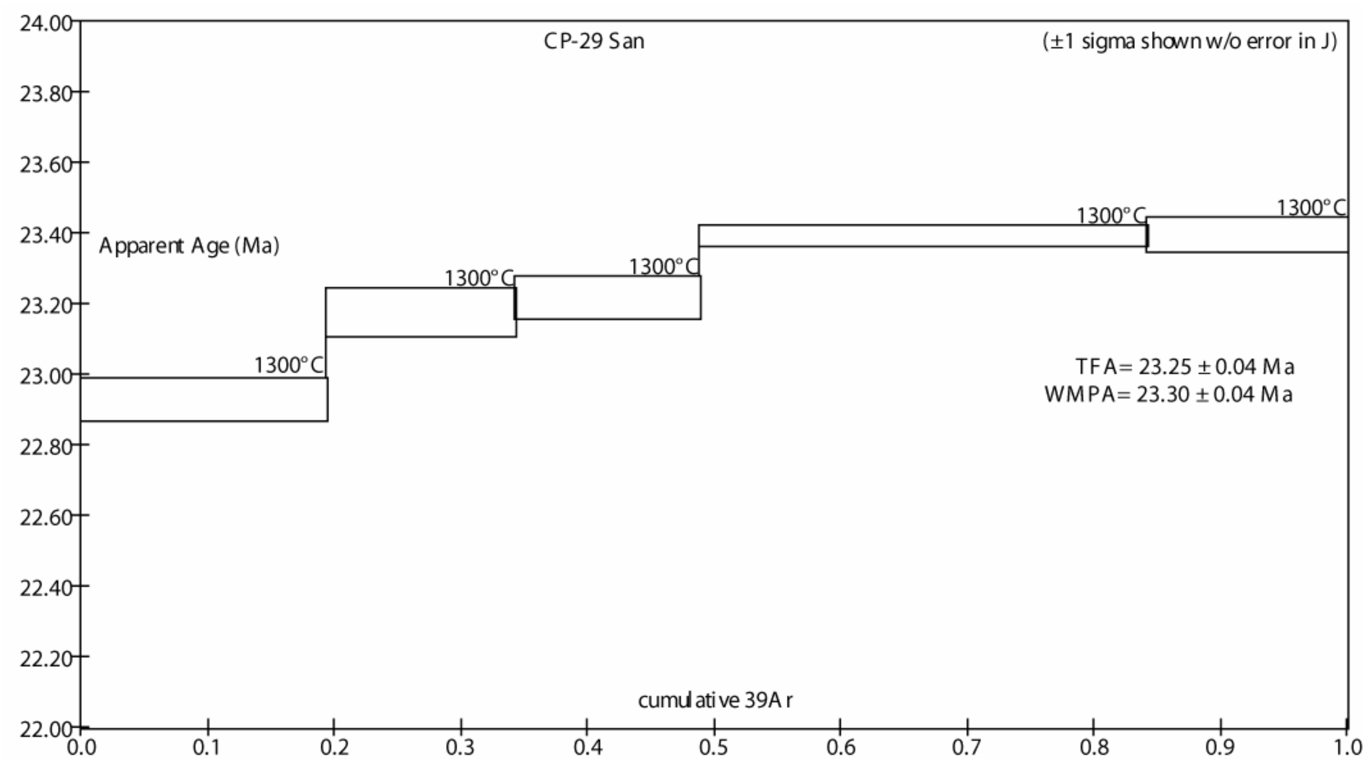

CP-62 WR
MSWD = 2.28 (< 2.41)
Age =7.12 ± 0.08 Ma
40/36 intercept=196.4 ± 19.3
(±1 sigma shown)
Atm
500°C
550°C
600°C
650°C
36/40
39/40
1200°C
1040°C
1100°C
980°C
700°C
860°C
920°C
800°C
750°C

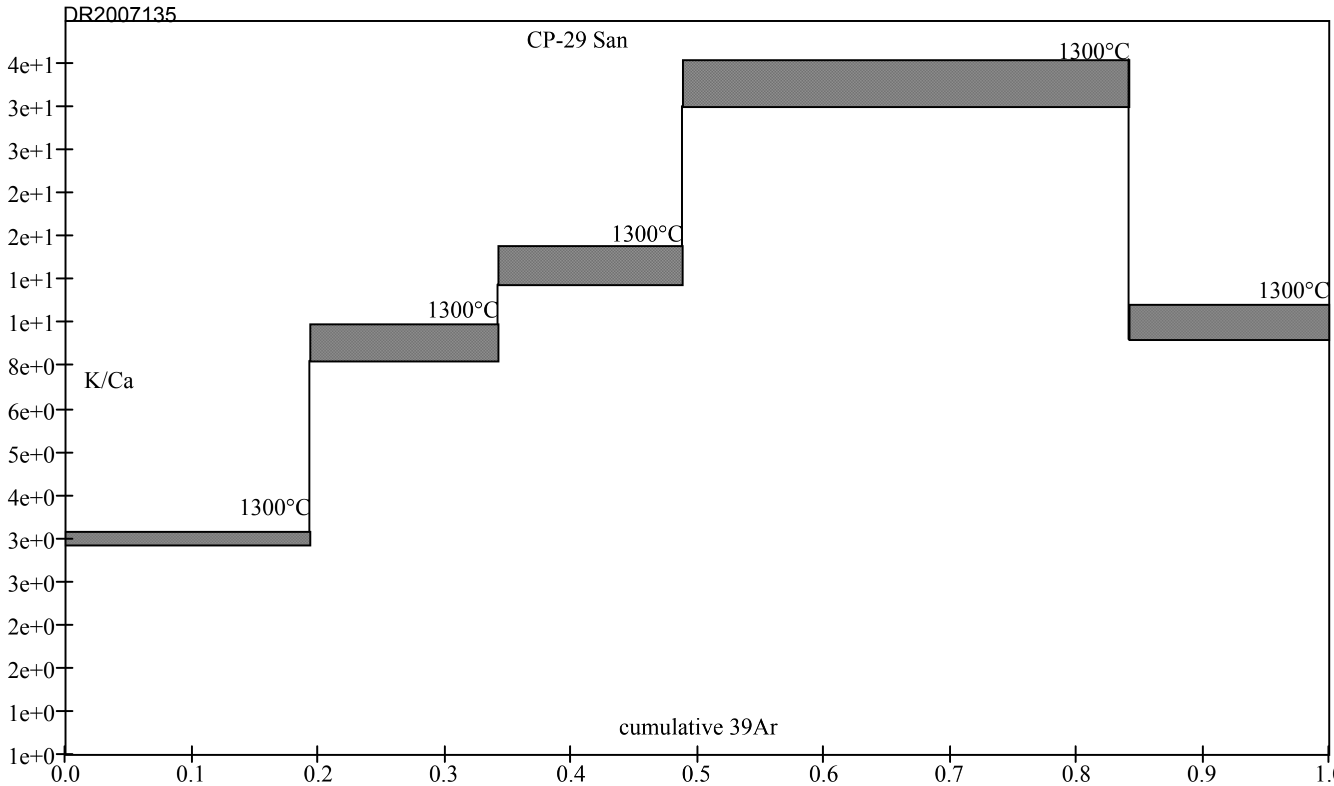

DR2007135
CP-62 WR
K/Ca
cumulative 39Ar
500°C
500°C
550°C
600°C
650°C
700°C
750°C
800°C
860°C
920°C
980°C
1040°C
1100°C
1200°C
8e-1
6e-1
5e-1
4e-1
3e-1
3e-1
2e-1
2e-1
1e-1
1e-1
8e-2
6e-2
5e-2
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

