Supplementary Material: Sample localities

All coordinates were determined using the Global Positioning System with WGS84 as the datum, and accuracy probably better than 0.0005° (about 50 m).

08-035 (K06-455). Dark grey trachyte with large (1 mm+) bladed alkali feldspar crystals as phenocrysts. Collected from the Barrier, adjacent to the southern shores of Lake Turkana at 2.3179°N, 36.6203°E. Alkali feldspars separated were 0.5 to 1.4 mm in size.

08-024. Small pumice clasts up to 15 mm across from Tuff K, Errum, in the Shungura Formation at 4.8722°N, 35.9433°E, elevation about 410 m, yielded alkali feldspar for dating. Outcrop of Tuff K-alpha and Tuff K-beta are in a cuesta, with an ~1.2 m silty bed between the tuffs.

08-031A, B, C (K04-368). Three individual rounded pumice clasts, with maximum dimension about 50 mm, from the Orange Tuff in the KBS Member, Koobi Fora Formation in Area 109, Koobi Fora, 3.8184°N, 36.2617°E.

08-029. Small rounded pumice clasts rarely up to 20 mm across, from Tuff G at the base of Member G, Shungura Formation at an altitude of about 434 m at 5.0815°N, 36.0095°E. This locality is near the American Camp used during the Omo Research Expedition in the late 1960s. Single crystals of alkali feldspar (and quartz) were separated from an aggregate sample of pumice clasts.

08-032A, B (K04-374). Pumice clasts from the Burgi Tuff at the base of the Burgi Member, Koobi Fora Formation in Area 202, Koobi Fora, at the type ‘Suregei isolate’ site, with coordinates 3.7878°N, 36.3340°E. 08-032A consists of alkali feldspar from a single pumice clast 40 x 25 x 25 mm, mass about 11 g, whereas 08-032B was alkali feldspar separated from a composite of two pumice clasts with maximum dimensions of 25 mm and combined mass of about 4.5 g.

08-026A, B. Small (usually <10 mm across) pumice clasts from Tuff C-gamma, Member C, Shungura Formation, at an altitude of about 400 m, at 5.0639°N, 36.0251°E. Processed as two composite samples, with most crystals being calcic oligoclase.

08-020A, B; 08-034A, B. Samples 08-020A and B were collected by IMcD in 2008, whereas samples 08-034A and B were collected by FHB in 2004, as samples E04-006. Rounded pumice clasts up to 55 mm in size with sporadic alkali feldspar phenocrysts, which were separated. From Tuff B-delta, deposited as a tuffitic sand in a channel cut into Tuff B-gamma and Tuff B-beta (=Tulu Bor Tuff), Member B, Shungura Formation at 5.0533°N, 36.0294°E.

08-036A to F (MB08-06). Pumice clasts up to 13 cm in size collected by MJB from the Naibar Tuff, Lonyumun Member, Koobi Fora Formation in Area 117, Koobi Fora, 4.0973°N, 36.2904°E. Collected from a small channel where the Naibar Tuff crops out along the south side of Il Naibar. Alkali feldspars were separated from each of 6 pumice clasts.

Supplementary Table 1. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of sanidine from the Alder Creek Rhyolite (ACs)

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^{*}/^{39}Ar_K$ ± c.v.	% $^{40}Ar^{*}$	^{40}Ar mol ge x 10^{-14}	Calculated Ma ± 1 s.d.
J = 2.690E-4 ± 0.26%								
5631-01	0.3339 ± 32.3%	2.6600 ± 185%	2.5374 ± 0.40%	19.2	2.4395 ± 1.37%	96.1	1.48	1.183 ± 0.017
-02	0.3405 ± 19.6%	7.4871 ± 45.8%	2.5367 ± 0.41%	6.8	2.4408 ± 0.92%	96.2	2.07	1.184 ± 0.011
-03	0.5202 ± 21.6%	20.563 ± 25.2%	2.5575 ± 0.43%	2.5	2.4183 ± 1.45%	94.5	1.34	1.173 ± 0.017
-04	0.2553 ± 21.9%	2.5081 ± 111%	2.5401 ± 0.39%	20.3	2.4652 ± 0.78%	97.1	2.54	1.195 ± 0.010
-05	0.2973 ± 21.6%	2.6280 ± 101%	2.4913 ± 0.44%	19.4	2.4040 ± 0.91%	96.5	2.30	1.166 ± 0.011
-06	0.3075 ± 25.0%	6.4728 ± 53.4%	2.5665 ± 0.36%	7.9	2.4792 ±0.99%	96.6	1.98	1.202 ± 0.012
-07	0.4247 ± 12.3%	-	2.5737 ± 0.38%	-	2.4469 ± 0.75%	95.1	2.93	1.187 ± 0.010
-08	0.4255 ± 15.2%	2.6637 ± 112%	2.5727 ± 0.39%	19.2	2.4476 ± 0.88%	95.1	2.24	1.187 ± 0.011
-09	0.7290 ± 9.67%	0.5483 ± 536%	2.6552 ± 0.36%	93.0	2.4388 ± 0.94%	91.9	2.39	1.183 ± 0.012
-10	0.1896 ± 18.3%	1.7773 ± 97.7%	2.4836 ± 0.36%	28.7	2.4276 ± 0.56%	97.7	4.15	1.177 ± 0.008
		Arithmetic mean K/Ca (n = 9)		24.1 ± 27.1	Arithmetic mean age (n = 10)			1.184 ± 0.010
					Weighted mean age (n = 10)			1.183 ± 0.005
J = 2.690E-4 ± 0.26%								
5635-01	0.5058 ± 24.2%	-	2.5548 ± 0.55%	-	2.4064 ± 1.61%	94.2	1.10	1.167 ± 0.019
-02	0.8347 ± 12.2%	8.0412 ± 63.7%	2.6305 ± 0.49%	6.4	2.3887 ± 1.37%	90.8	1.44	1.158 ± 0.016
-03	0.5357 ± 12.3%	8.8706 ± 35.5%	2.5813 ± 0.38%	5.8	2.4285 ± 0.90%	94.1	2.07	1.178 ± 0.011
-04	1.0667 ± 9.46%	0.1949 ± 1628%	2.7622 ± 0.38%	261.8	2.4455 ± 1.29%	88.5	1.89	1.186 ± 0.016
-05	0.2252 ± 21.8%	-	2.5468 ± 0.43%	-	2.4791 ± 0.73%	97.3	3.31	1.202 ± 0.010
-06	0.1070 ± 109%	5.4055 ± 120%	2.5578 ± 0.52%	9.4	2.5291 ± 1.46%	98.9	1.26	1.226 ± 0.018
-07	0.1553 ± 64.2%	5.8709 ± 108%	2.5574 ± 0.42%	8.7	2.5145 ± 1.26%	98.3	1.57	1.219 ± 0.016
-08	0.1840 ± 58.5%	-	2.5579 ± 0.46%	-	2.5025 ± 1.36%	97.8	1.44	1.214 ± 0.017
-09	2.1415 ± 3.63%	-	3.0596 ± 0.43%	-	2.4267 ± 1.08%	79.3	2.87	1.177 ± 0.013
-10	0.8408 ± 13.2%	8.5265 ± 60.8%	2.5518 ± 0.41%	6.0	2.4366 ± 1.50%	95.5	1.30	1.182 ± 0.018
		Arithmetic mean K/Ca (n = 6)	49.7 ± 103.9		Arithmetic mean age (n = 10)			1.191 ± 0.023
					Weighted mean age (n = 10)			1.191 ± 0.007
J = 2.689E-4 ± 0.30%								
5654-01	0.3301 ± 25.9%	3.5324 ± 157%	2.5451 ± 0.39%	14.4	2.4490 ± 1.11%	96.2	1.69	1.188 ± 0.014
-02	0.3237 ± 25.0%	-	2.5412 ± 0.41%	-	2.4443 ± 1.07%	96.2	2.00	1.186 ± 0.013
-03	0.2378 ± 34.2%	7.0928 ± 58.2%	2.5376 ± 0.42%	7.2	2.4716 ± 1.06%	97.4	1.85	1.199 ± 0.013
-04	10.1483 ± 1.35%	13.3066 ± 31.7%	2.3530 ± 0.36%	3.8	2.3630 ± 2.00%	44.1	4.00	1.146 ± 0.023
-05	0.1913 ± 41.9%	4.2322 ± 116%	2.5194 ± 0.37%	12.1	2.4648 ± 1.04%	97.8	1.77	1.196 ± 0.013
-06	0.4337 ± 22.2%	-	2.5507 ± 0.43%	-	2.4210 ± 1.27%	94.9	1.58	1.174 ± 0.015
-07	0.4036 ± 17.5%	8.0780 ± 48.3%	2.5552 ± 0.43%	6.3	2.4408 ± 0.96%	95.5	2.06	1.184 ± 0.012
-08	6.4251 ± 1.71%	6.9881 ± 63.9%	4.3926 ± 0.36%	7.3	2.4979 ± 1.49%	56.9	3.82	1.212 ± 0.018
-09	0.5778 ± 14.0%	3.5904 ± 98.4%	2.5710 ± 0.42%	14.2	2.4016 ± 1.09%	93.4	2.07	1.165 ± 0.013
-10	0.6850 ± 8.01%	4.2116 ± 87.2%	2.5925 ± 0.38%	12.1	2.3920 ± 0.80%	92.3	2.66	1.160 ± 0.010
			Arithmetic mean K/Ca (n = 7)	9.7 ± 4.0	Arithmetic mean age (n = 10)			1.181 ± 0.020
					Weighted mean age (n = 10)			1.180 ± 0.006
J = 2.689E-4 ± 0.30%								
5657-01	0.5479 ± 15.9%	7.8015 ± 50.5%	2.6141 ± 0.40%	6.6	2.4569 ± 1.13%	94.0	1.92	1.192 ± 0.014
-02	0.3456 ± 15.2%	6.8290 ± 40.9%	2.5734 ± 0.42%	7.5	2.4750 ± 0.76%	96.2	2.83	1.201 ± 0.010
-03	21.0617 ± 0.90%	0.7546 ± 425%	8.6641 ± 0.40%	67.6	2.4393 ± 2.92%	28.2	7.99	1.183 ± 0.035
(-04	0.2244 ± 46.2%	-	2.5617 ± 0.41%	-	2.4943 ± 1.29%	97.4	1.46	1.210 ± 0.016)
-05	0.1550 ± 53.6%	0.0691 ± 4140%	2.4754 ± 0.36%	740.7	2.4283 ± 1.07%	98.1	2.79	1.178 ± 0.013
-06	0.1907 ± 41.9%	2.2382 ± 196%	2.5067 ± 0.46%	22.8	2.4507 ± 1.07%	97.8	1.65	1.189 ± 0.013
-07	0.5978 ± 13.6%	5.2494 ± 78.9%	2.6318 ± 0.39%	9.7	2.4579 ± 1.07%	93.4	1.89	1.192 ± 0.013
-08	0.3198 ± 18.9%	3.3590 ± 84.5%	2.5426 ± 0.40%	15.2	2.4495 ± 0.84%	96.3	2.63	1.188 ± 0.011
-09	2.2249 ± 4.98%	-	3.0962 ± 0.42%	-	2.4322 ± 1.44%	78.7	2.11	1.183 ± 0.017
-10	2.0366 ± 3.83%	0.8199 ± 361%	3.0373 ± 0.43%	6.2	2.4347 ± 1.08%	80.2	2.90	1.181 ± 0.013
			Arithmetic mean K/Ca (n = 8)	109.5 ± 255.9	Arithmetic mean age (n = 9)			1.188 ± 0.007
					Weighted mean age (n = 9)			1.189 ± 0.005

