SAMPLE PREPARATION AND ANALYSES

Comendite, trachyte, latite, and trachybasalt whole pumices or scoria were collected on the Chinese side of the border in 1989, 2005, and 2013 (Fig. 1, Table 1). Results for the ME comendite focus on a single ~0.5 m pumice (51) collected from a tephra fall deposit and the comendite type section ~26 km northeast of the caldera and from two different tephra fall deposits located ~33 km east of the caldera that contain pebble-sized pumice and 3-20 mg intact potassium feldspar and clinopyroxene crystals (BA and BB, Table 1). Trachyte results originate from pumices collected on the northern flank of the caldera (ME TC-10-13 and TC-15-13) and along the Chinese side of Tianchi shore (Baguamiao TC-24-13, Liuhaojie TC-27-13 L1, and TC-28-13 L2). ME trachybasalt scoria (CB1) was collected approximately halfway up the northern flank of the volcano and ME latite pumice (95) was collected ~22 km east of the caldera.

Pumices of comendite and trachyte were hand crushed and sieved to minimize crystal fragmentation. Potassium feldspar crystals and crystal-free pumice shards were hand picked from sieve fractions >0.355 mm. Crystals were etched in ~15% hydrofluoric acid to remove adhering glass and placed in a sonicating bath with ultrafiltered water for ~25 minutes. Clean crystals were then hand picked to obtain sanidine separates with minimal melt inclusions.

Three types of whole rock or pumice separates were prepared. Firstly, whole pumice clasts with either high crystal contents (i.e., >10%, TC 10-13, TC 15-13, TC 24-13, TC 27-13 and TC 28-13) or low crystal contents (i.e., <3%, 51, 95, and CB1) were either powdered in a tungsten carbide shatterbox (51, 95, and CB1) or in an aluminum ball mill (TC 10-13, TC 15-13, TC 24-13, TC 27-13, and TC 28-13), dissolved in hydrofluoric, nitric, and hydrochloric acids, and analyzed directly. These are designated by WR (i.e., whole rocks) in Tables 1 and DR 1. In addition, crystal-free trachyte and comendite pumice separates were either directly dissolved using hydrofluoric, nitric, and hydrochloric acids, and designated as CF Pumice (i.e., crystal-free pumice), or were sequentially dissolved using 10% hydrofluoric acid at room temperature in 2 hour increments where any unpicked crystals remained undissolved. The hydrofluoric acid solution containing the dissolved pumice was decanted from any remaining crystals and additional nitric and hydrochloric acids were added to ensure complete dissolution. These are designated as SD Pumice (i.e., sequential dissolution pumice). Major and trace element compositions of whole pumice powders and crystal-free pumice powders are given in Table DR 1, and average feldspar compositions of four sanidine crystals from each of the comendite and selected trachytes are given in Table DR 2.

In contrast to pumice, selected clean sanidine crystals were loaded into machined Al discs and irradiated for 30 (NM-266) or 20 (NM-274) minutes at the USGS TRIGA Reactor in Denver (CO). Fish Canyon Tuff sanidine (FC-2) was used as a flux monitor and assigned an age of 28.201 Ma (Kuiper, 2008). A ^{40}K decay constant of 5.463e^{-10}/a was used (Min, 2000). Argon was measured using a ThermoScientific ARGUS IV mass spectrometer (Jan) on line with an automated all metal extraction system at New Mexico Tech. NM266 was subjected to an extended delay following irradiation, thus a fixed value for ^{37}Ar based on a K/Ca ratio of 320 was used for data reduction. This value was verified by additional analyses (not presented here). Variation of this assumed value by an order of magnitude impacts final age assignments by <1 ka. The multi-collector configuration used for analysis was: ^{40}Ar-H1, ^{39}Ar-Ax, ^{38}Ar-L1, ^{37}Ar-L2, and ^{36}Ar-L3. Amplifiers used for H1, L1, and L2 Faradays were 1e^{12} Ohm, the Ax Faraday was 1e^{13} Ohm, and L3 used a CDD ion counter with a deadtime of 14ns. Samples were heated for 25-45 seconds using a 75W Photon Machines CO_2 laser. Reactive gases were removed during heating by 30-45 second reactions with a SAES NP-10 getter operated at 1.6A and a D-50 getter operated at room temperature. Mass spectrometer sensitivity was 6e^{-17} mol/fA. Typical total system blank and backgrounds were 1-3 ± 2-5%, 0.05-0.1 ± 15%, 0.02 ± 100%, 0.01 ± 100%, and 0.03 ± 5%, x 10^{-17} moles for masses 40, 39, 38, 37, and 36, respectively. Correction factors for interfering reactions originate from long-term monitoring of more lengthy irradiations. For the short irradiation times utilized here, the impact of these corrections on age determinations are minimal. J-factors were determined to precisions of ~±0.1% and used CO_2 laser fusions of at least 6-crystals from multiple radial positions around irradiation trays.

Approximately 200 mg of comendite, trachyte, latite, and trachybasalt whole rock powder or crystal-free pumice, directly dissolved or sequentially dissolved, were analyzed for uranium, thorium, and radium concentrations and isotope ratios using isotope dilution and ^{236}U, ^{229}Th, and ^{228}Ra spikes. Sr, Nd, and Pb isotope ratios were also measured on these same samples (Table DR 1). U-series isotope dilution and isotopic concentration measurements were undertaken using a ThermoScientific NeptunePlus MC-ICPMS at NMSU. Additional Nd and Pb isotope ratios were determined using MC-ICPMS with Nd isotopes normalized to $^{146}Nd/^{144}Nd=0.7219$ and Pb isotopes normalized to NBS997 Tl=0.41892, while Sr isotopes were measured using TIMS, normalized to $^{86}Sr/^{88}Sr=0.1194$.

Figure DR 1. $^{40}Ar/^{39}Ar$ age spectra of two multi-crystal aliquots (a and b) and fifteen single sanidine crystals (c-q) from a single ME comendite pumice (51). $^{40}Ar/^{39}Ar$ ages range from ~16 ka to within error of eruption and many have flat spectra not normally observed for sanidines affected by excess argon.

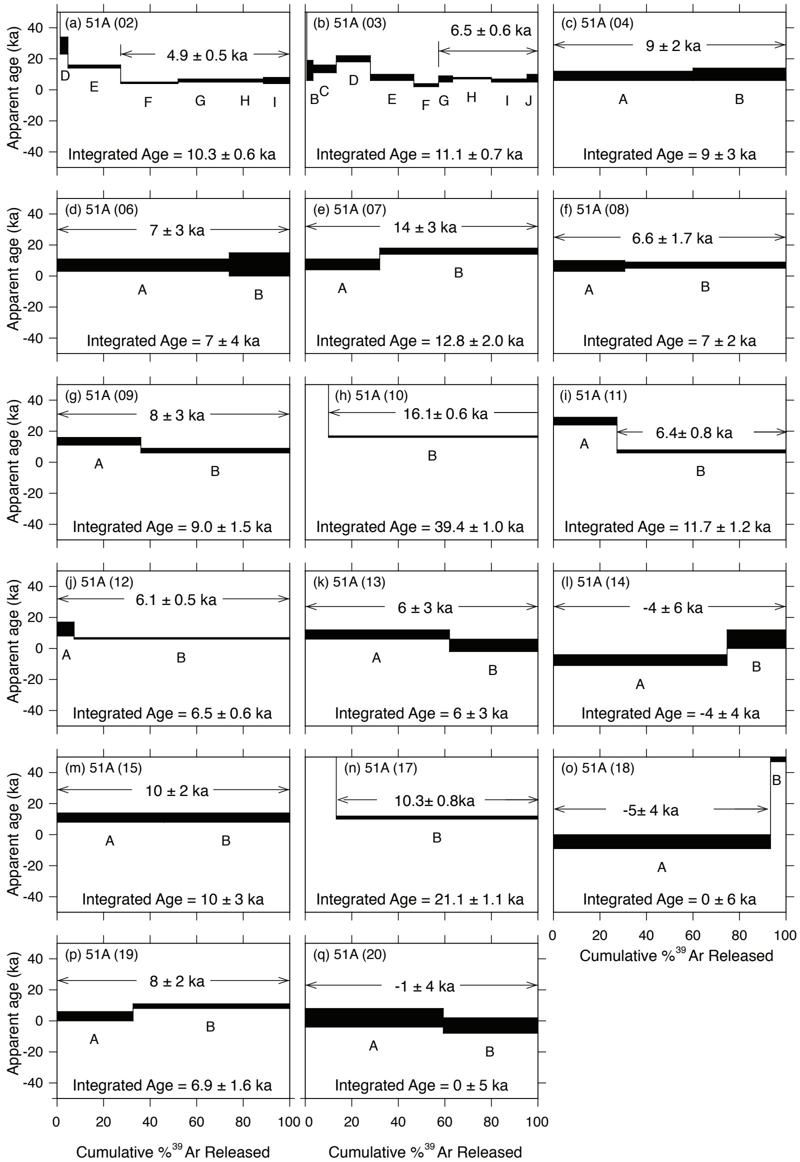

Figure DR 2. $^{40}Ar/^{39}Ar$ age spectra of two multi-crystal aliquots (a and b) and nine single crystals analyses (c-k) from ME BA sanidines. Integrated ages are as old as 210 ka whereas plateau segments are as young as ~4 ka. All plateau ages are older than the 946 CE eruption age.