4. Sample: SB51-47 CP-29 San SINGLE GRAIN AGES J=0.0020675

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
1300	14	3.0e-14	6.3629	0.0e+0	0.1553	0.0006	3.2	0.19449	0.972	22.9 ± 0.1
1300	14	2.3e-14	6.4652	0.0e+0	0.0544	0.0007	9.0	0.34257	0.967	23.2 ± 0.1
1300	14	2.3e-14	6.4397	0.0e+0	0.0360	0.0006	14	0.48790	0.973	23.2 ± 0.1
1300	14	5.5e-14	6.3866	0.0e+0	0.0136	0.0002	36	0.84253	0.989	23.4 ± 0.0
1300	14	2.5e-14	6.4548	0.0e+0	0.0488	0.0005	10	1.00000	0.978	23.4 ± 0.1

Total fusion age, TFA= 23.25 ± 0.04 Ma (including J)
Weighted mean plateau age, WMPA= 23.30 ± 0.04 Ma (including J)
Inverse isochron age =23.36 ± 0.23 Ma. (MSWD =17.26; 40Ar/36Ar=249.7 ± 152.4)
Steps used: 1300, 1300, 1300, 1300, 1300, (1–5/5 or 100% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.

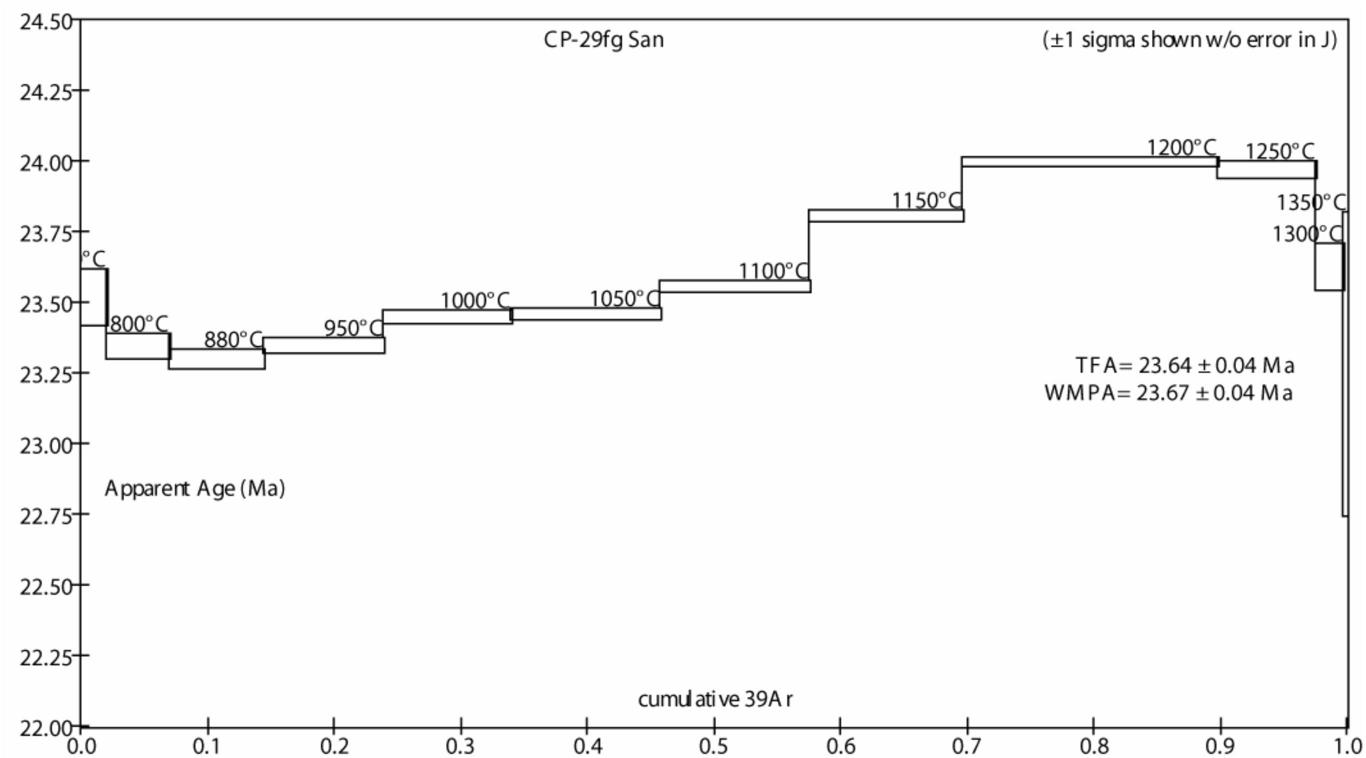


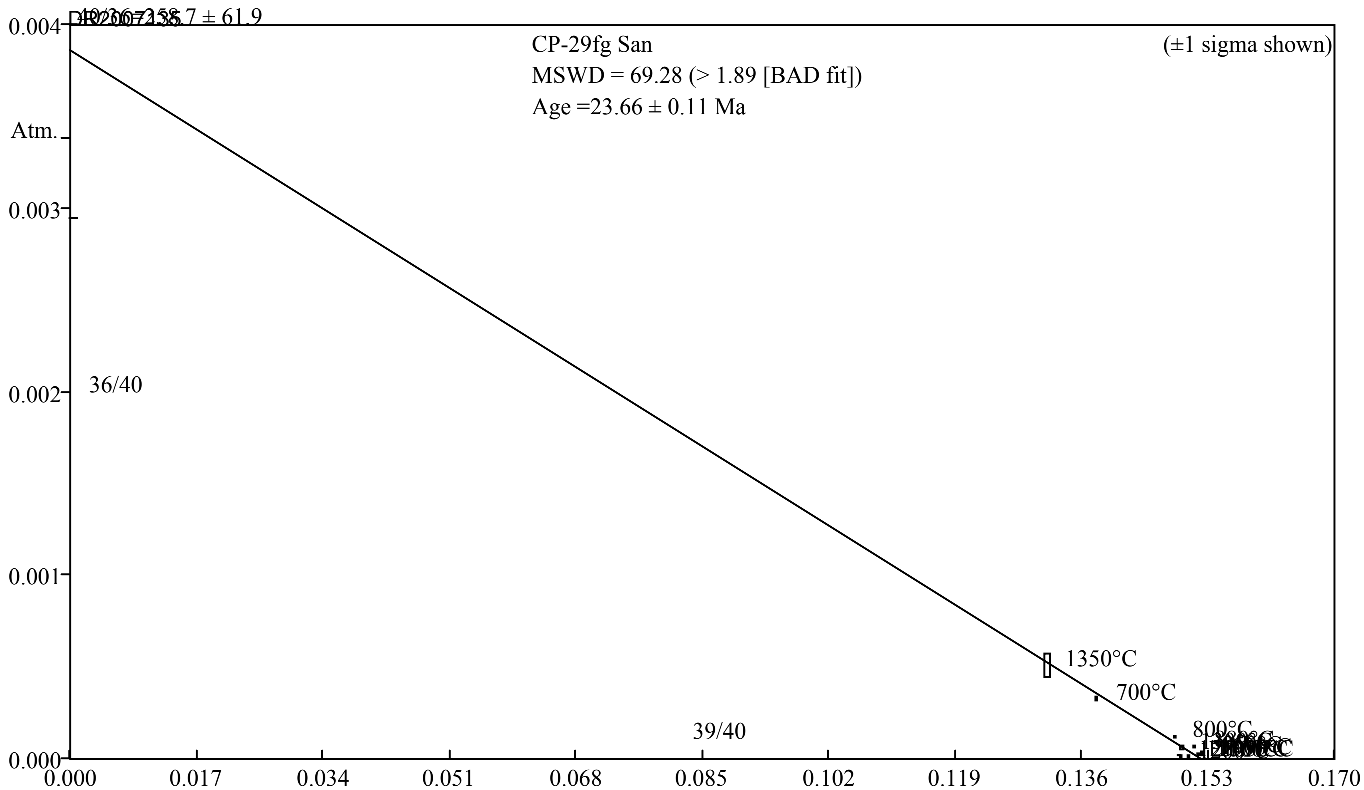

DR2007135
CP-29 San
K/Ca
cumulative 39Ar
1300°C
1300°C
1300°C
1300°C
1300°C
4e+1
3e+1
3e+1
2e+1
2e+1
1e+1
1e+1
8e+0
6e+0
5e+0
4e+0
3e+0
3e+0
2e+0
2e+0
1e+0
1e+0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

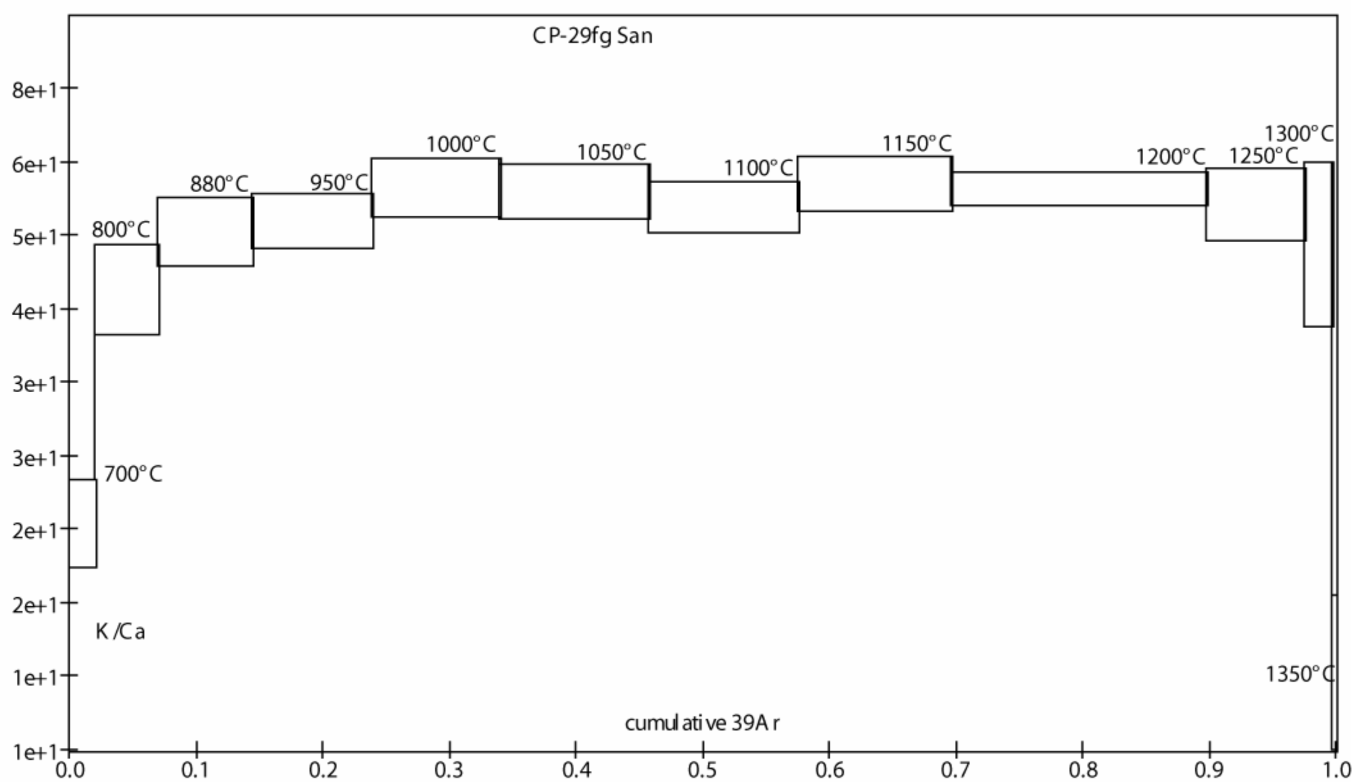
5. Sample: SB51-66 CP-29fg San J=0.0020062

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