$\lambda = 5.543 \times 10^{-10}\ a^{-1}$ Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57\ (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91\ (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0\ (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 2. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from trachyte in the Likayu West Volcano in The Barrier, Kenya, and from small pumice clasts in Tuff K, Member K, Shungura Formation, Errum, southern Ethiopia

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^*/^{39}Ar_K$ ± c.v.	$^{40}Ar^*$ % s.d.	^{40}Ar mol %	Calculated x 10^{-14} Ma
08-035 anorthoclase from trachyte, The Barrier; J = 2.689E-4 ± 0.30%								
5626-01	140.0 ± 1.12%	6.765 ± 86.2%	42.784 ± 0.40%	7.5	1.4083 ± 36.74%	3.3	19.4	0.683 ± 0.251
-02	89.77 ± 0.85%	4.625 ± 46.9%	27.783 ± 0.36%	11.0	1.2591 ± 21.62%	4.5	33.8	0.611 ± 0.132
-03	18.89 ± 1.07%	1.835 ± 143%	7.0988 ± 0.39%	27.8	1.5164 ± 4.53%	21.4	6.69	0.736 ± 0.033
-04	4.177 ± 4.02%	6.256 ± 84.9%	2.6809 ± 0.47%	8.2	1.4502 ± 3.51%	54.1	1.27	0.703 ± 0.025
-05	23.06 ± 0.94%	16.034 ± 17.8%	8.1361 ± 0.35%	3.2	1.3334 ± 5.72%	16.4	7.01	0.647 ± 0.037
-06	13.03 ± 1.61%	6.236 ± 73.0%	5.2459 ± 0.36%	8.2	1.3977 ± 4.78%	26.6	3.02	0.678 ± 0.033
-07	1.381 ± 6.22%	1.886 ± 169%	1.8508 ± 0.37%	27.0	1.4428 ± 1.82%	78.0	1.64	0.700 ± 0.013
-08	30.64 ± 1.24%	3.550 ± 142%	10.626 ± 0.38%	14.4	1.5726 ± 7.93%	14.8	5.34	0.763 ± 0.061
-09	0.404 ± 18.0%	5.563 ± 60.8%	1.5183 ± 0.45%	9.2	1.4019 ± 1.61%	92.3	1.17	0.680 ± 0.011
-10	23.72 ± 0.84%	6.280 ± 52.6%	8.6317 ± 0.35%	8.1	1.6248 ± 4.54%	18.8	6.59	0.788 ± 0.036
		Arithmetic mean K/Ca (n = 10)		12.5 ± 8.4	Arithmetic mean age (n = 10)			0.699 ± 0.053
					Weighted mean age (n = 10)			0.694 ± 0.009
08-024 anorthoclase, Tuff K; J = 2.690E-4 ± 0.26%								
5645-01	3.795 ± 2.93%	-	4.2331 ± 0.36%	-	3.1106 ± 1.18%	73.5	2.85	1.509 ± 0.018
-02	0.2294 ± 40.2%	8.268 ± 55.7%	3.2478 ± 0.40%	6.2	3.1852 ± 0.34%	98.1	1.92	1.545 ± 0.015
-03	0.6729 ± 7.3%	10.226 ± 22.5%	3.3296 ± 0.37%	5.0	3.1372 ± 0.61%	94.2	3.71	1.522 ± 0.010
-04	0.5575 ± 20.5%	0.8242 ± 715%	3.3562 ± 0.47%	61.9	3.1909 ± 1.16%	95.1	1.74	1.548 ± 0.018
-05	0.2643 ± 30.8%	6.359 ± 50.4%	3.2035 ± 0.38%	8.0	3.1288 ± 0.86%	97.7	2.40	1.518 ± 0.014
-06	0.1696 ± 64.2%	2.252 ± 224%	3.2133 ± 0.45%	22.7	3.1632 ± 1.11%	98.4	1.53	1.534 ± 0.018
-07	0.3728 ± 15.8%	1.496 ± 182%	3.2063 ± 0.69%	34.1	3.0958 ± 0.68%	96.6	3.38	1.502 ± 0.011
-08	1.943 ± 7.3%	3.420 ± 166%	3.7195 ± 0.45%	14.9	3.1466 ± 1.43%	84.6	1.83	1.526 ± 0.022
-09	0.1525 ± 58.9%	0.3411 ± 1257%	3.2008 ± 0.38%	149.5	3.1546 ± 0.92%	98.6	2.04	1.530 ± 0.015
(-10	0.3269 ± 38.0%	4.384 ± 120%	3.3538 ± 0.49%	11.6	3.2591 ± 1.23%	97.2	1.55	1.581 ± 0.020)
		Arithmetic mean K/Ca (n = 8)		37.8 ± 49.0	Arithmetic mean age (n = 9)			1.526 ± 0.015
					Weighted mean age (n = 9)			1.522 ± 0.006