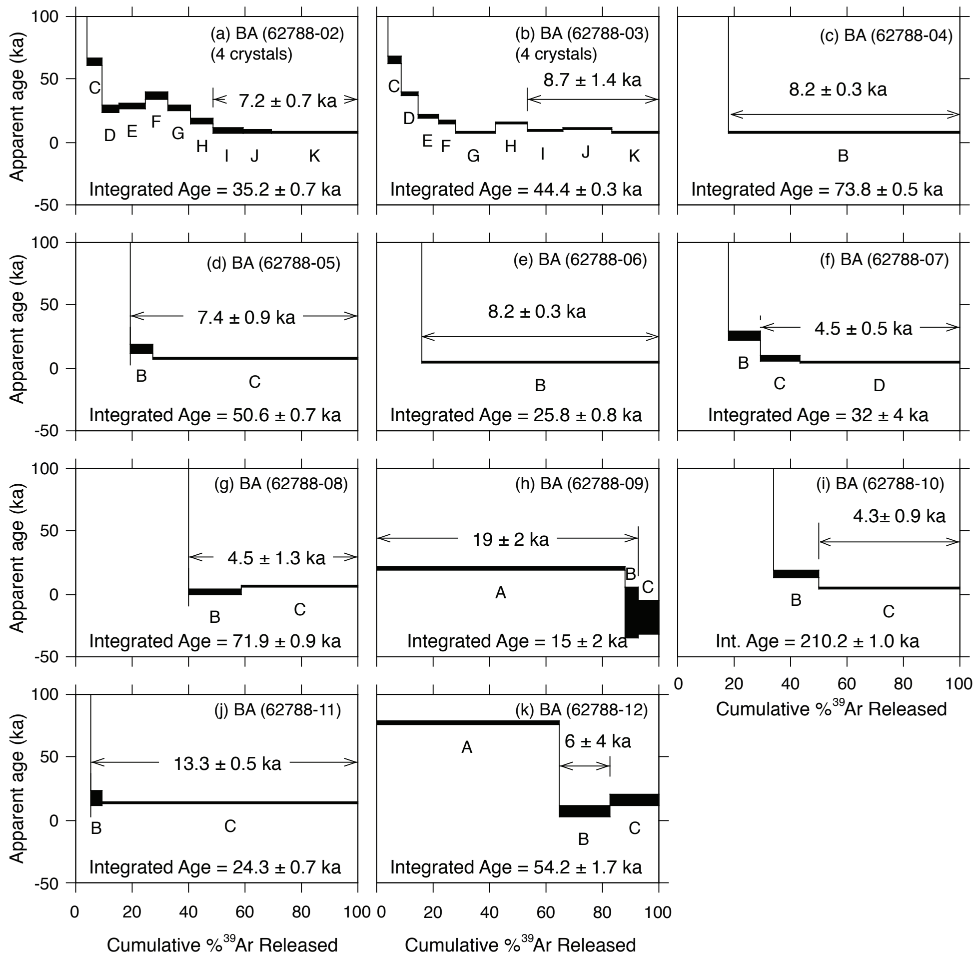

Figure DR 3. Example of $^{40}Ar/^{39}Ar$ age spectra of two multi-crystal aliquots (a and b) and coarse and fine portions of single crystals subjected to hydrofluoric acid etching (c-f) for sanidines obtained from distal portions (BB) of the ME comendite. Sanidines are as young as 3.3 ± 0.4 ka, however even with aggressive acid treatment apparent ages remain older than the 946 CE eruption age.

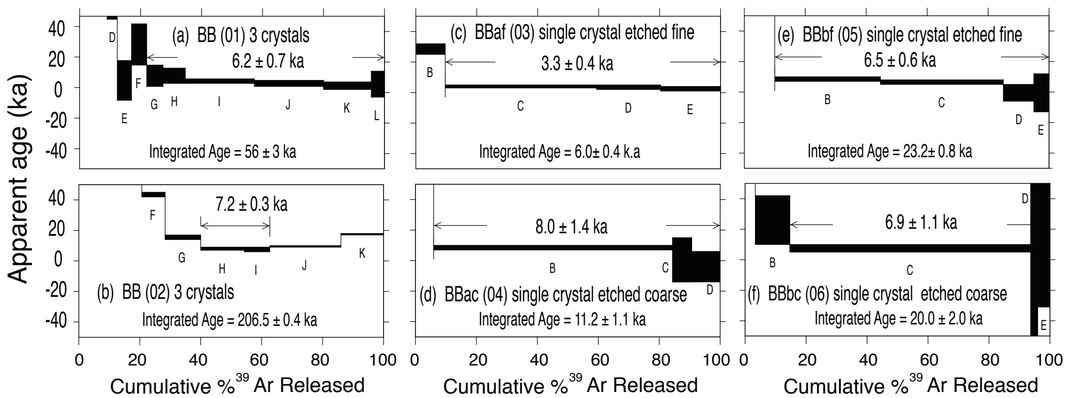

Figure DR 4. Single and multi-crystal $^{40}Ar/^{39}Ar$ age spectra of sanidines from the ME trachtye. Plateau ages range from 4.1 ± 0.8 to 9.9 ± 1.0 ka.

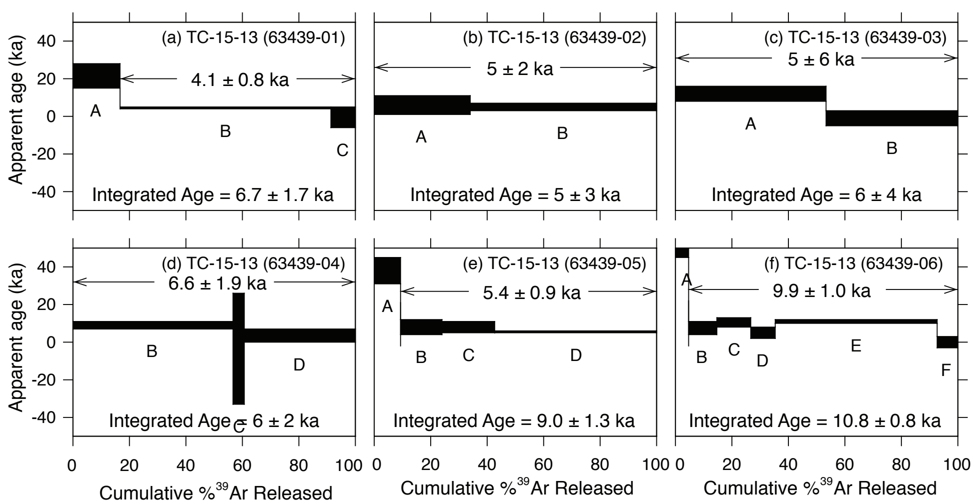

Figure DR 5. Single and multi-crystal $^{40}Ar/^{39}Ar$ age spectra of sanidines from the presumed 1668 CE Baguamiao trachyte. Plateau ages range from 2.8 ± 0.6 to 8.4 ± 0.4 ka.

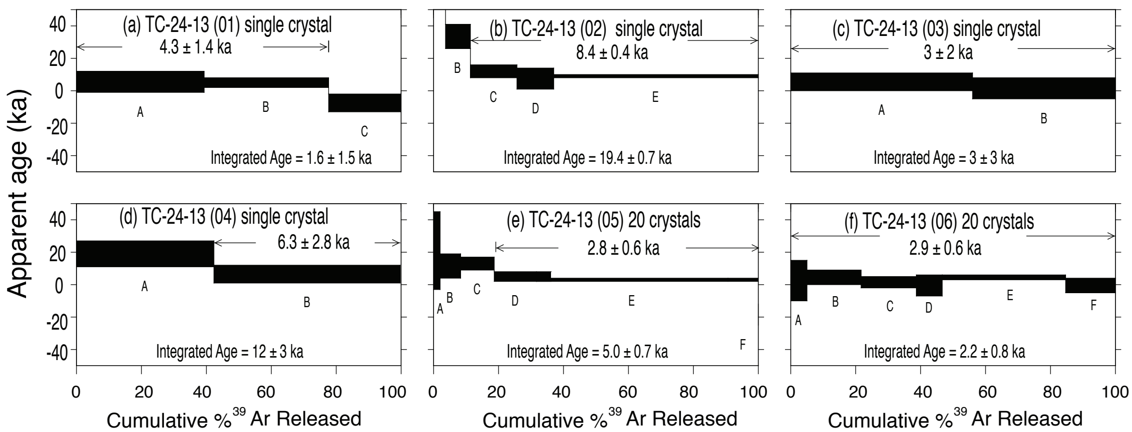

Figure DR 6. Single and multi-crystal $^{40}Ar/^{39}Ar$ age spectra of sanidines from the presumed 1903 CE Liuhaojie trachyte. Plateau ages range from 4.2 ± 0.9 to 7.7 ± 0.6 ka.

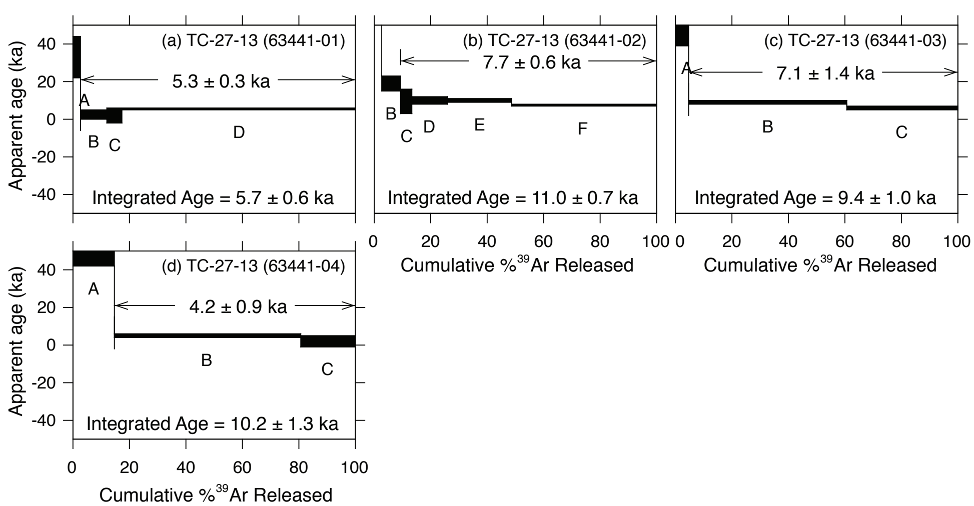

Table DR 1. Major oxides, trace elements, and Sr, Nd, Pb isotopes of Changbaishan whole rocks and crystal-free pumices.