700	12	1.7e-14	7.2508	3.4e-4	0.0239	0.0024	20	0.01989	0.902	23.5 ± 0.1
800	12	3.9e-14	6.7412	0.0e+0	0.0115	0.0008	43	0.07054	0.963	23.3 ± 0.1
880	12	5.6e-14	6.6200	0.0e+0	0.0096	0.0005	51	0.14472	0.979	23.3 ± 0.0
950	12	7.0e-14	6.5710	0.0e+0	0.0093	0.0003	53	0.23826	0.988	23.3 ± 0.0
1000	12	7.7e-14	6.5802	0.0e+0	0.0084	0.0002	59	0.33991	0.991	23.4 ± 0.0
1050	12	8.8e-14	6.5720	0.0e+0	0.0085	0.0002	58	0.45673	0.993	23.5 ± 0.0
1100	12	9.0e-14	6.6031	0.0e+0	0.0089	0.0002	55	0.57544	0.992	23.6 ± 0.0
1150	12	9.2e-14	6.6562	0.0e+0	0.0083	0.0001	59	0.69588	0.995	23.8 ± 0.0
1200	12	1.5e-13	6.7046	0.0e+0	0.0084	0.0001	58	0.89754	0.996	24.0 ± 0.0
1250	12	5.9e-14	6.7119	0.0e+0	0.0088	0.0002	56	0.97464	0.993	24.0 ± 0.0
1300	12	1.7e-14	6.6972	0.0e+0	0.0097	0.0004	50	0.99663	0.981	23.6 ± 0.1
1350	12	2.9e-15	7.6221	0.0e+0	0.0425	0.0039	12	1.00000	0.850	23.3 ± 0.5

Total fusion age, TFA= 23.64 ± 0.04 Ma (including J)
Weighted mean plateau age, WMPA= 23.67 ± 0.04 Ma (including J)
Inverse isochron age =23.66 ± 0.11 Ma. (MSWD =69.28; 40Ar/36Ar=258.7 ± 61.9)
Steps used: 700, 800, 880, 950, 1000, 1050, 1100, 1150, 1200, 1250, 1300, 1350, (1–12/12 or 100% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.