$\lambda = 5.543 \times 10^{-10}\ a^{-1}$ Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57\ (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91\ (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0\ (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 4. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from pumice clasts in Tuff G, Member G, Shungura Formation, and from pumice clasts in the Burgi Tuff, Burgi Member, Koobi Fora Formation, Kenya

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^{*}/^{39}Ar_{K}$ ± c.v.	$^{40}Ar^{*}$ %	^{40}Ar mol %	Calculated x 10^{-14} Ma ±
08-029 anorthoclase from pumice clasts, Tuff G; J = 2.689E-4 ± 0.30%								
5614-01	2.2995 ± 3.7%	0.4157 ± 304%	5.3835 ± 0.36%	122.7	4.7090 ± 0.68%	87.4	6.00	2.283 ± 0.017
-02	0.5553 ± 18.9%	0.0512 ± 486%	4.8313 ± 0.37%	99.6	4.6663 ± 0.76%	96.6	3.07	2.262 ± 0.019
(-04	242.135 ± 9.91%	72.343 ± 298%	99.3450 ± 8.4%	0.7	27.8628 ± 15.8%	28.0	0.67	13.466 ± 2.123)
-05	0.3164 ± 24.8%	0.2949 ± 552%	4.7485 ± 0.42%	173.0	4.6538 ± 0.66%	98.0	4.52	2.256 ± 0.016
-06	0.2598 ± 80.9%	3.1006 ± 151%	4.7527 ± 0.51%	16.5	4.6770 ± 1.42%	98.4	1.50	2.268 ± 0.033
-11	0.1654 ± 32.9%	2.4581 ± 48.4%	4.7067 ± 0.34%	20.8	4.6585 ± 0.49%	99.0	5.56	2.259 ± 0.013
-13	1.3280 ± 16.7%	7.1837 ± 84.1%	5.2407 ± 0.58%	7.1	4.8528 ± 1.47%	92.6	1.45	2.353 ± 0.035
-14	0.7678 ± 16.9%	2.0226 ± 163%	4.7990 ± 0.44%	25.2	4.5725 ± 0.95%	95.3	2.59	2.217 ± 0.022
		Arithmetic mean K/Ca (n = 7)		66.4 ± 65.1	Arithmetic mean age (n = 7)			2.271 ± 0.041
					Weighted mean age (n = 7)			2.262 ± 0.012
08-032A anorthoclase from pumice clast, Burgi Tuff; J = 2.689E-4 ± 0. 30%								
5628-01	0.6590 ± 17.6%	5.8169 ± 61.5%	5.6259 ± 0.38%	8.8	5.4344 ± 0.74%	96.6	3.32	2.634 ± 0.021
(-02	1.5467 ± 11.2%	11.2365 ± 50.0%	13.8556 ± 0.36%	4.5	13.4068 ± 0.53%	96.8	5.20	6.492 ± 0.040)
-03	1.0912 ± 23.5%	10.1907 ± 96.0%	5.7036 ± 0.69%	5.0	5.3879 ± 1.57%	94.5	1.35	2.612 ± 0.042
-04	1.4026 ± 13.4%	3.3338 ± 177%	5.8631 ± 0.45%	15.3	5.4500 ± 1.12%	93.0	2.01	2.642 ± 0.030
-05	1.3912 ± 19.3%	7.8495 ± 130%	5.7653 ± 0.59%	6.5	5.3591 ± 1.59%	93.0	1.39	2.598 ± 0.042
-06	0.9408 ± 22.5%	18.8101 ± 44.6%	5.7584 ± 0.54%	2.7	5.4942 ± 1.26%	95.4	1.68	2.663 ± 0.035
-07	1.5452 ± 14.7%	4.1369 ± 189%	5.9234 ± 0.58%	12.3	5.4692 ± 1.36%	92.3	1.76	2.651 ± 0.037
-08	1.4399 ± 19.3%	2.3737 ± 418%	5.9308 ± 0.53%	21.5	5.5059 ± 1.58%	92.8	1.50	2.669 ± 0.043
-09	0.0484 ± 670%	2.3085 ± 414%	5.6239 ± 0.63%	22.1	5.6100 ± 1.80%	99.8	1.16	2.719 ± 0.050
-10	0.8686 ± 32.1%	6.0829 ± 258%	5.7562 ± 0.60%	8.4	5.5030 ± 1.61%	95.6	1.24	2.668 ± 0.044
		Arithmetic mean K/Ca (n = 9)		11.4 ± 7.0	Arithmetic mean age (n = 9)			2.651 ± 0.036
					Weighted mean age (n = 9)			2.645 ± 0.014
08-032B anorthoclase from pumice clast, Burgi Tuff; J = 2.689E-4 ± 0.30%								
(5629-01	1.7076 ± 7.2%	11.4591 ± 25.4%	6.6274 ± 0.35%	4.5	6.1309 ± 0.70%	92.5	4.21	2.972 ± 0.023)
-02	1.0281 ± 19.2%	14.2553 ± 43.3%	5.6722 ± 0.58%	3.6	5.3783 ± 1.23%	94.8	1.91	2.607 ± 0.033
-03	0.9097 ± 12.8%	0.4674 ± 853%	5.6136 ± 0.38%	109.2	5.3438 ± 0.75%	95.2	3.28	2.591 ± 0.021
-04	2.2050 ± 7.4%	5.9645 ± 95.3%	6.1870 ± 0.43%	8.6	5.5388 ± 0.99%	89.5	2.51	2.685 ± 0.028
-05	0.4612 ± 42.9%	6.1629 ± 134%	5.6871 ± 0.48%	8.3	5.5544 ± 1.15%	97.7	1.78	2.692 ± 0.032
-06	0.2711 ± 70.7%	22.3403 ± 36.3%	5.7729 ± 0.46%	2.3	5.7092 ± 1.09%	98.9	1.77	2.767 ± 0.031
-07	1.4155 ± 12.8%	6.3984 ± 179%	5.6942 ± 0.47%	8.0	5.2797 ± 1.13%	92.7	1.94	2.559 ± 0.030
-08	1.5299 ± 21.3%	5.6580 ± 202%	5.9392 ± 0.64%	9.0	5.4925 ± 1.85%	92.5	1.26	2.663 ± 0.050
-09	1.9386 ± 18.5%	15.5583 ± 82.4%	5.9717 ± 0.66%	3.3	5.0499 ± 2.07%	90.6	1.11	2.623 ± 0.055
		Arithmetic mean K/Ca (n = 8)		19.0 ± 36.5	Arithmetic mean age (n = 8)			2.648 ± 0.067
					Weighted mean age (n = 8)			2.640 ± 0.026