Sample ID	51	TC-10-13	TC-10-13	TC 15-13	TC 15-13	TC 24-13
Eruption	Millennium Eruption	Millennium Eruption	Millennium Eruption	Millennium Eruption	Millennium Eruption	Baguamiao
Age	946 CE	946 CE	946 CE	946 CE	946 CE	1668 CE
Composition	Comendite	Trachyte	Trachyte	Trachyte	Trachyte	Trachyte
Digestion type	Whole Rock	Whole Rock	CF-Pumice	Whole Rock	CF-Pumice	Whole Rock
XRF major element oxides normalized to 100%						
SiO_2	73.63	64.97	65.18	65.32	64.88	65.02
TiO_2	0.24	0.55	0.54	0.49	0.51	0.53
Al_2O_3	11.53	16.10	15.98	16.15	16.46	16.17
FeO*	3.94	4.87	5.06	4.59	5.00	4.57
MnO	0.08	0.13	0.14	0.13	0.14	0.12
MgO	0.03	0.43	0.29	0.26	0.27	0.37
CaO	0.30	1.44	1.38	1.35	1.35	1.55
Na_2O	5.49	5.64	5.69	5.72	5.66	5.72
K_2O	4.75	5.77	5.66	5.91	5.63	5.87
P_2O_5	0.12	0.10	0.09	0.08	0.09	0.08
Total	100	100	100	100	100	100
ICPMS trace elements (ppm)						
La	164.5	73.4	85.4	72.4	86.1	71.8
Ce	321.1	141.6	164.8	139.6	166.4	135.6
Pr	35.8	16.2	18.7	15.9	18.8	15.2
Nd	127.5	59.7	69.0	58.3	69.4	55.8
Sm	28	12	14	12	14	11
Eu	0.4	0.7	0.5	0.7	0.5	0.7
Gd	24.9	9.8	11.4	9.5	11.3	8.8
Tb	4	2	2	2	2	1
Dy	25	9	10	8	10	8
Ho	4.8	1.6	1.8	1.5	1.8	1.4
Er	12.4	4.0	4.7	3.8	4.6	3.5
Tm	1.7	0.5	0.6	0.5	0.6	0.5
Yb	10.3	3.3	4.0	3.2	3.9	3.0
Lu	1.5	0.5	0.6	0.5	0.6	0.5
Ba	14	119	46	82	38	118
Th	46.8	12.6	15.1	12.3	14.7	11.3
Nb	232.5	69.8	83.1	67.6	81.3	64.1
Y	123.1	39.2	45.9	37.7	45.3	35.7
Hf	48	13	16	13	16	12
Ta	15	4	5	4	5	4
U	9	3	3	3	3	2
Pb	37	11	13	12	13	10
Rb	338	121	140	120	137	116
Cs	5.2	1.3	1.6	1.4	1.6	1.2
Sr	7.0	34.2	15.7	23.1	13.3	46.3
Sc	1.9	4.9	4.8	4.4	4.7	4.6
Zr	1976	574	692	556	676	520
Sr Isotopes						
Whole rock	0.705355±0.000010	0.705083±0.000008 0.705069±0.000011		0.705231±0.000011		0.705070±0.000011
CF-Pumice	0.705210±0.000010 0.705268±0.000010		0.705177±0.0000015		0.705268±0.000011	
SD-Pumice	0.705230±0.000010		0.705128±0.0000010		0.705251±0.000008	
Nd Isotopes						
Whole rock	0.512581±0.000009	0.512569±0.000003 0.512567±0.000006		0.512569±0.000004		0.512578±0.000004
CF-Pumice	0.512575±0.000003 0.512573±0.000005		0.512563±0.000003		0.512567±0.000006	
SD-Pumice	0.512567±0.000005		0.512570±0.000003		0.512572±0.000003	
Pb Isotopes						
Whole rock						
$^{206}Pb/^{204}Pb$	17.532±0.001			17.550±0.001		17.516±0.001
$^{207}Pb/^{204}Pb$	15.517±0.001			15.520±0.001		15.513±0.001
$^{208}Pb/^{204}Pb$	37.847±0.001			37.851±0.001		37.827±0.002
CF-Pumice						
$^{206}Pb/^{204}Pb$	17.533±0.001	17.532±0.001	17.552±0.001		17.550±0.001	
$^{207}Pb/^{204}Pb$	15.518±0.001	15.519±0.001	15.522±0.001		15.519±0.001	
$^{208}Pb/^{204}Pb$	37.850±0.002	37.844±0.002	37.859±0.001		37.850±0.001	
SD-Pumice						
$^{206}Pb/^{204}Pb$	17.532±0.001		17.554±0.001		17.549±0.001	
$^{207}Pb/^{204}Pb$	15.516±0.001		15.512±0.001		15.519±0.001	
$^{208}Pb/^{204}Pb$	37.846±0.001		37.815±0.002		37.846±0.002	

Digestion Types are as follows: Whole Rock, a powder generated from whole pumice clasts directly digested (note, 51, 95, and CB1 contained very few crystals and are thus nearly crystal-free pumices), CF-Pumice, pumice shard separates or powdered pumice separates in which crystals were manually removed prior to direct digestion, SD-Pumice, pumice shard separates that had crystals manually removed and then were sequentially digested using 10% hydrofluoric acid at room temperature in two or three 2-hour steps, which allowed the pumice glass to be dissolved but left any crystals undissolved. Iron was measured as total Fe (FeO*). Strontium isotopes were analyzed using TIMS and Nd and Pb were analyzed using MC-ICPMS at NMSU. NBS987 Sr standard average (and 1 standard deviation for n=67) analyzed during the 16 month analyical period was $^{87}Sr/^{86}Sr$: 0.710279 ± 0.000027. Similarly, JNdi-1 Nd standard was $^{143}Nd/^{144}Nd$: 0.512090 ± 0.000011 and $^{145}Nd/^{144}Nd$: 0.348414 ± 0.000005 (n=132). NBS981 Pb standard ratios were $^{206}Pb/^{204}Pb$: 16.931 ± 0.003, $^{207}Pb/^{204}Pb$: 15.484 ± 0.002, and $^{208}Pb/^{204}Pb$: 36.675 ± 0.006 (n=162). Errors are 1 standard deviation for n total analyses. [1] indicates isotope results for $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ done at UCSC. 2nd sets of isotope ratios for Sr, Nd, and Pb are repeat analyses using a second, separate sample digestion.

TC 24-13 Baguamiao 1668 CE Trachyte CF-Pumice	TC 27-13 L1 Liuhaojie 1903 CE Trachyte L1 Whole Rock	TC 27-13 L1 Liuhaojie 1903 CE Trachyte L1 CF-Pumice	TC 28-13 L2 Liuhaojie 1903 CE Trachyte L2 Whole Rock	TC 28-13 L2 Liuhaojie 1903 CE Trachyte L2 CF-Pumice	95 Millennium Eruption 946 CE Latite Whole Rock	CB1 Millennium Eruption 946 CE Trachybasalt Whole Rock
65.33	64.80	65.07	64.86	65.09	60.28	50.92
0.49	0.50	0.54	0.47	0.54	1.24	3.08
16.09	16.65	15.83	16.70	15.94	16.66	17.12
4.97	4.37	5.22	4.21	5.08	6.11	9.32
0.14	0.12	0.14	0.11	0.14	0.13	0.13
0.25	0.30	0.28	0.29	0.29	1.88	4.58
1.29	1.46	1.45	1.50	1.45	3.10	8.13
5.72	5.72	5.66	5.61	5.58	5.22	3.87
5.65	5.99	5.72	6.17	5.79	4.58	2.22
0.08	0.08	0.09	0.08	0.09	0.29	0.62
100	100	100	100	100	100	100
87.9	64.2	82.3	58.8	84.9	58.9	37.6
173.7	122.4	155.6	110.8	162.3	113.1	76.1
18.9	13.9	17.7	12.7	18.4	13.1	9.3
68.5	51.3	64.9	46.9	68.0	49.6	38.2
13	10	13	9	13	10	8
0.5	0.8	0.5	0.9	0.5	2.4	2.9
10.6	8.3	10.2	7.4	10.6	8.7	7.4
2	1	2	1	2	1	1
9	7	9	6	10	7	6
1.7	1.3	1.7	1.2	1.8	1.3	1.0
4.3	3.3	4.2	3.0	4.4	3.1	2.3
0.6	0.5	0.6	0.4	0.6	0.4	0.3
3.7	2.7	3.6	2.6	3.7	2.5	1.6
0.6	0.4	0.6	0.4	0.6	0.4	0.2
45	129	48	170	49	798	676
14.7	10.5	13.7	9.3	14.1	8.5	4.6
82.2	59.5	77.6	52.3	79.3	50.1	38.3
45.1	33.1	42.9	30.1	44.2	31.0	24.4
15	11	14	10	14	9	6
6	4	5	4	5	9	3
3	2	3	2	3	2	1
12	10	12	10	14	10	5
140	110	130	102	137	85	39
1.6	1.2	1.6	1.0	1.6	0.9	0.3
13.7	43.6	18.7	50.6	20.1	352.0	823.0
4.2	4.3	4.5	4.1	4.7	9.7	19.9
678	480	636	427	652	379	260
	0.705062±0.000010		0.705201±0.000014		0.704971±0.000010[1]	0.704920±0.000010[1]
0.705171±0.000010 0.705178±0.000010 0.705258±0.000011		0.705143±0.000015		0.705216±0.000013		
	0.512570±0.000004		0.512576±0.000002		0.512586±0.000005	0.512608±0.000005
0.512568±0.000004 0.512575±0.000004 0.512575±0.000003		0.512576±0.000004		0.512573±0.000003		
	17.532±0.001 15.514±0.001 37.830±0.002		17.539±0.001 15.517±0.001 37.836±0.002		17.519±0.001 15.517±0.001 37.832±0.002	17.514±0.001 15.519±0.001 37.859±0.002
17.536±0.001 15.514±0.001 37.826±0.002		17.524±0.001 15.515±0.001 37.830±0.002		17.540±0.001 15.513±0.001 37.824±0.002		
17.532±0.001 15.511±0.001 37.819±0.002						

Table DR 2. Major oxides (weight percent) of representative potassium feldspars determined by electron microprobe analysis.

Sample ID	Composition	Crystal	SiO_2	Al_2O_3	CaO	FeO	SrO	BaO	Na_2O	K_2O	Total	An	Ab	Or	K/Ca
Liu. TC 27-13 L1	Trachyte	1 (kf2)	64.64	19.97	0.93	0.17	0.02	0.01	6.21	7.11	99.05	0.045	0.54	0.41	8.9
		2 (kf2)	64.93	19.80	0.73	0.16	0.02	0.00	5.83	7.62	99.09	0.036	0.52	0.45	12.1
		3 (kf2)	65.22	19.37	0.34	0.22	0.02	0.01	6.29	7.42	98.87	0.017	0.55	0.43	25.3
		4 (kf2)	65.05	19.66	0.65	0.20	0.02	0.00	6.01	7.56	99.16	0.032	0.53	0.44	13.4
Bag. TC 24-13	Trachyte	1 (kf2)	64.43	20.02	0.90	0.15	0.03	0.05	5.98	7.53	99.09	0.043	0.52	0.43	9.7
		2 (kf2)	64.75	19.98	0.85	0.18	0.02	0.03	6.03	7.43	99.27	0.041	0.53	0.43	10.2
		3 (kf2)	65.33	19.41	0.35	0.22	0.01	0.01	6.34	7.49	99.17	0.017	0.55	0.43	24.9
		4 (kf2)	65.08	19.96	0.72	0.15	0.01	0.02	6.06	7.69	99.69	0.035	0.53	0.44	12.4
ME TC 15-13	Trachyte	1 (kf2)	65.10	20.23	0.91	0.15	0.03	0.02	6.30	7.32	100.07	0.043	0.54	0.41	9.3
		2 (kf2)	65.13	20.23	0.98	0.16	0.02	0.01	6.14	7.47	100.14	0.047	0.53	0.42	8.8
		3 (kf2)	66.29	19.49	0.24	0.23	0.01	0.01	6.86	6.96	100.09	0.012	0.59	0.40	33.5
		4 (kf2)	65.23	20.08	0.81	0.16	0.04	0.01	5.88	7.94	100.14	0.039	0.51	0.45	11.4
ME 51	Comendite	1 (kf1)	67.14	18.92	0.01	-	-	-	7.14	6.50	99.71	0.0005	0.63	0.37	754.5
		2 (kf1)	67.15	19.00	0.01	-	-	-	7.23	6.55	99.95	0.0005	0.63	0.37	760.3
		3 (kf1)	67.36	18.87	0.01	-	-	-	7.28	6.45	99.97	0.0005	0.63	0.37	748.7
		4 (kf1)	67.02	18.80	0.01	-	-	-	7.13	6.28	99.24	0.0005	0.63	0.37	729.0

kf1 indicates potassium feldspars with a composition of An <0.1, Or ~35-38, and Ab 62-65. kf2 indicates potassium feldspar with a composition of An 1-5, Or >40, and Ab 50-60. Electron microprobe analyses done at Oregon State University and New Mexico Bureau of Geology and Mineral Resources.