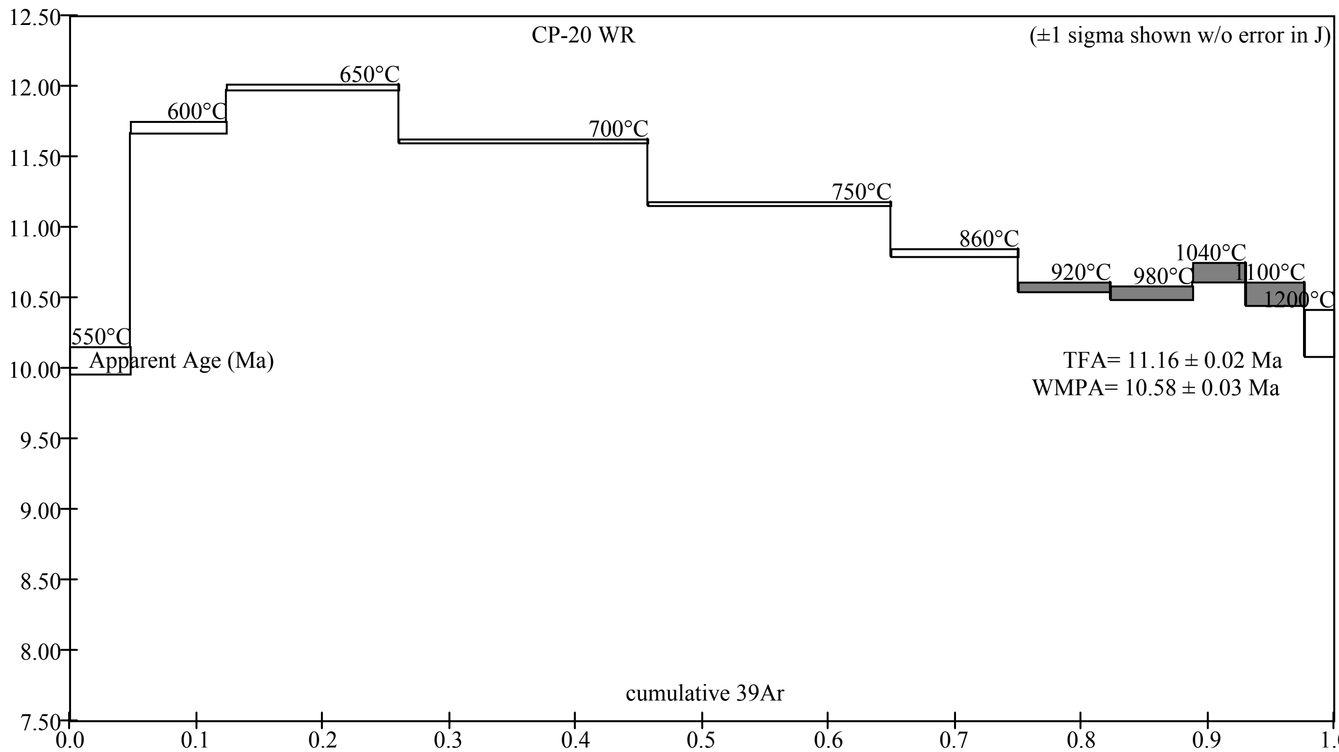

40/36=258.7 ± 61.9
CP-29fg San
(±1 sigma shown)
MSWD = 69.28 (> 1.89 [BAD fit])
Age =23.66 ± 0.11 Ma
Atm.
36/40
39/40
1350°C
700°C
800°C
0.004
0.003
0.002
0.001
0.000
0.000
0.017
0.034
0.051
0.068
0.085
0.102
0.119
0.136
0.153
0.170

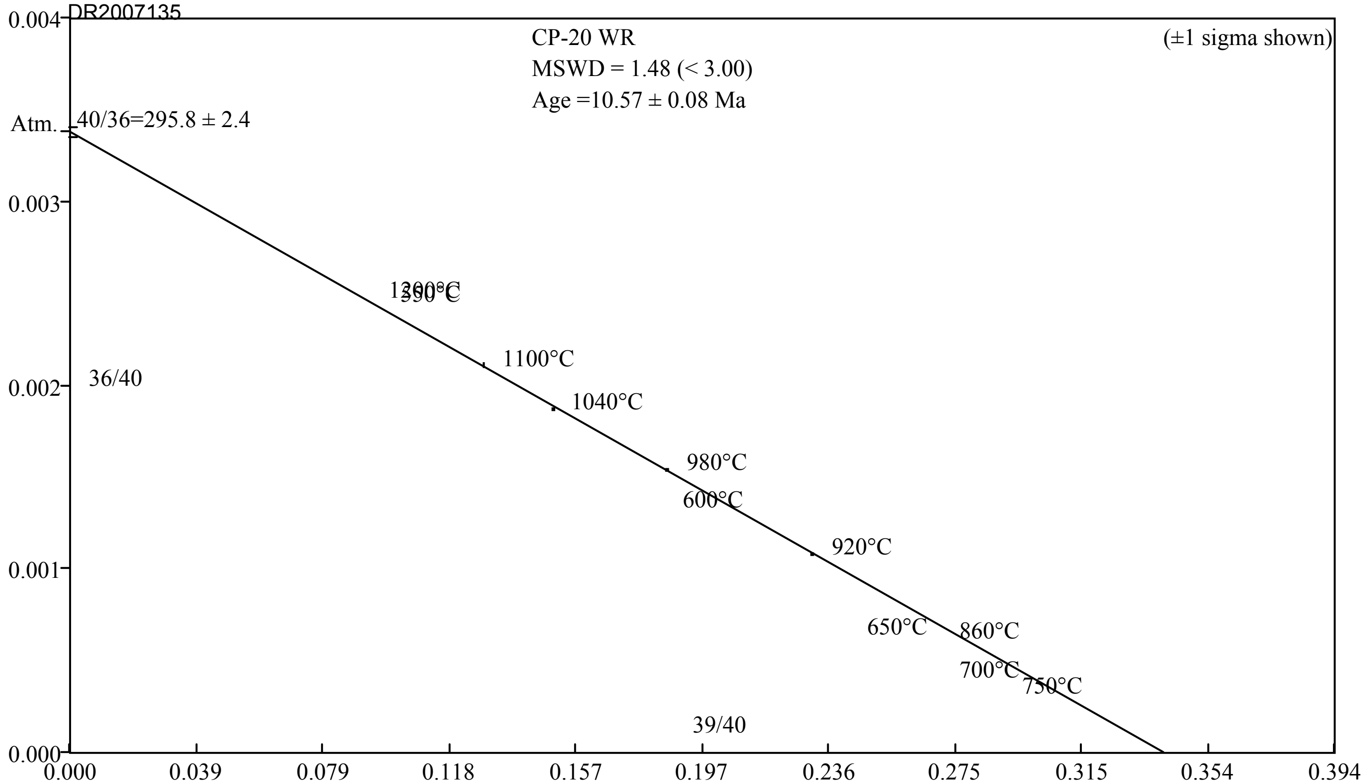

CP-29fg San
K /Ca
cumulative 39A r
700°C
800°C
880°C
950°C
1000°C
1050°C
1100°C
1150°C
1200°C
1250°C
1300°C
1350°C
8e+1
6e+1
5e+1
4e+1
3e+1
3e+1
2e+1
2e+1
1e+1
1e+1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