$\lambda = 5.543 \times 10^{-10}\ a^{-1}$ Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57\ (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91\ (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_{K} = 8.0\ (\pm 3.0) \times 10^{-4}$

$^{40}Ar^{*}$ – radiogenic ^{40}Ar $^{39}Ar_{K}$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 4. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from pumice clasts in Tuff G, Member G, Shungura Formation, and from pumice clasts in the Burgi Tuff, Burgi Member, Koobi Fora Formation, Kenya

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^*/^{39}Ar_K$ ± c.v.	$^{40}Ar^*$ %	^{40}Ar mol %	Calculated x 10^{-14} Ma ±
08-029 anorthoclase from pumice clasts, Tuff G; J = 2.689E-4 ± 0.30%								
5614-01	2.2995 ± 3.7%	0.4157 ± 304%	5.3835 ± 0.36%	122.7	4.7090 ± 0.68%	87.4	6.00	2.283 ± 0.017
-02	0.5553 ± 18.9%	0.0512 ± 486%	4.8313 ± 0.37%	99.6	4.6663 ± 0.76%	96.6	3.07	2.262 ± 0.019
(-04	242.135 ± 9.91%	72.343 ± 298%	99.3450 ± 8.4%	0.7	27.8628 ± 15.8%	28.0	0.67	13.466 ± 2.123)
-05	0.3164 ± 24.8%	0.2949 ± 552%	4.7485 ± 0.42%	173.0	4.6538 ± 0.66%	98.0	4.52	2.256 ± 0.016
-06	0.2598 ± 80.9%	3.1006 ± 151%	4.7527 ± 0.51%	16.5	4.6770 ± 1.42%	98.4	1.50	2.268 ± 0.033
-11	0.1654 ± 32.9%	2.4581 ± 48.4%	4.7067 ± 0.34%	20.8	4.6585 ± 0.49%	99.0	5.56	2.259 ± 0.013
-13	1.3280 ± 16.7%	7.1837 ± 84.1%	5.2407 ± 0.58%	7.1	4.8528 ± 1.47%	92.6	1.45	2.353 ± 0.035
-14	0.7678 ± 16.9%	2.0226 ± 163%	4.7990 ± 0.44%	25.2	4.5725 ± 0.95%	95.3	2.59	2.217 ± 0.022
		Arithmetic mean K/Ca (n = 7)		66.4 ± 65.1	Arithmetic mean age (n = 7)			2.271 ± 0.041
					Weighted mean age (n = 7)			2.262 ± 0.012
08-032A anorthoclase from pumice clast, Burgi Tuff; J = 2.689E-4 ± 0. 30%								
5628-01	0.6590 ± 17.6%	5.8169 ± 61.5%	5.6259 ± 0.38%	8.8	5.4344 ± 0.74%	96.6	3.32	2.634 ± 0.021
(-02	1.5467 ± 11.2%	11.2365 ± 50.0%	13.8556 ± 0.36%	4.5	13.4068 ± 0.53%	96.8	5.20	6.492 ± 0.040)
-03	1.0912 ± 23.5%	10.1907 ± 96.0%	5.7036 ± 0.69%	5.0	5.3879 ± 1.57%	94.5	1.35	2.612 ± 0.042
-04	1.4026 ± 13.4%	3.3338 ± 177%	5.8631 ± 0.45%	15.3	5.4500 ± 1.12%	93.0	2.01	2.642 ± 0.030
-05	1.3912 ± 19.3%	7.8495 ± 130%	5.7653 ± 0.59%	6.5	5.3591 ± 1.59%	93.0	1.39	2.598 ± 0.042
-06	0.9408 ± 22.5%	18.8101 ± 44.6%	5.7584 ± 0.54%	2.7	5.4942 ± 1.26%	95.4	1.68	2.663 ± 0.035
-07	1.5452 ± 14.7%	4.1369 ± 189%	5.9234 ± 0.58%	12.3	5.4692 ± 1.36%	92.3	1.76	2.651 ± 0.037
-08	1.4399 ± 19.3%	2.3737 ± 418%	5.9308 ± 0.53%	21.5	5.5059 ± 1.58%	92.8	1.50	2.669 ± 0.043
-09	0.0484 ± 670%	2.3085 ± 414%	5.6239 ± 0.63%	22.1	5.6100 ± 1.80%	99.8	1.16	2.719 ± 0.050
-10	0.8686 ± 32.1%	6.0829 ± 258%	5.7562 ± 0.60%	8.4	5.5030 ± 1.61%	95.6	1.24	2.668 ± 0.044
		Arithmetic mean K/Ca (n = 9)		11.4 ± 7.0	Arithmetic mean age (n = 9)			2.651 ± 0.036
					Weighted mean age (n = 9)			2.645 ± 0.014
08-032B anorthoclase from pumice clast, Burgi Tuff; J = 2.689E-4 ± 0.30%								
(5629-01	1.7076 ± 7.2%	11.4591 ± 25.4%	6.6274 ± 0.35%	4.5	6.1309 ± 0.70%	92.5	4.21	2.972 ± 0.023)
-02	1.0281 ± 19.2%	14.2553 ± 43.3%	5.6722 ± 0.58%	3.6	5.3783 ± 1.23%	94.8	1.91	2.607 ± 0.033
-03	0.9097 ± 12.8%	0.4674 ± 853%	5.6136 ± 0.38%	109.2	5.3438 ± 0.75%	95.2	3.28	2.591 ± 0.021
-04	2.2050 ± 7.4%	5.9645 ± 95.3%	6.1870 ± 0.43%	8.6	5.5388 ± 0.99%	89.5	2.51	2.685 ± 0.028
-05	0.4612 ± 42.9%	6.1629 ± 134%	5.6871 ± 0.48%	8.3	5.5544 ± 1.15%	97.7	1.78	2.692 ± 0.032
-06	0.2711 ± 70.7%	22.3403 ± 36.3%	5.7729 ± 0.46%	2.3	5.7092 ± 1.09%	98.9	1.77	2.767 ± 0.031
-07	1.4155 ± 12.8%	6.3984 ± 179%	5.6942 ± 0.47%	8.0	5.2797 ± 1.13%	92.7	1.94	2.559 ± 0.030
-08	1.5299 ± 21.3%	5.6580 ± 202%	5.9392 ± 0.64%	9.0	5.4925 ± 1.85%	92.5	1.26	2.663 ± 0.050
-09	1.9386 ± 18.5%	15.5583 ± 82.4%	5.9717 ± 0.66%	3.3	5.0499 ± 2.07%	90.6	1.11	2.623 ± 0.055
		Arithmetic mean K/Ca (n = 8)		19.0 ± 36.5	Arithmetic mean age (n = 8)			2.648 ± 0.067
					Weighted mean age (n = 8)			2.640 ± 0.026

$\lambda = 5.543 \times 10^{-10}\ a^{-1}$ Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57\ (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91\ (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0\ (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 5. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of plagioclase from pumice clasts in Tuff C-gamma, Member C, Shungura Formation, southern Ethiopia