Table DR 3. $^{40}Ar/^{39}Ar$ results for young Changbaishan sanidines from comendite and trachyte deposits.

Analysis Identifiers			Preferred Age						Integrated Age		
Sample	L#	Irrad	Analysis	n	$\%^{39}Ar$	MSWD	Age (ka)	± 1σ	n	Age (ka)	± 1σ
ME Comendite											
51	62784-02	NM-266A	Pt	4	72.5	1.0	4.95	± 0.49	8	10.3	± 0.6
51	62784-03	NM-266A	Pt	4	42.1	0.3	6.53	± 0.58	10	11.1	± 0.7
51	62784-04	NM-266A	Pt	2	100.0	0.0	8.8	± 2.3	2	9.0	± 3.0
51	62784-06	NM-266A	Pt	2	100.0	0.0	6.7	± 3.4	2	7.0	± 4.0
51	62784-07	NM-266A	Pt	2	100.0	4.8	14.1	± 3.3	2	12.8	± 2.0
51	62784-08	NM-266A	Pt	2	100.0	0.0	6.6	± 1.7	2	7.0	± 2.0
51	62784-09	NM-266A	Pt	2	100.0	5.2	8.1	± 2.5	2	9.0	± 1.5
51	62784-10	NM-266A	Step B	1	89.8	0.0	16.10	± 0.60	2	39.4	± 1.0
51	62784-11	NM-266A	Step B	1	72.5	0.0	6.40	± 0.80	2	11.7	± 1.2
51	62784-12	NM-266A	Pt	2	100.0	1.9	6.12	± 0.49	2	6.5	± 0.6
51	62784-13	NM-266A	Pt	2	100.0	1.9	5.9	± 3.2	2	6.0	± 3.0
51	62784-14	NM-266A	Pt	2	100.0	3.6	-4.2	± 5.8	2	-4.0	± 4.0
51	62784-15	NM-266A	Pt	2	100.0	0.0	10.4	± 2.1	2	10.0	± 3.0
51	62784-17	NM-266A	Step B	1	86.4	0.0	10.3	± 0.8	2	21.1	± 1.1
51	62784-18	NM-266A	Step A	1	93.5	0.0	-5.0	± 4.0	2	0.0	± 6.0
51	62784-19	NM-266A	Pt	2	100.0	4.0	7.9	± 2.3	2	6.9	± 1.6
51	62784-20	NM-266A	Pt	2	100.0	0.4	-1.4	± 3.7	2	0.0	± 5.0
ME Comendite											
BB	62789-01	NM-266B	Pt	6	77.8	2.0	6.20	± 0.73	12	56.0	± 3.0
BB	62789-02	NM-266B	Pt	2	22.8	0.4	7.16	± 0.33	10	207.0	± 0.4
BBaf	62789-03	NM-266B	Pt	3	90.3	1.9	3.32	± 0.39	5	6.0	± 0.4
BBac	62789-04	NM-266B	Pt	3	93.9	4.0	7.98	± 1.36	4	11.2	± 1.1
BBbf	62789-05	NM-266B	Pt	4	89.9	4.2	6.49	± 0.60	5	23.2	± 0.8
BBbc	62789-06	NM-266B	Pt	4	96.4	1.8	6.90	± 1.10	5	20.0	± 2.0
ME Comendite											
BA	62788-02	NM-266B	Pt	3	49.3	0.5	7.16	± 0.65	11	35.2	± 0.7
BA	62788-03	NM-266B	Pt	3	46.7	24.3	8.73	± 1.38	10	44.4	± 0.3
BA	62788-04	NM-266B	Step B	1	81.7	na	8.19	± 0.28	2	73.8	± 0.5
BA	62788-05	NM-266B	Pt	2	80.5	4.5	7.41	± 0.88	3	50.6	± 0.7
BA	62788-06	NM-266B	Step B	1	83.5	na	3.59	± 0.40	2	25.8	± 0.8
BA	62788-07	NM-266B	Pt	2	70.3	0.9	4.54	± 0.52	4	32.0	± 4.0
BA	62788-08	NM-266B	Pt	2	59.5	2.1	4.5	± 1.3	3	71.9	± 0.9
BA	62788-09	NM-266B	Pt	2	93.0	3.0	19.2	± 2.5	3	15.0	± 2.0
BA	62788-10	NM-266B	Step C	1	49.8	na	4.3	± 0.9	3	210.2	± 1.0
BA	62788-11	NM-266B	Pt	2	94.3	0.4	13.28	± 0.54	3	24.3	± 0.7
BA	62788-12	NM-266B	Step B	1	17.9	na	6.2	± 4.3	3	54.2	± 1.7
ME Trachyte											
TC-15-13	63439-01	NM-274B	Pt	2	83.1	0.7	4.05	± 0.83	3	6.70	± 1.35
TC-15-13	63439-02	NM-274B	Pt	2	100.0	0.1	4.7	± 2.1	2	4.87	± 2.30
TC-15-13	63439-03	NM-274B	Pt	2	100.0	4.7	5.0	± 6.4	2	5.59	± 2.96
TC-15-13	63439-04	NM-274B	Pt	3	100.0	1.1	6.6	± 1.9	3	5.79	± 2.13
TC-15-13	63439-05	NM-274B	Pt	3	90.5	0.5	5.41	± 0.85	4	8.99	± 1.13
TC-15-13	63439-06	NM-274B	Pt	5	95.1	3.8	9.9	± 1.0	6	10.78	± 0.74
Baguamiao Trachyte											
TC-24-13	63440-01	NM-274B	Pt	2	77.8	0.0	4.3	± 3.5	3	1.6	± 1.5
TC-24-13	63440-02	NM-274B	Pt	3	88.7	1.2	8.38	± 0.46	5	19.36	± 0.68
TC-24-13	63440-03	NM-274B	Pt	2	100.0	1.0	3.5	± 2.1	2	3.5	± 2.1
TC-24-13	63440-04	NM-274B	Step B	1	57.6	NA	6.3	± 2.8	2	11.5	± 2.4
TC-24-13	63440-05	NM-274B	Pt	2	79.2	1.3	2.82	± 0.58	5	5.00	± 0.60
TC-24-13	63440-06	NM-274B	Pt	6	100.0	1.5	2.95	± 0.77	6	2.24	± 0.76
Liuhaojie Trachyte											
TC-27-13	63441-01	NM-274B	Pt	3	96.8	1.2	5.31	± 0.32	4	5.72	± 0.54
TC-27-13	63441-02	NM-274B	Pt	4	90.1	1.7	7.72	± 0.60	6	10.97	± 0.65
TC-27-13	63441-03	NM-274B	Pt	2	94.7	5.8	7.1	± 1.4	3	9.38	± 0.80
TC-27-13	63441-04	NM-274B	Pt	2	85.2	0.8	4.23	± 0.90	3	10.2	± 1.3

Abbreviation and indicators are as follows: L#: lab identifier, Irrad: irradiation package identifier, Analysis: Pt- Plateau or individual step used for preferred age, n: number of steps used to calculate the preferred age, $\%^{39}Ar$: percentage of ^{39}Ar comprising the preferred age, MSWD: Mean Square Weighted Deviation, 1σ: 1 sigma errors calculated for ages, n: number of steps used to calculate the the integrated age, af or bf: aliquot sized to 140-240 mesh following crushing and HF acid treatment, and ac or bc: aliquot sized to 100-140 mesh following crushing and HF acid treatment.

Table DR 4. Raw $^{40}Ar/^{39}Ar$ results for Changbaishan sanidine and quartz crystals.

	ID	Power	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$	K/Ca	$^{40}Ar^*$	^{39}Ar	Age	±1σ
		(Watts)			(x 10^{-3})	(x 10^{-15} mol)		(%)	(%)	(ka)	(ka)
	51A, Sanidine, 5.4 mg,4 4 crystals, J=0.0000866±0.10%, IC=1.03054±0.00093, NM-266A, Lab#=62784-02										
X	B	0.5	9.462	0.0016	25.92	0.023	320	19.1	0.3	287	63
X	C	0.8	2.478	0.0016	5.876	0.099	320	29.9	1.5	117	14
X	D	1.0	1.577	0.0016	4.721	0.281	320	11.3	5.1	28.1	5.2
X	E	1.5	0.7847	0.0016	2.316	1.76	320	12.1	27.5	14.92	0.97
	F	1.7	0.3272	0.0016	1.000	1.94	320	7.8	52.2	3.93	0.79
	G	1.8	0.1428	0.0016	0.3337	1.64	320	27.2	73.0	5.84	0.84
	H	1.9	0.2290	0.0016	0.6400	1.27	320	14.8	89.2	5.2	1.1
	I	2.1	0.2781	0.0016	0.8010	0.849	320	12.7	100.0	5.5	1.8
	Integrated age ± 1σ			n=8		7.87		K2O=6.47%		10.3	0.6
	Plateau ± 1σ		steps F-I	n=4	MSWD=0.95	5.71			72.5	4.95	0.49
	51A, Sanidine, 3.63 mg, 4 crystals, J=0.0000866±0.10%, IC=1.031317±0.0014, NM-266A, Lab#=62784-03										
X	A	0.5	11.43	0.0016	33.98	0.058	320	12.2	1.0	222	20
X	B	0.8	2.456	0.0016	8.043	0.147	320	3.0	3.5	11.8	6.3
X	C	1.0	1.906	0.0016	6.160	0.590	320	4.3	13.6	12.9	2.6
X	D	1.2	2.123	0.0016	6.743	0.846	320	5.9	28.1	19.9	2.0
X	E	1.5	1.830	0.0016	6.021	1.101	320	2.6	47.0	7.4	1.8
X	F	1.6	0.4987	0.0016	1.610	0.635	320	3.3	57.9	2.6	1.4
	G	1.8	0.2355	0.0016	0.6349	0.349	320	17.8	63.9	6.4	1.9
	H	1.9	0.2140	0.0016	0.5522	0.946	320	21.2	80.1	6.94	0.77
	I	2.1	0.5207	0.0016	1.617	0.921	320	7.0	95.9	5.7	1.1
	J	2.5	0.2927	0.0016	0.8210	0.239	320	15.0	100.0	6.8	2.7
	Integrated age ± 1σ			n=10		5.83		K2O=7.12%		11.1	0.7
	Plateau ± 1σ		steps G-J	n=4	MSWD=0.29	2.46			42.1	6.53	0.58
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-04										
	A	0.4	0.9246	0.0016	2.922	0.389	320	6.0	60.3	8.7	2.7
	B	3.0	1.516	0.0016	4.914	0.256	320	3.9	100.0	9.2	4.1
	Integrated age ± 1σ			n=2		0.645				9.0	3.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=0.01	0.645			100.0	8.8	2.3
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-06										
	A	0.4	1.635	0.0016	5.374	0.268	320	2.6	74.0	6.7	3.8
	B	3.0	0.5009	0.0016	1.525	0.094	320	8.8	100.0	6.9	7.5
	Integrated age ± 1σ			n=2		0.362				7.0	4.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=0.00	0.362			100.0	6.7	3.4
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-07										
	A	0.4	0.8478	0.0016	2.703	0.242	320	5.2	32.2	6.9	3.6
	B	3.0	0.4557	0.0016	1.186	0.511	320	22.0	100.0	15.6	1.7
	Integrated age ± 1σ			n=2		0.753				12.8	2.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=4.76	0.753			100.0	14.1	3.3
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-08										
	A	0.4	0.5254	0.0016	1.629	0.206	320	7.3	31.2	6.0	3.8
	B	3.0	0.2496	0.0016	0.6751	0.454	320	17.7	100.0	6.8	1.9
	Integrated age ± 1σ			n=2		0.660				7.0	2.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=0.04	0.660			100.0	6.6	1.7