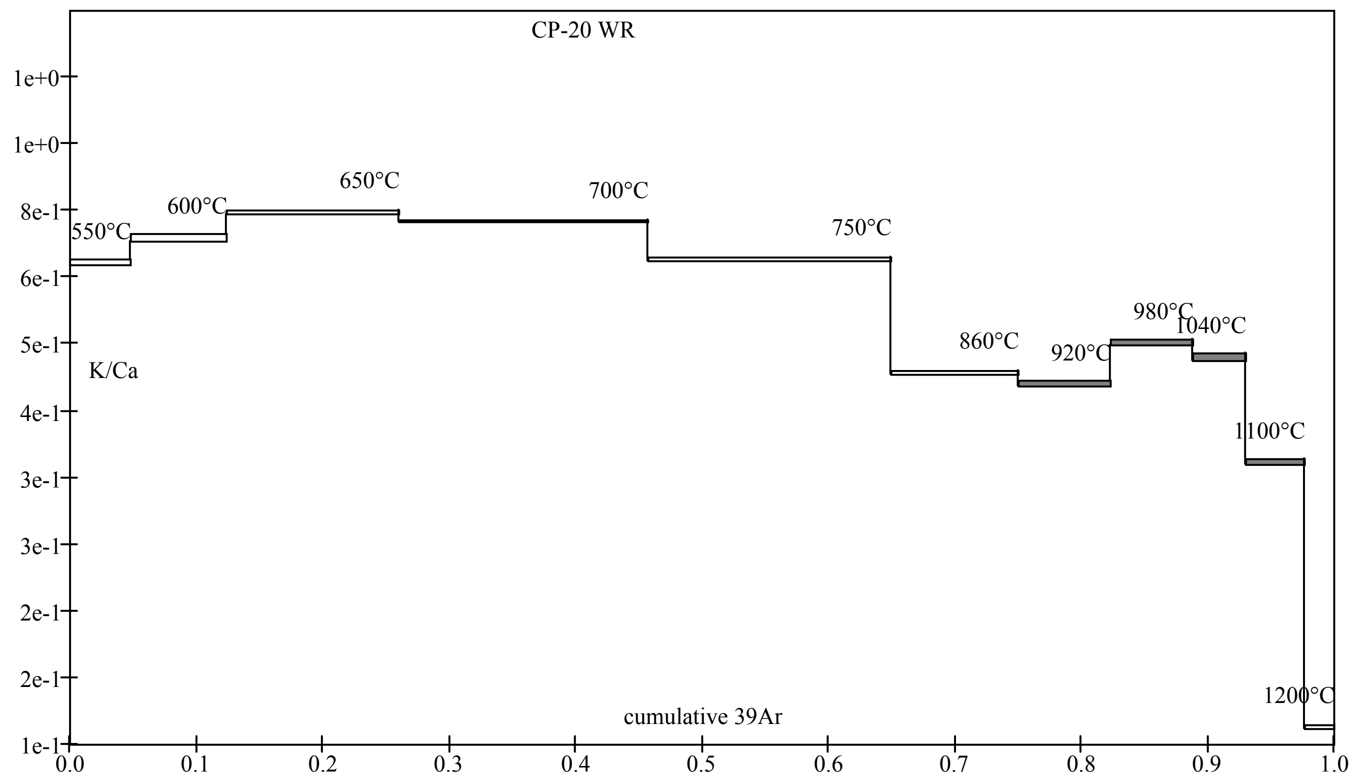
6. Sample: SB51-68 CP-20 WR J=0.0019996

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
550	12	5.1e-14	10.2891	7.6e-4	0.7389	0.0254	0.66	0.04872	0.272	10.1 ± 0.1
600	12	4.1e-14	5.4091	0.0e+0	0.6790	0.0073	0.72	0.12420	0.602	11.7 ± 0.0
650	12	5.7e-14	4.1305	0.0e+0	0.6203	0.0027	0.79	0.26007	0.808	12.0 ± 0.0
700	12	7.4e-14	3.6877	0.0e+0	0.6413	0.0015	0.76	0.45780	0.876	11.6 ± 0.0
750	12	6.7e-14	3.4449	0.0e+0	0.7304	0.0012	0.67	0.64926	0.901	11.2 ± 0.0
860	12	3.8e-14	3.6883	0.0e+0	1.0819	0.0023	0.45	0.75033	0.815	10.8 ± 0.0
920	12	3.2e-14	4.3283	0.0e+0	1.1227	0.0047	0.44	0.82337	0.680	10.6 ± 0.0
980	12	3.5e-14	5.3805	5.7e-4	0.9765	0.0083	0.50	0.88873	0.545	10.5 ± 0.1
1040	12	2.8e-14	6.6490	8.0e-4	1.0254	0.0125	0.48	0.92971	0.447	10.7 ± 0.1
1100	12	3.7e-14	7.7758	1.1e-3	1.4714	0.0164	0.33	0.97704	0.376	10.5 ± 0.1
1200	12	2.5e-14	10.6848	1.6e-3	3.6729	0.0265	0.13	1.00000	0.267	10.3 ± 0.2

Total fusion age, TFA= 11.16 ± 0.02 Ma (including J)
Weighted mean plateau age, WMPA= 10.58 ± 0.03 Ma (including J)
Inverse isochron age =10.57 ± 0.08 Ma. (MSWD =1.48; 40Ar/36Ar=295.8 ± 2.4)
Steps used: 920, 980, 1040, 1100, (7–10/11 or 23% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.