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{37}Ar/^{39}Ar$ ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^{*}/^{39}Ar_K$ ± c.v.	$^{40}Ar^{*}$ %	^{40}Ar mol x 10^{-14}	Calculated Age Ma ± 1 s.d.
08-026A plagioclase from pumice clasts; J = 2.690E-4 ± 0.26%								
5648-01	7.9165 ± 1.78%	4.1104 ± 4.43%	29.2341 ± 0.78%	0.124	6.1690 ± 6.85%	21.0	2.97	2.991 ± 0.205
-02	1.1943 ± 8.45%	2.2800 ± 9.74%	8.4682 ± 0.93%	0.224	5.1189 ± 5.93%	60.4	0.61	2.483 ± 0.147
-03	1.6472 ± 5.72%	3.0372 ± 5.92%	10.9133 ± 9.80%	0.168	6.2881 ± 4.57%	57.5	0.96	3.049 ± 0.140
-04	21.5719 ± 1.77%	3.1367 ± 8.70%	70.2424 ± 1.30%	0.163	6.7482 ± 13.5%	9.6	4.31	3.272 ± 0.440
-05	2.6231 ± 4.67%	2.3388 ± 9.95%	14.0886 ± 1.21%	0.220	6.5246 ± 5.64%	46.2	0.98	3.164 ± 0.178
-06	7.9175 ± 2.14%	2.5351 ± 8.65%	30.0720 ± 1.01%	0.210	6.8790 ± 7.09%	22.8	2.13	3.335 ± 0.236
-07	6.7556 ± 1.74%	3.7097 ± 3.89%	29.9846 ± 0.80%	0.138	5.3165 ± 6.62%	21.2	2.76	2.578 ± 0.171
-08	3.2187 ± 3.65%	2.7777 ± 6.97%	15.4753 ± 0.98%	0.184	6.1858 ± 5.69%	39.9	1.30	2.999 ± 0.171
-09	3.8549 ± 6.56%	3.7116 ± 11.3%	18.0121 ± 1.72%	0.138	6.9189 ± 10.7%	38.3	0.60	3.355 ± 0.358
-10	3.8627 ± 4.17%	3.1621 ± 9.81%	18.7182 ± 1.27%	0.161	7.5588 ± 6.29%	40.3	0.98	3.665 ± 0.231
		Arithmetic mean K/Ca (n = 10)		0.117 ± 0.036	Arithmetic mean age (n = 10)			3.089 ± 0.357
					Weighted mean age (n = 10)			2.969 ± 0.113
08-026B plagioclase from pumice clasts; J = 2.690E-4 ± 0.26%								
5649-01	32.2424 ± 1.33%	3.0854 ± 5.68%	100.97 ± 0.95%	0.165	5.9370 ± 19.6%	5.9	8.98	2.879 ± 0.563
(-02	283.406 ± 2.05%	15.0558 ± 2.85%	870.61 ± 2.00%	0.044	34.6352 ± 20.2%	3.9	46.5	16.731 ± 3.369)
(-03	26.9351 ± 1.57%	2.3123 ± 11.8%	90.2434 ± 1.20%	0.221	10.8404 ± 9.37%	12.0	6.01	5.253 ± 0.492)
-04	9.8247 ± 1.79%	2.5793 ± 7.03%	34.2194 ± 0.96%	0.198	5.4630 ± 9.20%	15.9	2.72	2.649 ± 0.244
-05	17.6960 ± 1.57%	4.2661 ± 4.55%	55.9505 ± 0.95%	0.120	3.9915 ± 19.1%	7.1	4.59	1.936 ± 0.370
-06	1.8242 ± 8.85%	3.0111 ± 10.4%	10.2016 ± 1.56%	0.169	5.049 ± 9.51%	49.4	0.44	2.449 ± 0.233
-07	7.3050 ± 3.10%	4.2343 ± 7.53%	27.7350 ± 1.47%	0.121	6.4878 ± 9.75%	23.3	1.33	3.146 ± 0.307
-08	8.5050 ± 2.18%	2.9082 ± 8.45%	32.3707 ± 1.19%	0.175	7.4728 ± 6.89%	23.0	1.94	3.623 ± 0.249
-09	5.7448 ± 3.98%	3.6453 ± 7.07%	23.1003 ± 1.39%	0.140	6.4163 ± 10.3%	27.7	1.06	3.111 ± 0.319
-10	6.2777 ± 2.81%	2.7219 ± 8.18%	25.5900 ± 1.01%	0.187	7.2581 ± 7.14%	28.3	1.74	3.519 ± 0.251
		Arithmetic mean K/Ca (n = 8)		0.159 ± 0.029	Arithmetic mean age (n = 8)			2.914 ± 0.561
					Weighted mean age (n = 8)			2.966 ± 0.197

$\lambda = 5.543 \times 10^{-10} a^{-1}$ Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57 (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91 (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0 (\pm 3.0) \times 10^{-4}$

$^{40}Ar^{*}$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 6. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from pumice clasts in Tuff B-delta, Member B, Shungura Formation, Ethiopia