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($\times 10^{-3}$)	$^{39}Ar_K$ ($\times 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-09										
	A	0.4	0.6076	0.0016	1.759	0.360	320	13.6	36.1	12.9	2.4
	B	3.0	0.1522	0.0016	0.3464	0.638	320	29.5	100.0	6.8	1.3
	Integrated age ± 1σ			n=2		0.998				9.0	1.5
	Plateau ± 1σ		steps A-B	n=2	MSWD=5.19	0.998			100.0	8.1	2.5
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-10										
X	A	0.4	4.117	0.0016	8.710	0.199	320	37.5	10.2	244.2	5.7
	B	3.0	0.3359	0.0016	0.7689	1.75	320	31.0	100.0	16.12	0.62
	Integrated age ± 1σ			n=2		1.95				39.4	1.0
	Plateau ± 1σ		steps B-B	n=1	NA	1.752			89.8	16.12	0.62
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-11										
X	A	0.4	0.7066	0.0016	1.818	0.336	320	23.3	27.5	25.8	2.6
	B	3.0	0.0770	0.0016	0.0981	0.886	320	58.3	100.0	6.41	0.81
	Integrated age ± 1σ			n=2		1.22				11.7	1.2
	Plateau ± 1σ		steps B-B	n=1	NA	0.886			72.5	6.41	0.81
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-12										
	A	0.4	0.8315	0.0016	2.535	0.187	320	9.3	7.5	12.1	4.4
	B	3.0	0.0866	0.0016	0.1380	2.33	320	48.5	100.0	6.08	0.36
	Integrated age ± 1σ			n=2		2.51				6.5	0.6
	Plateau ± 1σ		steps A-B	n=2	MSWD=1.85	2.515			100.0	6.1	0.5
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-13										
	A	0.4	0.6372	0.0016	1.955	0.306	320	8.3	62.3	8.3	2.9
	B	3.0	0.1488	0.0016	0.4407	0.185	320	7.5	100.0	1.7	3.9
	Integrated age ± 1σ			n=2		0.491				6.0	3.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=1.87	0.491			100.0	5.9	3.2
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-14										
	A	0.4	2.478	0.0016	8.536	0.429	320	-1.9	75.2	-7.6	3.5
	B	3.0	1.087	0.0016	3.540	0.141	320	3.3	100.0	5.6	6.0
	Integrated age ± 1σ			n=2		0.571				-4.0	4.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=3.58	0.571			100.0	-4.2	5.8
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-15										
	A	0.4	0.2208	0.0016	0.5009	0.231	320	31.0	46.3	10.5	3.4
	B	3.0	0.0883	0.0016	0.0522	0.269	320	80.7	100.0	10.3	2.8
	Integrated age ± 1σ			n=2		0.500				10.0	3.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=0.00	0.500			100.0	10.4	2.1
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-17										
X	A	0.4	1.412	0.0016	2.842	0.202	320	40.3	13.6	89.7	4.7
	B	3.0	0.2798	0.0016	0.7019	1.29	320	23.9	100.0	10.30	0.75
	Integrated age ± 1σ			n=2		1.49				21.1	1.1
	Plateau ± 1σ		steps B-B	n=1	NA	1.287			86.4	10.30	0.75
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-18										
	A	0.4	3.504	0.0016	11.96	0.342	320	-0.9	93.5	-5.1	4.4
X	B	3.0	2.098	0.0016	5.396	0.024	320	23.9	100.0	79.2	33.2
	Integrated age ± 1σ			n=2		0.366				0	6
	Plateau ± 1σ		steps A-A	n=1	MSWD=0.00	0.342			93.5	-5.1	4.4
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-19										
	A	0.4	0.3504	0.0016	1.104	0.304	320	5.0	32.8	2.7	2.8
	B	3.0	0.0962	0.0016	0.1095	0.622	320	63.4	100.0	8.9	1.2
	Integrated age ± 1σ			n=2		0.926				6.9	1.6
	Plateau ± 1σ		steps A-B	n=2	MSWD=3.96	0.926			100.0	7.9	2.3
	51A, Sanidine, SC, J=0.0000866±0.10%, IC=1.03025±0.00161, NM-266A, Lab#=62784-20										
	A	0.4	4.557	0.0016	15.38	0.240	320	0.2	59.6	1.7	6.1
	B	3.0	0.1920	0.0016	0.6974	0.162	320	-11.5	100.0	-3.4	4.7

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($\times 10^{-3}$)	$^{39}Ar_K$ ($\times 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	$\pm 1\sigma$ (ka)
	Integrated age ± 1σ			n=2		0.402				0.0	5.0
	Plateau ± 1σ	steps A-B		n=2	MSWD=0.43	0.402			100.0	-1.4	3.7
	BB, sanidine, 3 crystals 5.5 mg, J=0.0000863±0.05%, IC=1.030544±0.00093, NM-266B, Lab#=62789-01										
X	A	0.5	240.4	0.0016	792.3	0.256	320	2.6	3.5	994	51
X	B	0.8	8.364	0.0016	22.12	0.176	320	21.8	5.9	288.1	9.8
X	C	1.0	3.407	0.0016	7.729	0.237	320	32.8	9.2	176.2	6.5
X	D	1.2	2.853	0.0016	8.351	0.237	320	13.3	12.4	59.8	6.4
X	E	1.5	7.794	0.0016	26.19	0.359	320	0.6	17.3	7.4	6.6
X	F	1.6	8.883	0.0016	29.37	0.354	320	2.2	22.2	31.0	6.9
	G	1.8	1.345	0.0016	4.303	0.387	320	4.9	27.5	10.4	3.6
	H	1.9	0.6016	0.0016	1.777	0.542	320	11.6	34.9	10.9	2.5
	I	2.1	0.1377	0.0016	0.2885	1.66	320	34.4	57.6	7.1	0.8
	J	2.5	0.2546	0.0016	0.7206	1.65	320	13.8	80.2	5.4	0.9
	K	3.0	0.1548	0.0016	0.4120	1.132	320	17.3	95.7	4.0	1.2
	L	3.3	0.1456	0.0016	0.3599	0.315	320	23.0	100.0	5.0	4.2
	Integrated age ± 1σ			n=12		7.30		K2O=5.91%		56	3
	Plateau ± 1σ	steps G-L		n=6	MSWD=2.03	5.68			77.8	6.20	0.73
	BB, sanidine, 3 crystals, 7.51 mg, J=0.0000863±0.05%, IC=1.03137±0.0014, NM-266B, Lab#=62789-02										
X	A	0.5	41.03	0.0016	92.09	0.142	320	33.7	1.2	2180	20
X	B	0.8	14.08	0.0016	7.158	0.300	320	85.0	3.8	1887.6	5.4
X	C	1.0	12.29	0.0016	2.482	0.632	320	94.0	9.2	1822.8	2.5
X	E	1.5	1.699	0.0016	1.800	1.37	320	68.5	20.9	183.12	0.94
X	F	1.6	0.4124	0.0016	0.4523	0.878	320	66.9	28.5	42.81	0.80
x	G	1.8	0.1648	0.0016	0.2108	1.35	320	60.4	40.1	15.00	0.52
	H	1.9	0.0805	0.0016	0.0906	1.67	320	63.2	54.3	7.27	0.38
	I	2.1	0.0670	0.0016	0.0555	0.991	320	72.7	62.8	6.82	0.66
X	J	2.5	0.0993	0.0016	0.1079	2.71	320	65.3	86.1	9.45	0.26
X	K	3.0	0.1472	0.0016	0.1098	1.62	320	76.7	100.0	16.91	0.40
	Integrated age ± 1σ			n=10		11.67		K2O=6.92%		206.5	0.4
	Plateau ± 1σ	steps H-I		n=2	MSWD=0.35	2.659			22.8	7.16	0.33
	BBaf, sanidine, SC, etchted, fine, 5.42 mg, J=0.0000863±0.05%, IC=1.03128±0.00104, NM-266B, Lab#=62789-03										
X	A	0.3	6.706	0.0016	19.64	0.020	320	13.5	0.3	142.9	53.9
X	B	0.7	0.5468	0.0016	1.222	0.702	320	33.1	9.7	28.2	1.7
	C	1.5	0.1664	0.0016	0.4589	3.69	320	14.6	59.5	3.67	0.35
	D	2.0	0.0643	0.0016	0.1256	1.56	320	34.6	80.5	3.10	0.69
	E	3.0	0.0584	0.0016	0.1256	1.45	320	27.2	100.0	2.18	0.69
	Integrated age ± 1σ			n=5		7.41		K2O=6.09%		6.0	0.4
	Plateau ± 1σ	steps C-E		n=3	MSWD=1.93	6.69			90.3	3.32	0.39
	BBac, sanidine, SC, etched, coarse, 1.42 mg, J=0.0000863±0.05%, IC=1.03128±0.00104, NM-266B, Lab#=62789-04										
X	A	0.6	1.198	0.0016	2.200	0.123	320	45.6	6.1	85.7	8.3
	B	1.5	0.1755	0.0016	0.3903	1.59	320	31.3	84.4	8.30	0.69
	C	2.0	0.0080	0.0016	0.0066	0.131	320	-399.7	90.8	-0.3	7.1
	D	3.0	0.0377	0.0016	0.2018	0.187	320	-101.5	100.0	-4.8	5.1
	Integrated age ± 1σ			n=4		2.04		K2O=6.38%		11.2	1.1
	Plateau ± 1σ	steps B-D		n=3	MSWD=3.98	1.913			93.9	8.0	1.4
	BBbf, sanidine, SC, etched, fine, 2.22 mg, J=0.0000863±0.05%, IC=1.03128±0.00104, NM-266B, Lab#=62789-05										
X	A	0.5	2.386	0.0016	4.173	0.320	320	48.2	10.1	181.1	3.8
	B	0.8	0.1532	0.0016	0.3175	1.106	320	35.4	44.7	8.15	0.88
	C	1.5	0.2338	0.0016	0.6429	1.28	320	16.0	85.1	5.72	0.85
	D	2.0	0.0367	0.0016	0.1186	0.319	320	-20.7	95.1	-1.0	2.9
	E	3.0	0.0856	0.0016	0.2816	0.157	320	-8.3	100.0	-1.0	6.1
	Integrated age ± 1σ			n=5		3.19		K2O=6.39%		23.20	0.80
	Plateau ± 1σ	steps B-E		n=4	MSWD=4.15	2.87			89.9	6.5	0.6
	BBbc, sanidine, SC, etched, coarse, 0.71 mg, J=0.0000863±0.05%, IC=1.03128±0.00104, NM-266B, Lab#=62789-06										