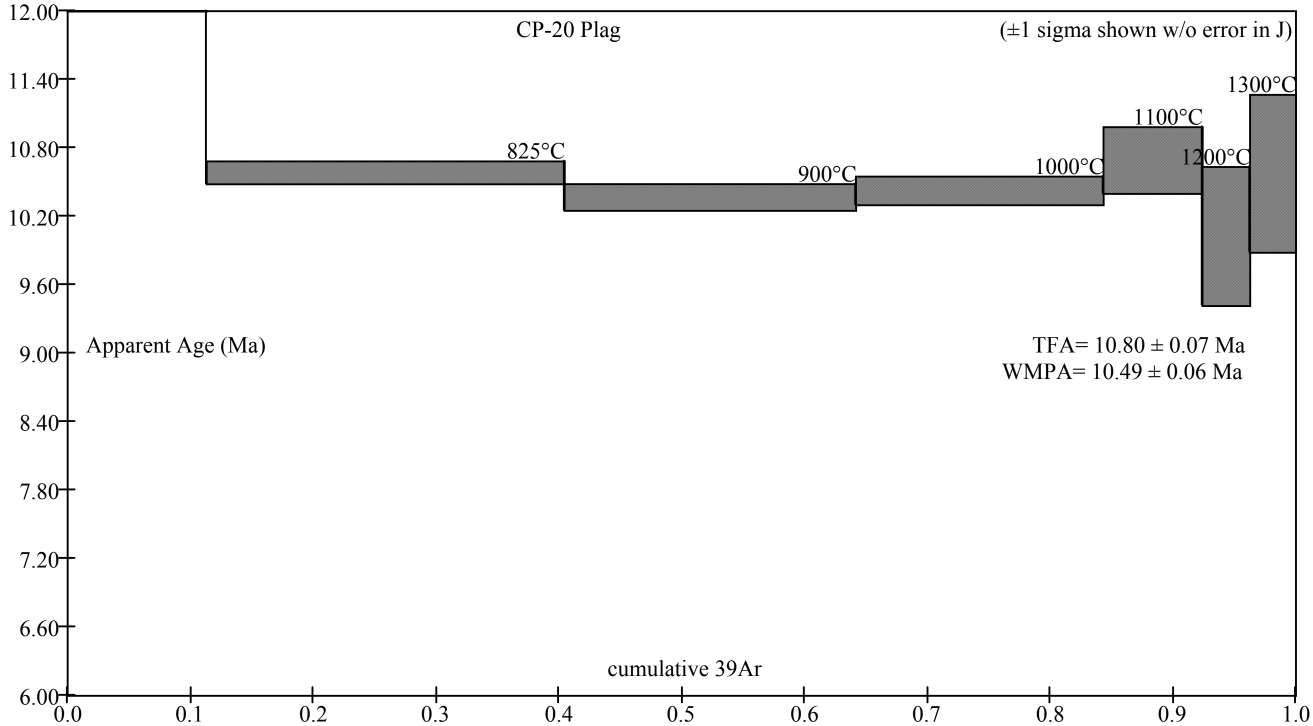

CP-20 WR
MSWD = 1.48 (< 3.00)
Age =10.57 ± 0.08 Ma
(±1 sigma shown)
Atm.
40/36=295.8 ± 2.4
36/40
39/40
1200°C
550°C
1100°C
1040°C
980°C
600°C
920°C
650°C
860°C
700°C
750°C
0.004
0.003
0.002
0.001
0.000
0.000
0.039
0.079
0.118
0.157
0.197
0.236
0.275
0.315
0.354
0.394

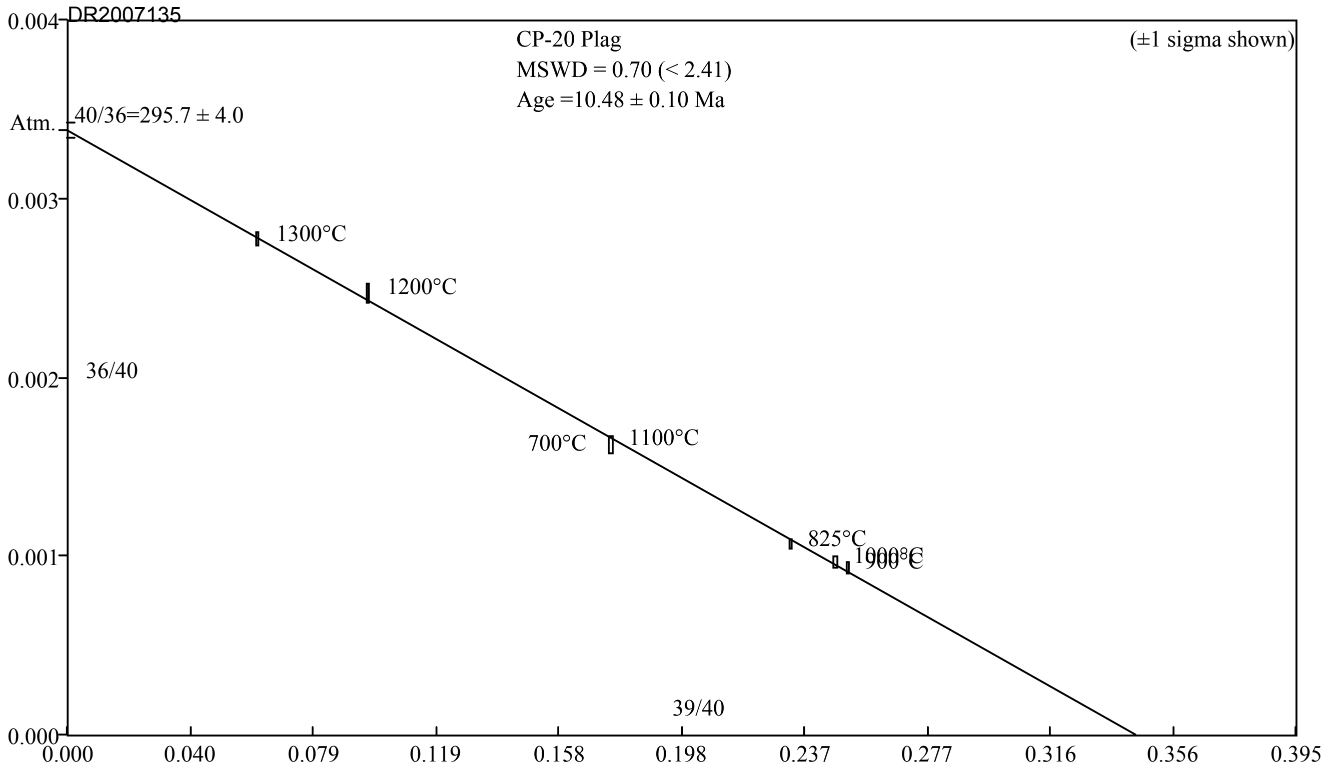

CP-20 WR
K/Ca
cumulative 39Ar
550°C
600°C
650°C
700°C
750°C
860°C
920°C
980°C
1040°C
1100°C
1200°C
1e+0
1e+0
8e-1
6e-1
5e-1
4e-1
3e-1
3e-1
2e-1
2e-1
1e-1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

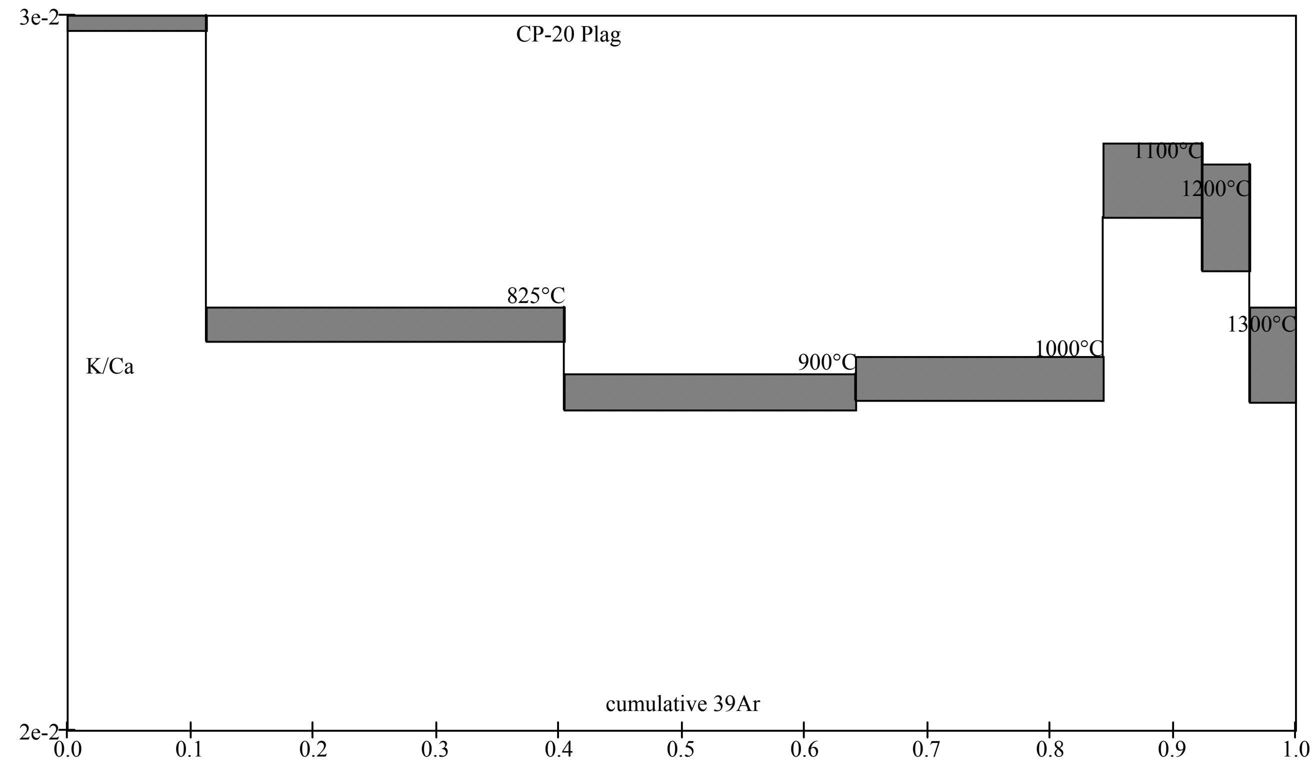
7. Sample: SB51-67 CP-20 Plag J=0.0020025