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^{*}/^{39}Ar_K$ ± c.v.	% $^{40}Ar^{*}$	^{40}Ar mol x 10^{-14}	Calculated age Ma ± 1 s.d.
08-020A anorthoclase from pumice clast; J = 2.690E-4 ± 0.26%								
5652-01	0.7968 ± 20.0%	3.3292 ± 126%	7.3611 ± 0.33%	15.3	7.1269 ± 0.74%	96.8	5.15	3.455 ± 0.027
-02	2.0242 ± 3.9%	0.3456 ± 794%	7.6270 ± 0.35%	147.7	7.0275 ± 0.51%	92.1	7.85	3.407 ± 0.019
(-04	651.14 ± 0.59%	-	211.409 ± 0.44%	-	18.991 ± 8.28%	9.0	178	9.193 ± 0.760)
(-05	7.9698 ± 2.9%	5.6401 ± 120%	9.5879 ± 0.40%	9.0	7.2361 ± 1.08%	75.5	4.36	3.508 ± 0.039)
-06	0.7301 ± 19.6%	0.1223 ± 5355%	7.2644 ± 0.41%	416.7	7.0474 ± 0.73%	97.0	3.42	3.417 ± 0.026
-07	1.6309 ± 7.6%	5.2032 ± 83.4%	7.4848 ± 0.33%	9.8	7.0055 ± 0.63%	93.6	4.27	3.397 ± 0.023
08	0.7859 ± 19.5%	7.2831 ± 109%	7.2482 ± 0.42%	7.1	7.0206 ± 0.77%	96.9	2.99	3.404 ± 0.028
-09	1.0662 ± 15.6%	4.2747 ± 156%	7.3835 ± 0.38%	11.9	7.0704 ± 0.80%	95.8	2.87	3.428 ± 0.029
-10	0.3133 ± 32.8%	7.1831 ± 55.8%	7.1297 ± 0.40%	7.1	7.0416 ± 0.59%	98.8	4.30	3.414 ± 0.022
(-11	359.97 ± 0.47%	3.4685 ± 63.5%	120.89 ± 0.34%	14.7	14.5213 ± 5.56%	12.0	187	7.034 ± 0.391)
(-12	30.0063 ± 1.11%	12.789 ± 66.3%	16.731 ± 0.40%	4.0	7.8725 ± 1.54%	47.1	6.66	3.816 ± 0.059)
-13	0.9217 ± 25.7%	19.893 ± 87.5%	7.3131 ± 0.57%	2.6	7.0552 ± 1.16%	96.5	2.13	3.421 ± 0.041
-14	0.9361 ± 22.9%	36.261 ± 24.9%	7.3563 ± 0.54%	1.4	7.1076 ± 1.05%	96.6	2.21	3.446 ± 0.037
(-15	0.1630 ± 101%	5.8057 ± 174%	7.2645 ± 0.45%	8.8	7.2197 ± 0.81%	99.4	2.52	3.500 ± 0.030)
(-16	0.8389 ± 26.7%	1.0329 ± 1069%	8.4856 ± 0.50%	49.4	8.2375 ± 0.95%	97.1	2.26	3.993 ± 0.039)
5661-01	1.9998 ± 4.22%	15.129 ± 20.1%	7.6936 ± 0.38%	3.4	7.1133 ± 0.53%	92.5	7.29	3.449 ± 0.020
-02	0.7173 ± 10.2%	10.506 ± 34.3%	7.2392 ± 0.39%	4.9	7.0345 ± 0.51%	97.2	6.43	3.411 ± 0.019
-03	1.8378 ± 4.92%	1.1918 ± 332%	7.6863 ± 0.34%	42.8	7.1430 ± 0.52%	92.9	5.54	3.463 ± 0.020
-04	0.7291 ± 11.1%	1.3774 ± 26.9%	7.2985 ± 0.39%	37.0	7.0825 ± 0.52%	97.0	6.26	3.434 ± 0.020
		Arithmetic mean K/Ca (n = 13)		54.4 ± 115.7	Arithmetic mean age (n = 13)			3.427 ± 0.021
					Weighted mean age (n = 13)			3.426 ± 0.011
08-020B anorthoclase from pumice clast; J = 2.690E-4 ± 0. 26%								
5653-01	0.3115 ± 18.9%	2.9837 ± 100%	7.0498 ± 0.38%	17.1	6.9588 ± 0.46%	98.7	6.86	3.374 ± 0.018
-02	1.1482 ± 12.8%	11.9491 ± 51.0%	7.4096 ± 0.37%	4.3	7.0786 ± 0.72%	95.5	4.04	3.432 ± 0.026
-03	2.0981 ± 4.97%	9.8431 ± 60.2%	7.5644 ± 0.36%	5.2	6.9509 ± 0.59%	91.9	4.54	3.370 ± 0.022
-04	0.5783 ± 13.8%	2.7576 ± 119%	7.2048 ± 0.34%	18.5	7.0349 ± 0.48%	97.6	5.45	3.411 ± 0.019
-05	0.5710 ± 14.1%	13.5638 ± 24.2%	7.1650 ± 0.36%	3.8	7.0058 ± 0.50%	97.8	5.88	3.397 ± 0.019
-06	0.7366 ± 12.4%	7.8281 ± 54.1%	7.1889 ± 0.37%	6.5	6.9761 ± 0.54%	97.0	4.91	3.382 ± 0.020
-07	4.0660 ± 2.29%	6.8141 ± 48.6%	8.1956 ± 0.37%	7.5	6.9981 ± 0.59%	85.4	7.73	3.393 ± 0.022
-08	11.1212 ± 1.75%	-	10.3468 ± 0.35%	-	7.0597 ± 0.99%	68.2	6.01	3.423 ± 0.035
-09	1.3686 ± 7.94%	14.3756 ± 30.8%	7.3225 ± 0.35%	3.6	6.9282 ± 0.59%	94.6	4.72	3.359 ± 0.022
-10	0.8408 ± 13.2%	-	7.1967 ± 0.34%	-	6.9472 ± 0.59%	96.5	4.26	3.368 ± 0.022
		Arithmetic mean K/Ca (n = 8)		8.3 ± 6.0	Arithmetic mean age (n = 10)			3.391 ± 0.025
					Weighted mean age (n = 10)			3.387 ± 0.011
08-034A anorthoclase from pumice clast; J = 2.689E-4 ± 0.30%								
5630-01	1.4294 ± 7.19%	5.2286 ± 43.3%	7.3507 ± 0.35%	9.8	6.9313 ± 0.57%	94.3	5.21	3.359 ± 0.022
-02	1.2364 ± 30.3%	6.9641 ± 112%	7.4205 ± 0.65%	7.3	7.0595 ± 1.69%	95.1	1.30	3.421 ± 0.059
-03	0.7078 ± 11.2%	4.5730 ± 36.4%	7.2769 ± 0.39%	11.2	7.0703 ± 0.51%	97.2	6.61	3.427 ± 0.020
-04	0.7300 ± 41.3%	0.5273 ± 1398%	7.3752 ± 0.53%	74.6	7.1587 ± 1.34%	97.1	1.63	3.469 ± 0.048
(-05	1218.56 ± 111%	77.987 ± 5853%	408.072 ± 108%	0.65	48.048 ± 151%	11.8	0.17	23.16 ± 34.8)
-06	1.3261 ± 15.1%	5.2038 ± 92.0%	7.4364 ± 0.45%	9.8	7.0473 ± 0.95%	94.8	2.56	3.416 ± 0.034
-07	0.4761 ± 27.3%	-	7.0536 ± 0.38%	-	6.9121 ± 0.67%	98.0	3.32	3.350 ± 0.025
(-08	351.456 ± 5.76%	-	109.547 ± 5.03%	-	5.7518 ± 50.5%	5.3	1.18	2.788 ± 1.406)
-09	0.5592 ± 21.5%	4.7790 ± 56.0%	7.1549 ± 0.39%	10.7	6.9922 ± 0.64%	97.7	4.02	3.389 ± 0.024
-10	0.0607 ± 438%	10.6153 ± 58.4%	7.1800 ± 0.57%	4.8	7.1697 ± 1.23%	99.9	1.74	3.475 ± 0.044
		Arithmetic mean K/Ca (n = 7)		18.3 ± 24.9	Arithmetic mean age (n = 8)			3.413 ± 0.046
					Weighted mean age (n = 8)			3.396 ± 0.017
08-034B anorthoclase from pumice clast; J = 2.689E-4 ± 0.30%								
5634-01	2.4888 ± 9.04%	9.8730 ± 47.9%	7.8823 ± 0.45%	5.2	7.1535 ± 1.04%	90.8	2.64	3.467 ± 0.038
-02	0.8064 ± 20.7%	12.4219 ± 28.0%	7.4100 ± 0.39%	4.1	7.1804 ± 0.79%	96.9	3.23	3.480 ± 0.029
-03	23.8385 ± 0.91%	5.6084 ± 33.5%	14.4721 ± 0.42%	9.1	7.4309 ± 1.23%	51.3	12.1	3.601 ± 0.045
-04	10.5856 ± 1.69%	9.1395 ± 23.2%	10.2824 ± 0.30%	5.6	7.1602 ± 0.91%	69.6	6.93	3.470 ± 0.033
-05	0.5078 ± 30.5%	1.7140 ± 202%	7.2185 ± 0.46%	29.8	7.0685 ± 0.79%	97.9	3.29	3.426 ± 0.029

(	-06	1735.2 ± 23.7%	121.918 ± 539%	5433.12 ± 23.4%	0.4	305.82 ± 28.1%	5.6	12.5	142.57 ± 38.54)
	-07	6.2420 ± 2.58%	0.8392 ± 358%	8.9972 ± 0.37%	60.8	7.1521 ± 0.81%	79.5	5.19	3.466 ± 0.030
	-08	1.6922 ± 11.4%	2.1483 ± 205%	7.5868 ± 0.47%	23.8	7.0871 ± 0.94%	93.4	2.68	3.435 ± 0.034
	-09	1.7762 ± 10.8%	-	7.8181 ± 0.42%	-	7.2922 ± 0.89%	93.3	3.27	3.534 ± 0.033
	-10	8.8009 ± 3.79%	-	10.0123 ± 0.49%	-	7.4103 ± 1.45%	74.0	2.92	3.591 ± 0.053

Arithmetic mean K/Ca (n = 7) 19.8 ± 20.7 Arithmetic mean age (n = 9) 3.497 ± 0.064

Weighted mean age (n = 9) 3.480 ± 0.021

$\lambda = 5.543 \times 10^{-10}$ a^{-1} Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57 (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91 (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0 (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 7. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from three pumice clasts in the Naibar Tuff, Lonyumun Member, Koobi Fora Formation, Kenya

