

TABLE A.  $^{40}\text{Ar}/^{39}\text{Ar}$  ANALYTICAL DATA, SAN JUAN VOLCANIC FIELD.  
[GSA Repository]

BGC Lab ID#	J ( $\times 10^{-2}$ )	Ca/K	$^{36}\text{Ar}/^{39}\text{Ar}$	$^{40}\text{Ar}^*/^{39}\text{Ar}$	% $^{40}\text{Ar}^*$	Age (Ma) $\pm 1 \sigma$
<b>Dacite dike, Schinzel Flats (Sample KF-132):</b>						
Irradiation #1:						
2963-01	2.090	0.0158	0.00005	0.6988	98.0	26.16 $\pm$ 0.06
2963-02	2.090	0.0169	0.00006	0.6986	97.4	26.15 $\pm$ 0.06
2963-03	2.090	0.0659	0.00006	0.6992	97.9	26.17 $\pm$ 0.06
2963-05	2.090	0.0166	0.00006	0.6977	97.8	26.11 $\pm$ 0.06
2963-06	2.090	0.0151	0.00002	0.6984	99.2	26.14 $\pm$ 0.06
2963-07	2.090	0.0159	0.00002	0.6990	99.4	26.16 $\pm$ 0.06
2963-09	2.090	0.0171	0.00005	0.6974	98.1	26.10 $\pm$ 0.08
Weighted average, 1 $\sigma$ error without error in J =						26.15 $\pm$ 0.01
1 $\sigma$ error with error in J =						$\pm$ 0.08
Irradiation #2:						
4051-01	1.530	0.0452	0.00005	0.9541	98.8	26.15 $\pm$ 0.06
4051-02	1.530	0.0193	0.00007	0.9536	97.9	26.14 $\pm$ 0.06
4051-03	1.530	0.0214	0.00004	0.9556	98.8	26.19 $\pm$ 0.07
4051-04	1.530	0.0169	0.00005	0.9548	98.5	26.17 $\pm$ 0.09
4051-06	1.530	0.0331	0.00005	0.9525	98.7	26.11 $\pm$ 0.07
Weighted average, 1 $\sigma$ error without error in J =						26.15 $\pm$ 0.02
1 $\sigma$ error with error in J =						$\pm$ 0.10
Rejected, $^{40}\text{Ar}^* < 97\%$ :						
2963-08	2.090	0.0575	0.00021	0.7060	92.3	26.42 $\pm$ 0.07
4051-05	1.530	0.0725	0.00014	0.9569	96.2	26.23 $\pm$ 0.07
4051-07	1.530	0.0263	0.00011	0.9464	96.7	25.94 $\pm$ 0.07
4051-08	1.530	0.1660	0.00021	0.9526	94.6	26.11 $\pm$ 0.06
<b>Dacite of Fisher Gulch, from Fisher Gulch (Sample KF-58):</b>						
Irradiation #1:						
2962-01	2.083	0.0375	0.00003	0.7583	99.1	28.27 $\pm$ 0.08
2962-02	2.083	0.0326	0.00002	0.7615	99.5	28.39 $\pm$ 0.06
2962-04	2.083	0.0436	0.00004	0.7601	98.7	28.34 $\pm$ 0.06
2962-05	2.083	0.0421	0.00002	0.7583	99.4	28.27 $\pm$ 0.06
2962-06	2.083	0.0532	0.00006	0.7603	98.2	28.35 $\pm$ 0.06
2962-07	2.083	0.0744	0.00003	0.7641	99.4	28.49 $\pm$ 0.06
2962-08	2.083	0.0343	0.00003	0.7623	99.2	28.42 $\pm$ 0.06
2962-09	2.083	0.0892	0.00003	0.7617	99.3	28.40 $\pm$ 0.07
2962-10	2.083	0.0310	0.00003	0.7646	99.0	28.50 $\pm$ 0.06
Weighted average, 1 $\sigma$ error without error in J =						28.38 $\pm$ 0.03
1 $\sigma$ error with error in J =						$\pm$ 0.09
Rejected, $^{40}\text{Ar}^* < 98\%$ :						
2962-03	2.083	0.0569	0.00011	0.7615	96.2	28.39 $\pm$ 0.07

**Chiquito Peak Tuff, intracaldera (Sample MD-8a):**

Irradiation #1:

2957-01	2.091	0.0358	0.00003	0.7600	99.2	28.44 ± 0.08
2957-02	2.091	0.0254	0.00002	0.7593	99.2	28.42 ± 0.08
2957-03	2.091	0.0539	0.00003	0.7626	98.9	28.54 ± 0.07
2957-05	2.091	0.1678	0.00003	0.7626	99.6	28.54 ± 0.07
2957-06	2.091	0.1167	0.00004	0.7597	99.0	28.43 ± 0.07
2957-08	2.091	0.1091	0.00003	0.7584	99.2	28.38 ± 0.06

Weighted average, 1  $\sigma$  error without error in J = 28.46 ± 0.03  
 1  $\sigma$  error with error in J = ± 0.09

Irradiation #2:

4049-01	1.529	0.0257	0.00003	1.036	99.3	28.37 ± 0.07
4049-02	1.529	0.0252	0.00006	1.038	98.5	28.43 ± 0.08
4049-03	1.529	0.0297	0.00004	1.036	98.9	28.35 ± 0.08
4049-04	1.529	0.0475	0.00004	1.039	99.0	28.44 ± 0.09
4049-05	1.529	0.0255	0.00006	1.039	98.3	28.43 ± 0.08
4049-06	1.529	0.0314	0.00006	1.039	98.5	28.45 ± 0.08
4049-07	1.529	0.1175	0.00009	1.035	98.0	28.33 ± 0.09
4049-08	1.529	0.0927	0.00007	1.034	98.3	28.32 ± 0.09

Weighted average, 1  $\sigma$  error without error in J = 28.39 ± 0.02  
 1  $\sigma$  error with error in J = ± 0.11

Rejected,  $^{40}\text{Ar}^* < 98\%$ :

2957-04	2.091	0.2156	0.00008	0.7653	97.9	28.64 ± 0.08
2957-07	2.091	0.0976	0.00008	0.7580	97.6	28.37 ± 0.07

**Chiquito Peak Tuff, outflow, basal tuff north of Bishop Rock (Sample MD-192):**

Irradiation #1:

2961-01	2.082	0.0337	0.00001	0.7603	99.6	28.33 ± 0.08
2961-02	2.082	0.0287	0.00001	0.7593	99.6	28.29 ± 0.06
2961-03	2.082	0.0387	0.00003	0.7594	99.0	28.30 ± 0.07
2961-04	2.082	0.0402	0.00001	0.7599	99.7	28.32 ± 0.06
2961-05	2.082	0.0289	0.00002	0.7631	99.5	28.43 ± 0.07
2961-06	2.082	0.0385	0.00002	0.7621	99.4	28.40 ± 0.06
2961-08	2.082	0.0310	0.00004	0.7614	98.8	28.37 ± 0.08
2961-09	2.082	0.0299	0.00002	0.7630	99.3	28.43 ± 0.07

Weighted average, 1  $\sigma$  error without error in J = 28.36 ± 0.02  
 1  $\sigma$  error with error in J = ± 0.08

Irradiation #2:

4053-01	1.537	0.0342	0.00004	1.034	99.0	28.43 ± 0.08
4053-02	1.537	0.0382	0.00003	1.035	99.4	28.47 ± 0.06
4053-03	1.537	0.0549	0.00007	1.038	98.2	28.55 ± 0.07
4053-04	1.537	0.0383	0.00003	1.037	99.3	28.53 ± 0.08
4053-05	1.537	0.0367	0.00004	1.036	99.1	28.49 ± 0.09
4053-06	1.537	0.0418	0.00006	1.030	98.4	28.33 ± 0.07
4053-07	1.537	0.0419	0.00006	1.029	98.6	28.31 ± 0.08
4053-08	1.537	0.0313	0.00004	1.037	99.0	28.52 ± 0.12

Weighted average, 1  $\sigma$  error without error in J = 28.45 ± 0.03  
 1  $\sigma$  error with error in J = ± 0.12

Rejected,  $^{40}\text{Ar}^* < 98\%$ :

2961-07	2.082	0.0447	0.00019	0.7679	93.3	28.61 ± 0.08
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**South Fork Tuff, east side Bennett Peak (Sample MD-167):**