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($\times 10^{-3}$)	$^{39}Ar_K$ ($\times 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
X	A	0.5	3.304	0.0016	4.468	0.038	320	60.1	3.6	313	26
X	B	0.8	0.2329	0.0016	0.2244	0.117	320	70.9	14.8	25.2	8.0
	C	1.5	0.0845	0.0016	0.1128	0.828	320	56.5	93.9	6.9	1.1
	D	2.0	-0.2722	0.0016	-1.1822	0.023	320	-22.6	96.2	10	39
	E	3.0	0.0526	0.0016	-0.1354	0.040	320	189.3	100.0	13	23
	Integrated age ± 1σ			n=5		1.047		K2O=6.57%		20.0	2.0
	Plateau ± 1σ	steps C-E		n=3	MSWD=1.76	0.892			85.2	6.9	1.1
	Unit BA, Sanidine, 5.38 mg, 4 crystals, J=0.0000864±0.04%, IC=1.030544±0.00100, NM-266B, Lab#=62788-02										
X	A	0.5	8.127	0.0016	4.196	0.220	320	84.9	3.3	1089.4	7.0
X	B	0.8	3.132	0.0016	1.917	0.281	320	82.0	7.5	405.1	4.8
X	C	1.0	0.8164	0.0016	1.388	0.358	320	49.3	12.8	63.1	3.6
X	D	1.2	0.4916	0.0016	1.091	0.378	320	33.4	18.5	25.5	3.3
X	E	1.5	0.5589	0.0016	1.272	0.612	320	31.9	27.6	27.8	2.2
X	F	1.6	0.5625	0.0016	1.097	0.502	320	41.6	35.1	36.5	2.6
X	G	1.8	0.3402	0.0016	0.5685	0.508	320	49.5	42.6	26.1	2.4
X	H	1.9	0.2262	0.0016	0.3867	0.540	320	47.7	50.7	16.5	2.2
	I	2.1	0.1669	0.0016	0.3575	0.686	320	33.6	60.9	8.5	1.8
	J	2.5	0.1362	0.0016	0.2625	0.640	320	39.6	70.4	8.1	1.9
	K	3.0	0.1754	0.0016	0.4222	1.98	320	25.7	100.0	6.81	0.75
	Integrated age ± 1σ			n=11		6.71		K2O=5.54%		35.20	0.70
	Plateau ± 1σ	steps I-K		n=3	MSWD=0.48	3.310			49.3	7.16	0.65

	ID	Power (Watts)	^{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 (ka)	±1σ (ka)
	Unit BA, Sanidine, 7.06 mg, 4 crystals, J=0.0000864±0.04%, IC=1.03137±0.001397, NM-266B, Lab#=62788-03										
X	B	0.8	7.305	0.0016	8.905	0.370	320	64.0	4.1	738.7	4.0
X	C	1.0	1.350	0.0016	3.158	0.438	320	30.5	8.8	64.8	2.5
X	D	1.2	0.6882	0.0016	1.494	0.544	320	35.1	14.8	37.8	1.7
X	E	1.5	0.3989	0.0016	0.8973	0.702	320	32.3	22.5	20.0	1.2
X	F	1.6	0.2424	0.0016	0.4593	0.531	320	42.3	28.3	15.7	1.3
X	G	1.8	0.1088	0.0016	0.1941	1.26	320	43.5	42.1	6.96	0.56
X	H	1.9	0.1546	0.0016	0.1857	1.027	320	62.8	53.3	14.61	0.63
	I	2.1	0.1178	0.0016	0.2041	1.182	320	45.4	66.3	7.92	0.60
	J	2.5	0.1292	0.0016	0.1752	1.59	320	57.4	83.6	11.04	0.44
	K	3.0	0.0883	0.0016	0.1287	1.49	320	52.8	100.0	6.73	0.45
	Integrated age ± 1σ			n=10		9.13		K2O=5.75%		44.40	0.30
	Plateau ± 1σ		steps I-K	n=3	MSWD=24.32	4.260			46.7	8.7	1.4
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-04										
X	A	0.6	2.922	0.0016	2.032	0.435	320	79.5	18.3	366.3	1.9
	B	3.0	0.0713	0.0016	0.0404	1.94	320	81.4	100.0	8.19	0.28
	Integrated age ± 1σ			n=2		2.37				73.80	0.50
	Plateau ± 1σ		steps B-B	n=1		1.939			81.7	8.19	0.28
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-05										
X	A	0.6	1.888	0.0016	1.539	0.406	320	75.9	19.5	225.8	2.0
	B	0.7	0.2935	0.0016	0.6551	0.174	320	32.0	27.9	14.5	3.4
	C	3.0	0.0983	0.0016	0.1512	1.50	320	50.9	100.0	7.30	0.42
	Integrated age ± 1σ			n=3		2.08				50.60	0.70
	Plateau ± 1σ		steps B-C	n=2	MSWD=4.46	1.672			80.5	7.41	0.88
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-06										
X	A	0.6	2.339	0.0016	4.937	0.357	320	37.5	16.5	138.1	2.9
	B	3.0	0.0780	0.0016	0.1615	1.81	320	32.2	100.0	3.59	0.40
	Integrated age ± 1σ			n=2		2.17				25.80	0.80
	Plateau ± 1σ		steps B-B	n=1		1.809			83.5	3.59	0.40
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-07										
X	A	0.6	36.47	0.0016	120.4	0.365	320	2.4	18.3	139.1	13.4
X	B	0.7	0.6012	0.0016	1.471	0.229	320	26.7	29.7	25.1	3.2
	C	0.8	0.2091	0.0016	0.5407	0.284	320	20.5	44.0	6.5	2.2
	D	3.0	0.0659	0.0016	0.1030	1.119	320	47.9	100.0	4.41	0.54
	Integrated age ± 1σ			n=4		2.00				32.0	4.0
	Plateau ± 1σ		steps C-D	n=2	MSWD=0.89	1.402			70.3	4.54	0.52
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-08										
X	A	0.6	1.242	0.0016	0.5033	0.560	320	88.0	40.5	171.9	1.2
	B	0.7	0.0406	0.0016	0.0823	0.259	320	24.8	59.2	1.3	2.4
	C	3.0	0.0508	0.0016	0.0385	0.565	320	73.7	100.0	5.0	1.0
	Integrated age ± 1σ			n=3		1.38				71.9	0.9
	Plateau ± 1σ		steps B-C	n=2	MSWD=2.13	0.824			59.5	4.5	1.3
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-09										
	A	0.6	0.3823	0.0016	0.8549	0.515	320	32.7	88.1	19.4	1.4
	B	0.7	0.0991	0.0016	0.6338	0.029	320	-107	93.0	-15	20
x	C	3.0	0.0555	0.0016	0.5536	0.041	320	-254	100.0	-19	13
	Integrated age ± 1σ			n=3		0.584				15.0	2.0
	Plateau ± 1σ		steps A-B	n=2	MSWD=2.98	0.543			93.0	19.2	2.5
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-10										
X	A	0.6	4.043	0.0016	0.8992	0.484	320	93.5	34.5	596.5	1.8
X	B	0.7	0.1293	0.0016	0.0860	0.221	320	78.8	50.2	15.2	2.6