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^*/^{39}Ar_K$ ± c.v.	% $^{40}Ar^*$	^{40}Ar mol ge x 10^{-14}	Calculated ge Ma ± 1 s.d.
08-036A anorthoclase from pumice clast; J = 2.689E-4 ± 0.30%								
(5627-01	198.52 ± 0.79%	8.0281 ± 24.6%	66.4563 ± 0.36%	6.4	7.7981 ± 7.59%	11.7	70.1	3.779 ± 0.287)
-02	1.8728 ± 8.78%	10.109 ± 36.9%	8.7957 ± 0.39%	5.1	8.2490 ± 0.71%	93.8	4.59	3.997 ± 0.031
-03	1.3071 ± 6.45%	-	8.6337 ± 0.42%	-	8.2473 ± 0.51%	95.5	7.84	3.997 ± 0.024
-04	1.1279 ± 12.4%	1.6206 ± 262%	8.6204 ± 0.40%	31.5	8.2870 ± 0.64%	96.1	4.56	4.016 ± 0.028
-05	1.1123 ± 16.1%	6.1373 ± 88.0%	8.7310 ± 0.44%	8.3	8.4059 ± 0.77%	96.3	3.52	4.073 ± 0.034
06	1.6406 ± 7.75%	6.5579 ± 63.3%	8.7896 ± 0.38%	7.8	8.3087 ± 0.60%	94.5	4.49	4.026 ± 0.027
-07	3.2890 ± 2.88%	2.8655 ± 58.1%	9.1802 ± 0.40%	17.8	8.2090 ± 0.55%	89.4	10.1	3.978 ± 0.025
-08	1.4157 ± 8.17%	-	8.8166 ± 0.39%	-	8.3972 ± 0.57%	95.2	6.60	4.069 ± 0.026
-09	1.3384 ± 9.83%	1.8548 ± 2.92%	8.5665 ± 0.39%	27.5	8.1712 ± 0.62%	95.4	4.79	3.960 ± 0.027
-10	0.7849 ± 10.2%	1.4885 ± 135%	8.4435 ± 0.38%	3.4	8.2115 ± 0.48%	97.3	7.79	3.979 ± 0.023
		Arithmetic mean K/Ca (n = 7)		14.2 ± 11.6	Arithmetic mean age (n = 9)			4.011 ± 0.040
					Weighted mean age (n = 9)			4.006 ± 0.017
08-036B anorthoclase from pumice clast; J = 2.690E-4 ± 0. 26%								
5655-01	0.4543 ± 39.6%	0.2227 ± 1665%	8.4407 ± 0.42%	229.4	8.3052 ± 0.76%	98.4	3.29	4.026 ± 0.033
-02	0.1418 ± 133%	-	8.5640 ± 0.46%	-	8.5212 ± 0.79%	99.5	3.20	4.131 ± 0.034
-03	0.8799 ± 21.5%	9.0011 ± 42.5%	8.6696 ± 0.45%	5.7	8.4158 ± 0.81%	97.1	2.90	4.079 ± 0.034
-04	0.9367 ± 14.5%	4.1966 ± 74.4%	8.5064 ± 0.39%	12.2	8.2321 ± 0.63%	96.8	3.74	3.991 ± 0.027
-05	0.3984 ± 27.9%	2.6085 ± 84.3%	8.4183 ± 0.36%	19.6	8.3013 ± 0.53%	98.6	5.66	4.024 ± 0.024
-06	2.6636 ± 4.73%	2.0821 ± 97.5%	9.2099 ± 0.34%	24.5	8.4233 ± 0.58%	91.5	6.35	4.083 ± 0.026
-07	9.9745 ± 2.03%	5.1794 ± 51.6%	11.3194 ± 0.37%	9.9	8.3747 ± 0.89%	74.0	6.00	4.060 ± 0.038
-08	1.1986 ± 19.3%	4.2129 ± 126%	8.6067 ± 0.48%	12.1	8.2548 ± 0.96%	95.9	2.44	4.002 ± 0.039
-09	1.6510 ± 9.72%	8.6348 ± 36.0%	8.8537 ± 0.44%	5.9	8.3715 ± 0.72%	94.6	4.14	4.058 ± 0.031
-10	0.8467 ± 40.0%	9.4496 ± 60.0%	8.8305 ± 0.57%	5.4	8.5868 ± 1.29%	97.2	1.89	4.162 ± 0.055
		Arithmetic mean K/Ca (n = 9)		36.1 ± 72.8	Arithmetic mean age (n = 10)			4.062 ± 0.055
					Weighted mean age (n = 10)			4.051 ± 0.018
08-036C anorthoclase from pumice clast; J = 2.690E-4 ± 0.26%								
5656-01	0.7596 ± 18.6%	-	8.5425 ± 0.39%	-	8.3184 ± 0.64%	97.4	3.89	4.032 ± 0.028
-02	1.6619 ± 10.7%	-	8.8560 ± 0.46%	-	8.3652 ± 0.78%	94.5	3.21	4.055 ± 0.033
-03	0.8542 ± 12.6%	-	8.5197 ± 0.33%	-	8.2663 ± 0.51%	97.0	5.94	4.007 ± 0.023
-04	3.6178 ± 4.95%	2.3909 ± 203%	9.3546 ± 0.39%	21.3	8.2863 ± 0.77%	88.6	3.96	4.017 ± 0.033
-05	1.6986 ± 5.93%	0.3536 ± 493%	8.8005 ± 0.42%	144.3	8.2977 ± 0.57%	94.3	7.73	4.022 ± 0.025
-06	1.0270 ± 8.52%	3.8027 ± 40.5%	8.4920 ± 0.42%	13.4	8.1904 ± 0.53%	96.5	7.67	3.970 ± 0.023
-07	1.6835 ± 7.34%	0.7518 ± 331%	8.9391 ± 0.36%	67.8	8.4410 ± 0.58%	94.4	5.63	4.092 ± 0.026
-08	0.6728 ± 18.9%	2.0641 ± 148%	8.4746 ± 0.37%	24.7	8.2762 ± 0.59%	97.7	4.13	4.012 ± 0.026
-09	1.6795 ± 19.8%	0.4772 ± 1580%	9.0241 ± 0.66%	106.9	8.5268 ± 1.33%	94.5	1.79	4.133 ± 0.056
-10	1.4652 ± 13.1%	3.3673 ± 115%	8.5757 ± 0.46%	15.2	8.1441 ± 0.84%	95.0	3.37	3.948 ± 0.035
		Arithmetic mean K/Ca (n = 7)		56.3 ± 52.0	Arithmetic mean age (n = 10)			4.029 ± 0.054
					Weighted mean age (n = 10)			4.020 ± 0.017

$\lambda = 5.543 \times 10^{-10}$ a^{-1} Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57 (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91 (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0 (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 8. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from three pumice clasts in the Naibar Tuff, Lonyumun Member, Koobi Fora Formation, Kenya