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
700	15	1.0e-14	7.0342	0.0e+0	19.4381	0.0113	0.025	0.11352	0.527	13.3 ± 0.2
825	15	1.6e-14	4.3025	0.0e+0	21.5734	0.0046	0.023	0.40413	0.683	10.6 ± 0.1
900	15	1.2e-14	3.9867	1.3e-4	22.0430	0.0037	0.022	0.64162	0.722	10.4 ± 0.1
1000	15	1.1e-14	4.0500	0.0e+0	21.9523	0.0039	0.022	0.84404	0.715	10.4 ± 0.1
1100	15	6.0e-15	5.7279	0.0e+0	20.5872	0.0093	0.024	0.92473	0.518	10.7 ± 0.3
1200	15	5.2e-15	10.3551	0.0e+0	20.8397	0.0256	0.024	0.96334	0.269	10.0 ± 0.6
1300	15	7.8e-15	16.3991	0.0e+0	21.7781	0.0456	0.022	1.00000	0.179	10.6 ± 0.7

Total fusion age, TFA= 10.80 ± 0.07 Ma (including J)
Weighted mean plateau age, WMPA= 10.49 ± 0.06 Ma (including J)
Inverse isochron age =10.48 ± 0.10 Ma. (MSWD =0.70; 40Ar/36Ar=295.7 ± 3.3)
Steps used: 825, 900, 1000, 1100, 1200, 1300, (2–7/7 or 89% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.



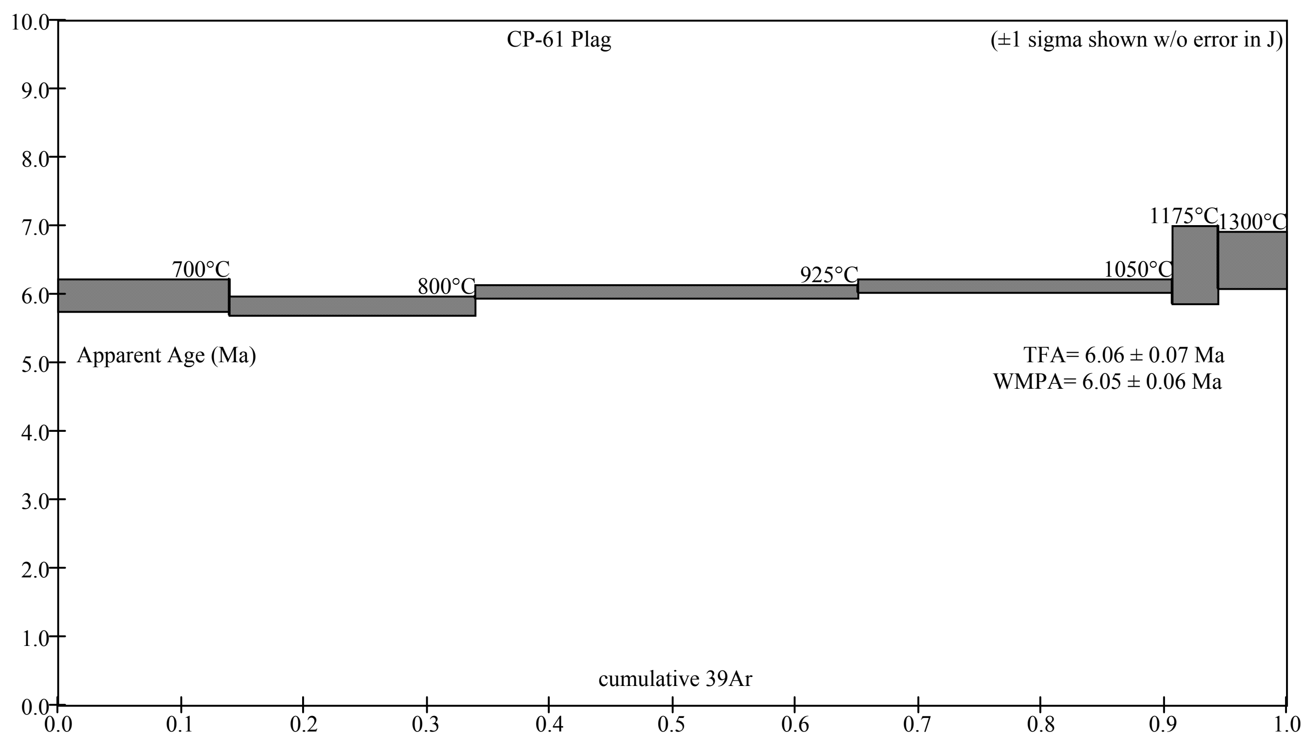

DR2007135
CP-20 Plag
MSWD = 0.70 (< 2.41)
Age =10.48 ± 0.10 Ma
(±1 sigma shown)
Atm.
40/36=295.7 ± 4.0
1300°C
1200°C
36/40
700°C
1100°C
825°C
1000°C
900°C
39/40
0.004
0.003
0.002
0.001
0.000
0.000
0.040
0.079
0.119
0.158
0.198
0.237
0.277
0.316
0.356
0.395