	ID	Power	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$	$^{39}Ar_K$	K/Ca	$^{40}Ar^*$	^{39}Ar	Age	±1σ
		(Watts)			(x 10^{-3})	(x 10^{-15} mol)		(%)	(%)	(ka)	(ka)
	C	3.0	0.1159	0.0016	0.2730	0.699	320	25.4	100.0	4.34	0.93
	Integrated age ± 1σ			n=3		1.40				210.2	1.0
	Plateau ± 1σ	steps C-C		n=1		0.699			49.8	4.34	0.93
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-11										
X	A	0.6	3.566	0.0016	7.645	0.206	320	36.6	5.7	205.9	4.5
	B	0.7	1.627	0.0016	5.111	0.138	320	6.7	9.5	17.3	6.1
	C	3.0	0.6758	0.0016	1.978	3.29	320	12.5	100.0	13.25	0.54
	Integrated age ± 1σ			n=3		3.63				24.30	0.70
	Plateau ± 1σ	steps B-C		n=2	MSWD=0.43	3.429			94.3	13.28	0.54
	Unit BA, Sanidine SC, J=0.0000864±0.04%, IC=1.03031±0.00109, NM-266B, Lab#=62788-12										
X	A	0.6	0.7616	0.0016	0.9021	0.485	320	64.7	65.3	77.2	1.4
	B	0.7	0.0411	0.0016	-0.0209	0.133	320	117.8	83.2	6.2	4.3
X	C	3.0	0.2740	0.0016	0.5603	0.124	320	37.6	100.0	15.9	4.4
	Integrated age ± 1σ			n=3		0.742				54.2	1.7
	Plateau ± 1σ	steps B-B		n=1		0.133			17.9	6.2	4.3
	TC-24-13, Sanidine SC, 0.78 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-01										
	A	0.5	2.420	0.0280	8.039	0.342	18.2	1.6	39.5	4.6	3.3
	B	1.0	0.1010	0.0265	0.2021	0.332	19.2	38.1	77.8	4.2	1.5
X	C	3.0	0.0877	0.0324	0.5083	0.192	15.8	-84.4	100.0	-8.0	2.6
	Integrated age ± 1σ			n=3		0.867	18.0	K2O=6.62%		1.6	1.5
	Plateau ± 1σ	steps A-B		n=2	MSWD=0.01	0.675			77.8	4.3	1.4
	TC-24-13, Sanidine 9 crystals, 4.05 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-02										
X	A	0.4	7.014	0.0691	16.55	0.161	7.4	30.3	3.7	250.7	8.6
x	B	0.6	1.716	0.0537	4.851	0.336	9.5	16.3	11.3	32.9	3.7
	C	0.8	0.9578	0.0562	2.909	0.642	9.1	10.0	26.0	11.2	2.0
	D	1.0	2.226	0.0569	7.320	0.484	9.0	2.7	37.0	7.0	3.2
	E	3.0	0.2168	0.0571	0.4862	2.76	8.9	33.5	100.0	8.27	0.44
	Integrated age ± 1σ			n=5		4.38	8.9	K2O=6.44%		19.36	0.68
	Plateau ± 1σ	steps C-E		n=3	MSWD=1.17	3.89			88.7	8.38	0.46
	TC-24-13, Sanidine SC, 0.62 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-03										
	A	0.6	0.6364	0.0362	1.984	0.422	14.1	7.2	56.2	5.3	2.8
	B	3.0	0.0826	0.0383	0.2340	0.329	13.3	11.9	100.0	1.0	3.2
	Integrated age ± 1σ			n=2		0.752	13.7	K2O=7.22%		3.5	2.1
	Plateau ± 1σ	steps A-B		n=2	MSWD=1.03	0.752			100.0	3.5	2.1
	TC-24-13, Sanidine SC, 0.65 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-04										
	A	0.6	1.109	0.0438	3.206	0.267	11.7	14.3	42.4	18.6	4.2
	B	3.0	0.1033	0.0403	0.1524	0.362	12.7	56.2	100.0	6.3	2.8
	Integrated age ± 1σ			n=2		0.630	12.2	K2O=5.77%		11.5	2.4
	Step B ± 1σ	step B		n=1	NA	0.362			57.6	6.3	2.8
	TC-24-13, Sanidine 20 crystals, 5.43 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-05										
X	A	0.4	13.09	0.0442	43.69	0.138	11.5	1.3	2.5	21	12
X	B	0.6	2.205	0.0400	7.129	0.385	12.8	4.3	9.4	11.2	3.6
X	C	0.8	1.003	0.0433	3.028	0.636	11.8	10.5	20.8	12.3	2.0
	D	1.0	0.3330	0.0362	0.9858	0.790	14.1	11.3	35.0	4.4	1.4
	E	2.5	0.7863	0.0475	2.573	3.63	10.7	2.8	100.0	2.61	0.53
	Integrated age ± 1σ			n=5		5.58	11.4	K2O=6.12%		5.00	0.60
	Plateau ± 1σ	steps D-E		n=2	MSWD=1.33	4.417			79.2	2.82	0.58
	TC-24-13, Sanidine 20 crystals, 3.63 mg, J=0.0000645±0.05%, IC=1.02237±0.00126, NM-274B, Lab#=63440-06										
	A	0.4	4.122	0.0517	13.87	0.221	9.9	0.4	5.3	2.1	6.1
	B	0.6	1.483	0.0497	4.898	0.692	10.3	2.2	22.0	3.8	2.1

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x\ 10^{-3}$)	$^{39}Ar_K$ ($x\ 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
	C	0.8	0.4053	0.0420	1.320	0.694	12.1	2.7	38.7	1.3	1.7
	D	1.0	0.4924	0.0500	1.680	0.330	10.2	-1.6	46.7	-0.9	3.3
	E	1.5	0.2656	0.0477	0.7729	1.58	10.7	12.9	84.9	3.9	0.8
	F	3.0	0.7305	0.0485	2.487	0.629	10.5	-1.1	100.0	-1.0	2.1
	Integrated age ± 1σ		n=6			4.15	10.7	K2O=6.81%		2.24	0.76
	Plateau ± 1σ	steps A-F	n=6		MSWD=1.52	4.15			100.0	2.95	0.77

TC-27-13, Sanidine SC, 2.89 mg, J=0.0000647±0.04%, IC=1.02237±0.00126, NM-274B, Lab#=63441-01

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x\ 10^{-3}$)	$^{39}Ar_K$ ($x\ 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
X	A	0.4	9.037	0.0461	29.64	0.112	11.1	3.0	3.2	32	11
	B	0.6	1.436	0.0533	4.791	0.313	9.6	1.2	12.3	2.0	2.7
	C	0.8	1.623	0.0526	5.441	0.196	9.7	0.7	17.9	1.4	4.0
	D	3.0	0.2006	0.0495	0.5128	2.84	10.3	23.5	100.0	5.37	0.29
	Integrated age ± 1σ		n=4			3.46	10.2	K2O=7.11%		5.72	0.54
	Plateau ± 1σ	steps B-D	n=3		MSWD=1.24	3.35			96.8	5.31	0.32

TC-27-13, Sanidine 20 crystals, 4.28 mg, J=0.0000647±0.04%, IC=1.02237±0.00126, NM-274B, Lab#=63441-02

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x\ 10^{-3}$)	$^{39}Ar_K$ ($x\ 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
X	A	0.4	9.172	0.0498	28.93	0.159	10.2	6.8	3.1	73.6	9.5
X	B	0.6	2.313	0.0535	7.285	0.342	9.5	6.8	9.9	18.6	4.0
	C	0.6	1.199	0.0572	3.786	0.188	8.9	6.5	13.6	9.1	6.3
	D	1.0	1.395	0.0521	4.442	0.644	9.8	5.7	26.2	9.4	2.1
	E	1.5	0.6130	0.0513	1.783	1.164	9.9	13.6	49.2	9.8	1.1
	F	3.0	0.3589	0.0499	0.9972	2.58	10.2	17.2	100.0	7.17	0.52
	Integrated age ± 1σ		n=6			5.08	10.0	K2O=7.04%		10.97	0.65
	Plateau ± 1σ	steps C-F	n=4		MSWD=1.70	4.58			90.1	7.72	0.60

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x\ 10^{-3}$)	$^{39}Ar_K$ ($x\ 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
	TC-27-13, Sanidine SC, 2.25 mg, J=0.0000647±0.04%, IC=1.02237±0.00126, NM-274B, Lab#=63441-03										
X	A	0.5	11.98	0.0343	39.11	0.157	14.9	3.5	5.3	49	11
	B	1.0	0.5498	0.0317	1.605	1.66	16.1	13.0	61.1	8.34	0.78
	C	3.0	0.1154	0.0335	0.2181	1.158	15.2	42.6	100.0	5.43	0.92
	Integrated age ± 1σ		n=3			2.98	15.7	K2O=7.86%		9.38	0.80
	Plateau ± 1σ	steps B-C	n=2		MSWD=5.84	2.821			94.7	7.1	1.4

TC-27-13, Sanidine SC, 1.42 mg, J=0.0000647±0.04%, IC=1.02237±0.00126, NM-274B, Lab#=63441-04

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x\ 10^{-3}$)	$^{39}Ar_K$ ($x\ 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
X	A	0.5	2.755	0.0196	7.971	0.252	26.0	14.3	14.8	46.7	4.9
	B	1.0	0.1426	0.0214	0.3350	1.123	23.9	27.9	80.9	4.5	0.9
	C	3.0	0.0655	0.0240	0.1554	0.325	21.3	23.9	100.0	1.6	3.1
	Integrated age ± 1σ		n=3			1.70	23.6	K2O=7.11%		10.2	1.3
	Plateau ± 1σ	steps B-C	n=2		MSWD=0.76	1.448	23.275±1.828		85.2	4.2	0.9

	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x 10^{-3}$)	$^{39}Ar_K$ ($x 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (ka)	±1σ (ka)
	ID	Power (Watts)	$^{40}Ar/^{39}Ar$	$^{37}Ar/^{39}Ar$	$^{36}Ar/^{39}Ar$ ($x 10^{-3}$)	$^{39}Ar_K$ ($x 10^{-15}$ mol)	K/Ca	$^{40}Ar^*$ (%)	^{39}Ar (%)	Age (Ma)	±1σ (Ma)
	51 Quartz, 1.96 mg, J=0.0000647±0.05%, IC=1.0224±0.00126, NM-274B, Lab#=63442-11										
X	A	0.4	62.42	0.0075	6.294	0.067	67.6	97.0	82.7	7.157	0.072
X	B	3.0	6.880	0.0557	12.45	0.014	9.2	46.5	100.0	0.379	0.076
	Integrated age ± 1σ			n=2		0.081	32.1	K2O=0.25%		5.987	0.070
	51 Quartz, 1.47 mg, J=0.0000647±0.05%, IC=1.0224±0.00126, NM-274B, Lab#=63442-12										
X	A	0.4	49.12	0.0341	6.550	0.095	15.0	96.1	86.7	5.580	0.042
X	B	3.0	13.64	0.0706	12.40	0.015	7.2	73.1	100.0	1.180	0.090
	Integrated age ± 1σ			n=2		0.109	13.1	K2O=0.44%		4.994	0.045

Notes:

Isotopic ratios corrected for blank, radioactive decay, and mass discrimination, not corrected for interfering reactions.
Errors quoted for individual analyses include analytical error only, without interfering reaction or J uncertainties.
Integrated age calculated by summing isotopic measurements of all steps.
Integrated age error calculated by quadratically combining errors of isotopic measurements of all steps.
Plateau age is inverse-variance-weighted mean of selected steps.
Plateau age error is inverse-variance-weighted mean error[3] times root MSWD where MSWD>1.
Plateau error is weighted error[3].
Isotopic abundances after[4].
X preceding sample ID denotes analyses excluded from plateau age calculations.
IC (Detector Intercalibration Factor) = Measured $^{40}Ar/^{36}Ar$ of air standard divided by 295.5
SC = Single Crystal
Weight percent K_2O calculated from ^{39}Ar signal, sample weight, and instrument sensitivity.
Ages calculated relative to FC-2 Fish Canyon Tuff Sanidine interlaboratory standard at 28.201 Ma[1].
Decay Constant (LambdaK (total)) = 5.463e-10/a[2]
Correction factors:
$(^{39}Ar/^{37}Ar)_{Ca}$ = 0.00066 ± 1e-05
$(^{36}Ar/^{37}Ar)_{Ca}$ = 0.000264 ± 1e-06
$(^{40}Ar/^{39}Ar)_K$ = 0.007614 ± 0.000105

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Table DR 5. U-series isotopes and maximum, pre-eruption radium ages of Changbaishan whole rocks and crystal-free pumices.