**Irradiation #1:**

2966-01	2.094	0.0538	0.00004	0.7700	98.6	28.86 ± 0.07
2966-02	2.094	0.0497	0.00003	0.7638	99.2	28.63 ± 0.09
2966-03	2.094	0.0502	0.00003	0.7680	99.2	28.78 ± 0.09
2966-04	2.094	0.0537	0.00002	0.7699	99.6	28.85 ± 0.09
2966-06	2.094	0.0512	0.00003	0.7681	99.2	28.79 ± 0.22
2966-07	2.094	0.0499	0.00003	0.7654	99.1	28.69 ± 0.06
2966-08	2.094	0.0526	0.00002	0.7694	99.6	28.83 ± 0.07
2966-09	2.094	0.0500	0.00002	0.7695	99.6	28.84 ± 0.07

Weighted average, 1  $\sigma$  error without error in J = 28.79 ± 0.03  
 1  $\sigma$  error with error in J = ± 0.09

**Irradiation #2:**

4047-01	1.536	0.0521	0.00002	1.044	99.5	28.71 ± 0.08
4047-02	1.536	0.0534	0.00007	1.043	98.2	28.67 ± 0.07
4047-03	1.536	0.0529	0.00005	1.044	98.7	28.68 ± 0.08
4047-05	1.536	0.0503	0.00006	1.048	98.5	28.79 ± 0.08
4047-06	1.536	0.0531	0.00004	1.046	99.2	28.76 ± 0.07
4047-08	1.536	0.0541	0.00005	1.046	98.9	28.76 ± 0.09

Weighted average, 1  $\sigma$  error without error in J = 28.69 ± 0.02  
 1  $\sigma$  error with error in J = ± 0.11

**Rejected,  $^{40}\text{Ar}^* < 98\%$ :**

2966-05	2.094	0.0483	0.00012	0.7680	95.7	28.78 ± 0.13
4047-04	1.536	0.0552	0.00009	1.037	97.8	28.51 ± 0.11
4047-07	1.536	0.0529	0.00011	1.046	97.3	28.75 ± 0.07

**Ra Jadero Tuff, from Dog Mountain southeast of Del Norte (Sample MD-43):**

**Irradiation #1:**

2956-01	2.091	0.0644	0.00002	0.7720	99.5	28.89 ± 0.07
2956-04	2.091	0.0701	0.00002	0.7682	99.5	28.75 ± 0.06
2956-05	2.091	0.0721	0.00002	0.7695	99.5	28.80 ± 0.07
2956-06	2.091	0.0705	0.00002	0.7700	99.6	28.81 ± 0.07
2956-07	2.091	0.0708	0.00003	0.7724	99.1	28.91 ± 0.07
2956-08	2.091	0.0681	0.00001	0.7729	99.9	28.92 ± 0.08
2956-09	2.091	0.0685	0.00004	0.7717	98.8	28.88 ± 0.07

Weighted average, 1  $\sigma$  error without error in J = 28.85 ± 0.03  
 1  $\sigma$  error with error in J = ± 0.09

**Irradiation #2:**

4050-01	1.529	0.0713	0.00008	1.043	98.1	28.54 ± 0.09
4050-02	1.529	0.0681	0.00004	1.051	99.0	28.74 ± 0.08
4050-03	1.529	0.0666	0.00003	1.054	99.4	28.85 ± 0.08
4050-05	1.529	0.0676	0.00004	1.046	99.0	28.62 ± 0.08
4050-07	1.529	0.0684	0.00007	1.046	98.4	28.62 ± 0.10
4050-08	1.529	0.0654	0.00005	1.051	98.8	28.75 ± 0.11

Weighted average, 1  $\sigma$  error without error in J = 28.69 ± 0.02  
 1  $\sigma$  error with error in J = ± 0.11

**Rejected, >2sd beyond mean:**

4050-06	1.529	0.0679	0.00004	1.057	99.1	28.92 ± 0.09
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Rejected, $^{40}\text{Ar}^* < 98\%$ :						
2956-02	2.091	0.0711	0.00012	0.7708	95.9	28.84 ± 0.14
2956-03	2.091	0.0659	0.00007	0.7655	97.8	28.65 ± 0.12
4050-04	1.529	0.0721	0.00009	1.050	97.9	28.71 ± 0.15