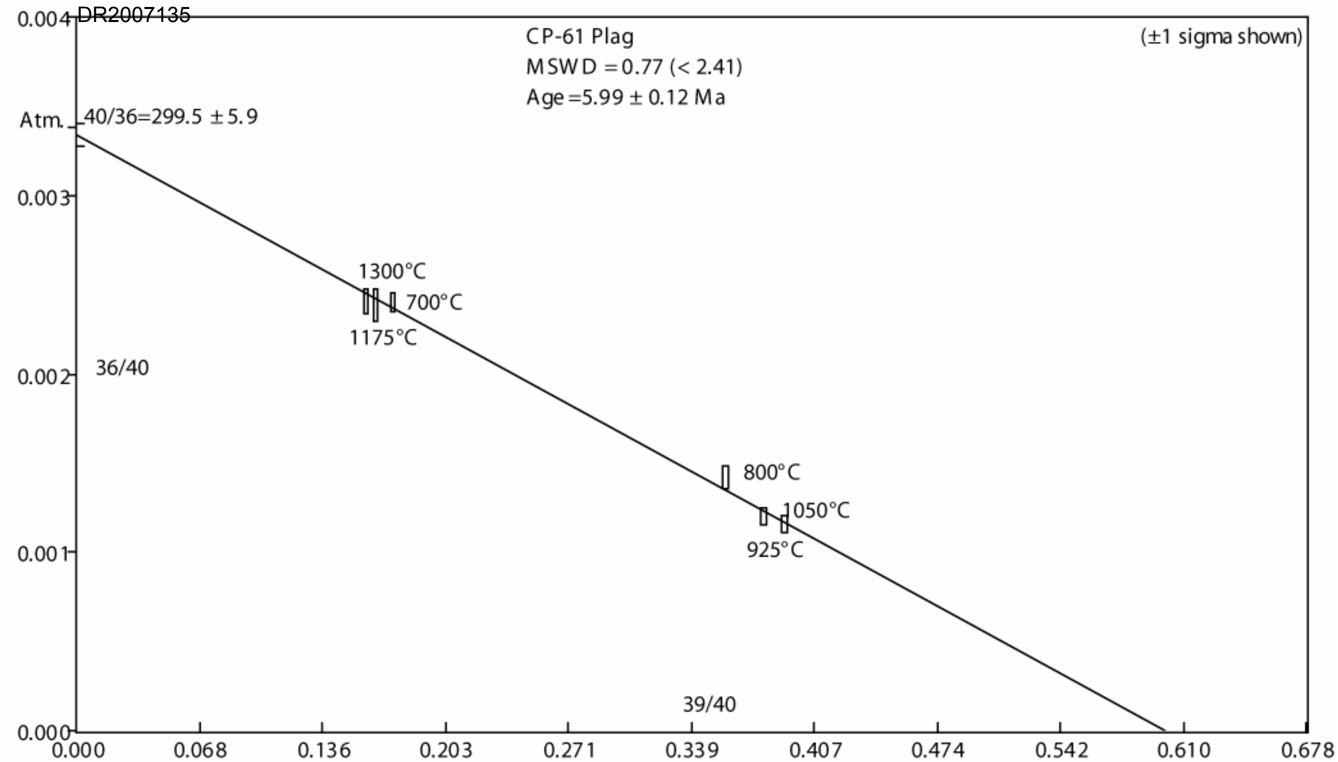

CP-20 Plag
K/Ca
825°C
900°C
1000°C
1100°C
1200°C
1300°C
cumulative 39Ar
3e-2
2e-2
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

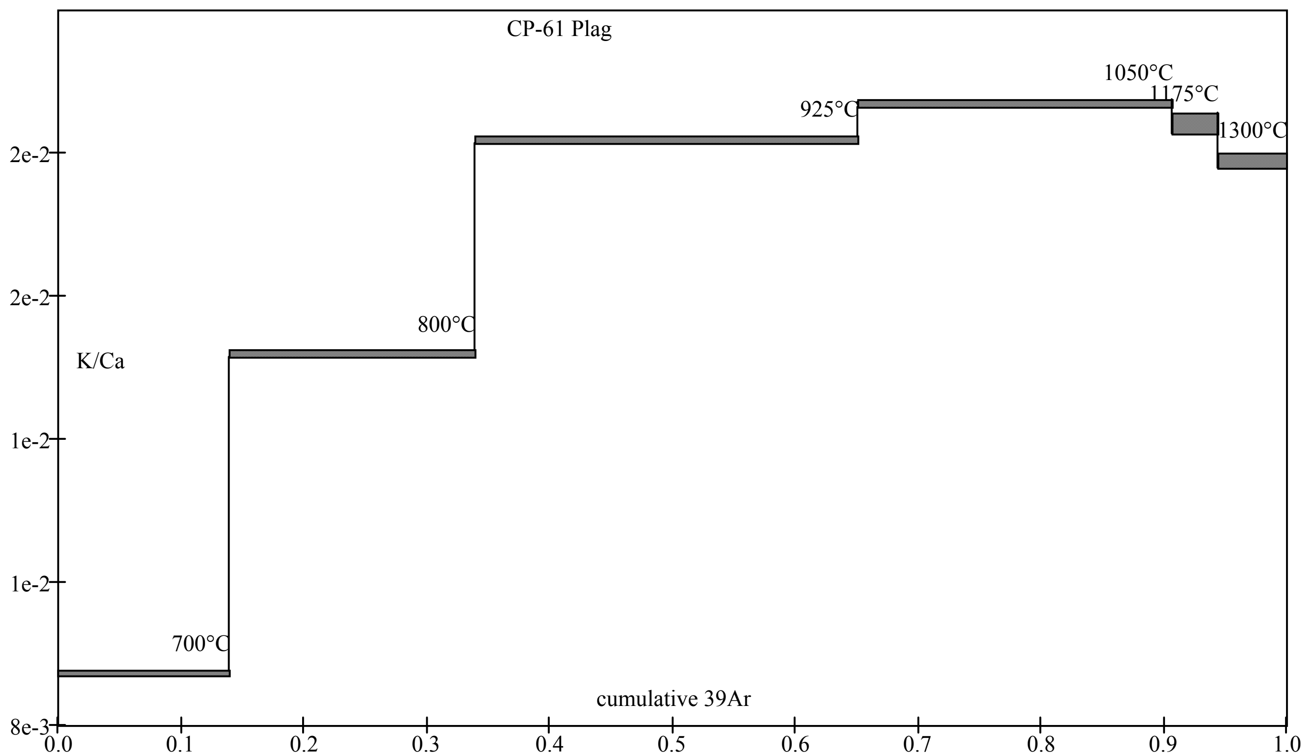
8. Sample: SB51-69 CP-61 Plag J=0.0019954

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	∑ 39Ar	40Ar*	Age (Ma)
700	15	7.8e-15	5.7409	0.0e+0	56.7740	0.0138	0.009	0.13980	0.290	6.0 ± 0.2
800	15	5.5e-15	2.7978	0.0e+0	33.9886	0.0040	0.014	0.33917	0.580	5.8 ± 0.1
925	15	8.0e-15	2.5647	0.0e+0	24.0890	0.0030	0.020	0.65157	0.656	6.0 ± 0.1
1050	15	6.7e-15	2.6466	0.0e+0	22.7163	0.0032	0.022	0.90716	0.644	6.1 ± 0.1
1175	15	2.2e-15	6.0894	1.1e-4	23.4764	0.0145	0.021	0.94410	0.294	6.4 ± 0.6
1300	15	3.5e-15	6.2816	9.4e-4	24.9127	0.0151	0.020	1.00000	0.288	6.5 ± 0.4

Total fusion age, TFA= 6.06 ± 0.07 Ma (including J)
Weighted mean plateau age, WMPA= 6.05 ± 0.06 Ma (including J)
Inverse isochron age =5.99 ± 0.12 Ma. (MSWD =0.77; 40Ar/36Ar=299.5 ± 5.2)
Steps used: 700, 800, 925, 1050, 1175, 1300, (1–6/6 or 100% ∑ 39Ar
t = dwell time in minutes.
40(mol) = moles corrected for blank and reactor-produced 40.
Ratios are corrected for blanks, decay, and interference.
∑39Ar is cumulative, 40Ar* = rad fraction.




DR2007135
CP-61 Plag
MSWD = 0.77 (< 2.41)
Age=5.99 ± 0.12 Ma
(±1 sigma shown)
Atm.
40/36=299.5 ± 5.9
1300°C
700°C
1175°C
36/40
800°C
1050°C
925°C
39/40
0.004
0.003
0.002
0.001
0.000
0.000
0.068
0.136
0.203
0.271
0.339
0.407
0.474
0.542
0.610
0.678


CP-61 Plag
1050°C
1175°C
925°C
1300°C
800°C
700°C
K/Ca
cumulative 39Ar
2e-2
2e-2
1e-2
1e-2
8e-3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0