												Measured		Age Corrected		
Eruption/Sample	**Age**	**Composition**	**Digestion Type**	**U ppm**	**Th ppm**	**Ra ppt**	**$(^{230}Th)/(^{238}U)$**	**$(^{230}Th)/(^{232}Th)$**	**2σ Error**	**$(^{226}Ra)/(^{230}Th)$**	**$(^{226}Ra)/(^{230}Th)_i$**	**Max Age**	**2% error**	**Corr**	**Max Age**	**2% error**
ME 51	946 CE	Comendite	CF-Pumice	10.91	52.01	3.932	1.093	0.698	0.0070	0.953	0.925					
ME 51	946 CE	Comendite	CF-Pumice II	11.04	53.30	3.929	1.106	0.697	0.0023	0.952	0.924	6881	6100-7990	1069	6881	6100-7990
ME 51	946 CE	Comendite	CF-Pumice Sequential	10.91	50.60	3.729	1.063	0.695	0.0027	0.929	0.887	**5967**	5444-6656	1069	**5967**	5444-6656
ME TC-10-13	946 CE	Trachyte	Whole Rock	2.61	12.25	0.780	1.096	0.711	0.0019	0.808	0.718	3700	3538-3923	1069	2857	2745-2975
				2.59	12.35											
ME TC-10-13	946 CE	Trachyte	CF-Pumice	3.09	14.66	0.754	1.083	0.694	0.0036	0.668	0.473	**2489**	**2400-2582**	1069	1446	1406-1487
ME TC-10-13	946 CE	Trachyte	CF-Pumice Sequential	2.99	13.95	0.717	1.039	0.677	0.0035	0.684	0.461	2600	2504-2700	1069	**1395**	**1356-1434**
ME TC-15-13	946 CE	Trachyte	Whole Rock	2.49	12.06	0.836	1.108	0.695	0.0033	0.900	0.840	5200	4824-5646	1069	4137	3911-4387
				2.49	12.09	0.837	1.106	0.695	0.0033	0.897	0.837					
ME TC-15-13	946 CE	Trachyte	CF-Pumice	2.96	14.28	0.740	1.109	0.699	0.0052	0.669	0.473	2495	2399-2582	1069	1446	1405-1487
ME TC-15-13	946 CE	Trachyte	CF-Pumice Sequential	2.79	13.83	0.695	1.136	0.696		0.651	0.432	**2376**	2293-2462	1069	**1277**	1244-1311
Baguamiao TC-24-13	1668 CE	Trachyte	Whole Rock	2.29	11.20	0.597	1.124	0.698	0.0026	0.688	0.638	2630	2554-2730	347	2293	2215-2374
Baguamiao TC-24-13	1668 CE	Trachyte	CF-Pumice	2.99	14.52	0.582	1.113	0.697	0.0029	0.518	0.440	1647	1599-1697	347	1309	1279-1344
				2.99	14.50	0.582	1.112	0.697		0.520	0.442					
Baguamiao TC-24-13	1668 CE	Trachyte	CF-Pumice II	2.91	14.01	0.547	1.102	0.697	0.0029	0.505	0.448					
Baguamiao TC-24-13	1668 CE	Trachyte	CF-Pumice Sequential	2.94	14.03	0.547	1.094	0.697	0.0029	0.504	0.424	**1582**	1537-1629	347	**1245**	1212-1278
Liuhaojie TC-27-13	1903 CE	Trachyte L1	Whole Rock	2.12	10.20	0.672	1.103	0.697	0.0037	0.853	0.846	4330	4080-4607	112	4223	3988-4486
Liuhaojie TC-27-13	1903 CE	Trachyte L1	CF-Pumice	2.93	14.06	0.519	1.105	0.702	0.0015	0.474	0.448	**1446**	1405-1487	112	**1337**	1301-1374
					14.12	0.520	1.106			0.473	0.447					
Liuhaojie TC-28-13	1903 CE	Trachyte L2	Whole Rock	2.00	9.40	0.452	1.076	0.697	0.0045	0.622	0.603	2196	2122-2271	112	2085	2018-2155
Liuhaojie TC-28-13	1903 CE	Trachyte L2	CF-Pumice	2.85	13.22	0.440	1.061	0.696	0.0038	0.425	0.397	**1249**	1205-1282	112	**1142**	1112-1171
ME 95	946 CE	Latite	Whole Rock	1.60	7.94	0.387	1.158	0.708	0.0028	0.621	0.397	**2189**	2118-2265	1069	**1142**	1112-1171
ME CB1	946 CE	Trachybasalt	Whole Rock	0.85	4.16	0.205	1.102	0.684	0.0028	0.650	0.444	**2370**	2288-2455	1069	**1325**	1289-1361
Reference Samples																
TML-1		Latite	Whole Rock	10.80	30.20	3.439	1.014	1.074	0.0028	1.002	----					
TML-2		Latite	Whole Rock	10.08	28.96	3.491	1.023	1.083	0.0026	1.003	----					
TML-3		Latite	Whole Rock	10.06	28.60	----	1.012	1.074	0.0028	----	----					
TML-4		Latite	Whole Rock	10.20	28.55	3.439	1.014	1.083	0.0026	1.002	----					
TML-5		Latite	Whole Rock	10.54	29.25	3.556	0.987	1.083	0.0026	1.012	----					
BCR-C-1		Basalt	Whole Rock	1.618	5.649	----	1.013	0.880	0.0035	----	----					
BCR-C-2		Basalt	Whole Rock	1.678	5.803	----	0.880	0.883	0.0038	1.004	----					
BCR-C-3		Basalt	Whole Rock	1.663	5.804	----	0.872	0.887	0.0038	1.018	----					
BCR-C-4		Basalt	Whole Rock	1.681	5.762	----	0.888	0.885	0.0033	0.996	----					
BCR-C-5		Basalt	Whole Rock	1.596	5.569	0.539	1.020	0.880	0.0035	1.011	----					
BCR-C-6		Basalt	Whole Rock	1.579	5.496	0.522	1.010	0.880	0.0035	0.969	----					

Digestion Types are as follows: Whole Rock, a powder generated from whole pumice clasts directly digested (note, 51, 95, and CB1 are nearly crystal free and assumed to represent the liquid composition); CF-Pumice, pumice shard separates or powdered pumice separates in which crystals were manually removed prior to direct digestion; CF-Pumice Sequential, pumice shard separates that had crystals manually removed and then were digested using 10% hydrofluoric acid at room temperture in two or three 2-hour steps, which allowed pumice glass to be dissolved and the solution decanted but left any crystals undissolved. Corr: refers to the number of years used for age-correcting initial $(^{226}Ra)/(^{230}Th)$ ratios. Bold ages are the youngets ages for each deposit analyzed. U, Th, and Ra decay constants were $\lambda_{238}=1.55135x10^{-10}$, $\lambda_{232}=4.93343x10^{-11}$, $\lambda_{230}=9.21738x10^{-6}$, and $\lambda_{226}=4.3322x10^{-4}$. Measured radium maximum ages assume $(^{226}Ra)/(^{230}Th)=0$ and are not corrected for eruption ages. Reference samples TML and BCR-C were used to independently evaluate accuracy and reproducibility of U-series isotope ratios. U and Th concentrations of reference samples were determined using the same U/Th spike as Changbaishan samples at the same time samples were processed with errors estimated to be ±2%.. Resulting U and Th determinations were then used to calibrate Ra spike used for both reference samples and unknowns. Ra concentrations used TML samples and were within ±2% compared to equilibrium concentrations for respective U and Th determined for each reference TML sample. BCR-C samples were then evaluated independently with Ra spike calibrated using TML.

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Table DR 6. Sanidine age calculations for lattice bearing Ar as reflected in quartz.

Lab ID	Weight (mg)	^{40}Ar (fA)	^{40}Ar Error (fA)	^{36}Ar (fA)	^{36}Ar Error (fA)	$^{40}Ar/^{36}Ar$	±1σ	$^{40}Ar^*$
63442-11	1.96	71.230	0.1141	0.009924	0.000623	7020	441	95.9
63442-12	1.47	80.694	0.1144	0.013323	0.000621	5924	276	95.1

Details

	$^{40}Ar^*/^{39}Ar_K$ (measured)	$^{39}Ar_K$ (measured) (mol)	$^{40}Ar^*$ (measured) (mol)	K_2O sample (from ^{39}Ar)	K_2O melt (measured)	K_2O qtz (assumed)	mg of melt in qtz (calculated)	$^{40}Ar^*_{total}$ (mol/g)	Ar Solubility Ksp[1] (mol/g)	Ar Solubility Rhyolite liquid[2] (mol/g)	Kd[3]	^{40}Ar partitioned in Ksp (mol/g)	Apparent age at eruption
63442-11a	60.551	6.693E-17	4.05E-15										
63442-11b	3.196	1.399E-17	4.47E-17										
Total			4.10E-15	0.25	4.75	0.0	0.103	3.98E-11	1.75E-11	1.50E-08	1.167E-03	4.64E-14	4.9 ka
63442-12a	47.186	9.452E-17	4.46E-15										
63442-12b	9.969	1.453E-17	1.45E-16										
Total			4.61E-15	0.44	4.75	0.0	0.136	3.39E-11	1.75E-11	1.50E-08	1.167E-03	3.96E-14	4.2 ka

Notes:
Analysis of quartz was conducted by a 2-step age spectrum method (see DR5) and are summarized here for calculation of argon partition into sanidine.
Weight of melt in quartz determined by meausring the ^{39}Ar in the quartz + melt sample and using ^{39}Ar as the proxy to determine total K content. By sssuming no K in quartz and knowing the K content of the melt as measured by SIMS allows the calculaiton of the mg of melt housed in the quartz sample.
The measursed argon concentration in the quartz will be a minimum value for the argon in the magma due to the posibilty that argon can be degassed from the melt inclusions upon eruption. Therefore, the determined "Apparent age at eruption" will be a mimimum value.
fA = Amps x10^{-15} and represents the measured intensities of argon isotopes following irradiaiton.
One additional significant figure is provided to prevent rounding errors for those wishing to reproduce the calculations.

[1] Kelley (2002)
[2] Carroll and Stolper (1993)
[3] Ratio of solubilities

Supplementary References

1. Taylor, J.R., 1982, An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements: Univ. Sci. Books, Mill Valley, Calif., 270 p.
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4. Carroll, M.R. and Stolper, E.M., 1993, Noble gas solubilities in silicate melts and glasses—new experimental results for argon and the relationship between solubility and ionic porosity: Geochim. Cosmochim. Acta, v. 57, p. 5039-5051.