**Ra Jadero Tuff, east side Bennett Peak (Sample MD-165):**

Irradiation #1:						
2965-02	2.097	0.0662	0.00004	0.7659	98.9	28.75 ± 0.08
2965-03	2.097	0.0684	0.00003	0.7653	99.0	28.72 ± 0.09
2965-04	2.097	0.0692	0.00004	0.7665	99.0	28.77 ± 0.08
2965-05	2.097	0.0682	0.00002	0.7677	99.7	28.81 ± 0.07
2965-06	2.097	0.2752	0.00006	0.7677	99.0	28.81 ± 0.08
2965-07	2.097	0.0706	0.00002	0.7679	99.6	28.82 ± 0.07
2965-08	2.097	0.0669	0.00002	0.7659	99.5	28.75 ± 0.07
2965-09	2.097	0.0670	0.00002	0.7640	99.4	28.68 ± 0.08

Weighted average, 1  $\sigma$  error without error in J = 28.77 ± 0.02

1  $\sigma$  error with error in J = ± 0.08

Irradiation #2:						
4046-01	1.537	0.0681	0.00005	1.045	99.0	28.75 ± 0.07
4046-02	1.537	0.0726	0.00006	1.040	98.5	28.61 ± 0.08
4046-03	1.537	0.0791	0.00006	1.044	98.5	28.73 ± 0.09
4046-04	1.537	0.0693	0.00004	1.038	99.1	28.57 ± 0.07
4046-05	1.537	0.0674	0.00005	1.042	98.9	28.68 ± 0.08
4046-06	1.537	0.0689	0.00006	1.049	98.6	28.87 ± 0.10
4046-07	1.537	0.0664	0.00003	1.050	99.4	28.89 ± 0.10
4046-08	1.537	0.0692	0.00003	1.047	99.3	28.81 ± 0.08

Weighted average, 1  $\sigma$  error without error in J = 28.72 ± 0.04

1  $\sigma$  error with error in J = ± 0.12

Rejected, $^{40}\text{Ar}^* < 98\%$ :						
2965-01	2.097	0.0709	0.00008	0.7674	97.3	28.80 ± 0.07

**Table Notes:**

Sanidine grains were hand-picked for analysis from crushed whole-rock samples. Mineral concentrates were washed in 5% HF and 10% HCl solutions in an ultrasonic cleaner for five minutes each. Samples were then packed in aluminum sample holders and irradiated in the core of a nuclear reactor. After several months of radioactive cooling, the samples were fused under ultra-high vacuum with a focused laser beam (Nd-YAG or Ar-Ion), followed by measurement of five Ar isotopes in a low-blank, high-sensitivity noble gas mass spectrometer (MAP 215 or 215-50). For additional analytical detail, see Deino and Potts (1990) and Deino and others (1990).

Sanidine WHRN-1J from the Pahranaagat Tuff, Nevada, was used as the flux monitor. Its age ( $22.636 \pm 0.007$  Ma; Best and others, 1995) was obtained through precise intercalibration with sanidine from the Fish Canyon Tuff, whose age for the purposes of using it as a reference material was taken to be 27.84 Ma (Cebula and others, 1986, modified after Samson and Alexander, 1987).

Errors in age for individual runs are 1  $\sigma$  analytical uncertainty, and are exclusive of error in J. Weighted averages are calculated using the inverse variance as the weighting factor (Taylor, 1982), while errors in the weighted averages are 1  $\sigma$  standard error of the mean (Samson and Alexander, 1987). Ca/K is calculated from  $^{37}\text{Ar}/^{39}\text{Ar}$  using a multiplier of 1.96.  $^{40}\text{Ar}^*$  refers to radiogenic argon.  $\lambda = 5.543 \times 10^{-10} \text{ y}^{-1}$ . Both irradiations were carried out in the hydraulic rabbit facility of the Omega West reactor of the Los Alamos National Laboratory. Irradiation #1 was 28

hours in duration and employed Cd shielding, for which the isotopic interference corrections were  $(^{36}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = (2.58 \pm 0.06) \times 10^{-4}$ ,  $(^{39}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = (6.7 \pm 0.3) \times 10^{-4}$ , and  $(^{40}\text{Ar}/^{39}\text{Ar})_{\text{K}} = (8 \pm 7) \times 10^{-4}$ . Irradiation #2 was 22 hours in duration and did not employ Cd shielding, with the following isotopic interference corrections:  $(^{36}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = (2.58 \pm 0.06) \times 10^{-4}$ ,  $(^{39}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = (6.7 \pm 0.3) \times 10^{-4}$ ,  $(^{40}\text{Ar}/^{39}\text{Ar})_{\text{K}} = (2.4 \pm 0.2) \times 10^{-2}$ . Error in J for both irradiations is approximately  $\pm 6 \times 10^{-5}$ .

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