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^*/^{39}Ar_K$ ± c.v.	% $^{40}Ar^*$	^{40}Ar mol ge x 10^{-14}	Calculated Ma ± 1 s.d.
08-036D anorthoclase from pumice clast; J = 2.690E-4 ± 0.26%								
5658-01	0.6655 ± 10.4%	0.9487 ± 390%	8.4771 ± 0.33%	53.8	8.2799 ± 0.42%	97.7	7.17	4.014 ± 0.020
-02	1.2243 ± 6.16%	3.6254 ± 96.1%	8.6463 ± 0.36%	14.1	8.2859 ± 0.47%	95.8	8.67	4.017 ± 0.021
-03	1.0890 ± 8.08%	1.3199 ± 308%	8.6165 ± 0.39%	38.7	8.2944 ± 0.51%	96.3	7.27	4.021 ± 0.023
-04	1.5795 ± 4.56%	3.2881 ± 84.0%	8.7602 ± 0.36%	15.5	8.2947 ± 0.46%	94.7	9.83	4.021 ± 0.021
-05	0.9363 ± 13.7%	13.421 ± 41.2%	8.5308 ± 0.37%	3.8	8.2636 ± 0.59%	96.9	4.20	4.006 ± 0.026
-06	0.6964 ± 16.5%	10.289 ± 57.7%	8.4460 ± 0.40%	5.0	8.2473 ± 0.58%	97.6	4.19	3.998 ± 0.025
-07	0.4188 ± 42.7%	5.8934 ± 150%	8.5138 ± 0.41%	8.7	8.3928 ± 0.75%	98.6	2.83	4.068 ± 0.032
-08	1.2071 ± 11.4%	-	8.7429 ± 0.39%	-	8.3850 ± 0.63%	95.9	4.25	4.065 ± 0.028
-09	2.5918 ± 3.40%	0.6050 ± 537%	9.0524 ± 0.37%	84.3	8.2856 ± 0.51%	91.5	8.00	4.017 ± 0.023
-10	2.8700 ± 4.63%	2.0886 ± 233%	9.1437 ± 0.35%	24.4	8.2959 ± 0.61%	90.7	5.58	4.022 ± 0.027
		Arithmetic mean K/Ca (n = 9)		27.6 ± 26.9		Arithmetic mean age (n = 10)		4.025 ± 0.023
						Weighted mean age (n = 10)		4.021 ± 0.012
08-036E anorthoclase from pumice clast; J = 2.690E-4 ± 0. 26%								
5659-01	1.1169 ± 11.5%	4.5105 ± 132%	8.6168 ± 0.38%	11.3	8.2891 ± 0.60%	96.2	4.16	4.018 ± 0.026
-02	12.6281 ± 1.75%	-	12.1826 ± 0.33%	-	8.4496 ± 0.94%	69.4	6.58	4.096 ± 0.040
-03	0.8412 ± 21.8%	4.7343 ± 98.7%	8.5220 ± 0.38%	10.8	8.2758 ± 0.76%	97.1	5.86	4.012 ± 0.032
-04	2.2454 ± 8.02%	-	9.1081 ± 0.43%	-	8.4436 ± 0.78%	92.7	3.42	4.093 ± 0.034
-05	7.8864 ± 2.35%	-	10.7119 ± 0.37%	-	8.3810 ± 0.81%	78.2	5.17	4.063 ± 0.035
-06	2.2736 ± 4.39%	-	8.9587 ± 0.32%	-	8.2872 ± 0.50%	92.5	5.65	4.017 ± 0.023
(-07	203.945 ± 1.96%	390.509 ± 21.7%	67.3148 ± 1.47%	0.1	7.3618 ± 12.3%	10.9	2.80	3.569 ± 0.438)
-08	0.9561 ± 14.1%	8.0160 ± 73.0%	8.6056 ± 0.39%	6.4	8.3282 ± 0.62%	96.8	3.79	4.037 ± 0.027
-09	6.9616 ± 7.72%	-	10.5980 ± 0.50%	-	8.5399 ± 1.94%	80.6	3.28	4.140 ± 0.081
-10	2.1115 ± 6.76%	0.5764 ± 1060%	9.0482 ± 0.37%	88.6	8.4233 ± 0.64%	93.1	4.87	4.083 ± 0.028
		Arithmetic mean K/Ca (n = 4)		29.3 ± 39.6		Arithmetic mean age (n = 9)		4.062 ± 0.044
						Weighted mean age (n = 9)		4.046 ± 0.016
08-036F anorthoclase from pumice clast; J = 2.690E-4 ± 0.26%								
5660-01	0.8806 ± 18.4%	3.7638 ± 195%	8.4347 ± 0.42%	13.6	8.1762 ± 0.73%	96.9	3.31	3.964 ± 0.031
-02	1.0938 ± 9.89%	11.1040 ± 55.5%	8.6159 ± 0.35%	4.6	8.3002 ± 0.53%	96.3	4.55	4.024 ± 0.024
-03	5.1813 ± 1.73%	0.6018 ± 387%	9.6764 ± 0.36%	8.5	8.1443 ± 0.54%	84.2	11.7	3.948 ± 0.024
-04	0.5763 ± 14.0%	4.1258 ± 103%	8.4685 ± 0.31%	12.4	8.3008 ± 0.43%	98.0	5.89	4.024 ± 0.020
-05	2.9969 ± 4.86%	6.2022 ± 76.0%	9.1302 ± 0.33%	8.2	8.2572 ± 0.63%	90.4	5.26	4.003 ± 0.027
-06	1.1882 ± 11.7%	-	8.7272 ± 0.41%	-	8.3748 ± 0.64%	96.0	3.93	4.060 ± 0.028
-07	0.9216 ± 12.3%	1.4662 ± 438%	8.4654 ± 0.38%	34.8	8.1929 ± 0.57%	96.8	3.68	3.972 ± 0.025
-08	2.1763 ± 7.39%	-	8.8656 ± 0.43%	-	8.2211 ± 0.73%	92.7	3.40	3.985 ± 0.031
-09	0.9636 ± 10.5%	-	8.5606 ± 0.35%	-	8.2751 ± 0.51%	96.7	5.48	4.011 ± 0.023
(-10	7.7986 ± 2.36%	-	10.7975 ± 0.35%	-	8.4918 ± 0.79%	78.7	5.98	4.116 ± 0.034)
			Arithmetic mean K/Ca (n = 6)	13.7 ± 10.8		Arithmetic mean age (n = 9)		3.999 ± 0.035
						Weighted mean age (n = 9)		4.001 ± 0.015

$\lambda = 5.543 \times 10^{-10}$ a^{-1} Fluence monitor: 92-176 from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca} = 2.57 (\pm 0.25) \times 10^{-4}$ $(^{39}Ar/^{37}Ar)_{Ca} = 6.91 (\pm 0.94) \times 10^{-4}$ $(^{40}Ar/^{39}Ar)_K = 8.0 (\pm 3.0) \times 10^{-4}$

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Results within parentheses have been excluded from the calculation of the mean

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Supplementary Table 9. Results of laser fusion $^{40}Ar/^{39}Ar$ dating of single crystals of anorthoclase from a trachyte from the eastern flanks of Kakorinya Volcano, The Barrier, northern Kenya at 2.3213ºN, 36.6098ºE

Run No.	$^{36}Ar/^{39}Ar$ x 10^{-3} ± c.v.	$^{37}Ar/^{39}Ar$ x 10^{-2} ± c.v.	$^{40}Ar/^{39}Ar$ ± c.v.	K/Ca	$^{40}Ar^*/^{39}Ar_K$ ± c.v.	% $^{40}Ar^*$	^{40}Ar mol x 10^{-15}	Calculated Age Ma ± 1 s.d.
K06-453 anorthoclase from trachyte; J = 2.624E-4 ± 0.17%								
BE4866	2.88 ± 8.00%	1.256 ± 5.97%	1.0330 ± 0.93%	34.2	0.18226 ± 37.0%	17.6	0.72	0.0863 ± 0.0319
BE4867	3.32 ± 4.82%	3.141 ± 2.01%	1.2174 ± 0.62%	13.7	0.23927 ± 19.4%	19.7	1.23	0.1133 ± 0.0220
BE4869	11.38 ± 2.28%	4.517 ± 2.50%	3.5570 ± 0.88%	9.5	0.19788 ± 36.6%	5.6	2.42	0.0937 ± 0.0343
BE4870	2.56 ± 5.08%	1.316 ± 6.00%	0.9804 ± 0.96%	32.7	0.22501 ± 16.5%	22.9	0.69	0.1065 ± 0.0175
BE4872	9.46 ± 1.59%	1.957 ± 3.37%	2.9571 ± 0.17%	22.0	0.16110 ± 27.4%	5.5	2.63	0.0763 ± 0.0209
BE4873	5.16 ± 2.71%	2.239 ± 1.88%	1.7469 ± 0.22%	19.2	0.22315 ± 18.5%	12.8	3.33	0.1056 ± 0.0195
BE4875	3.80 ± 1.58%	1.679 ± 2.62%	1.3445 ± 0.24%	25.6	0.22307 ± 7.56%	16.6	3.13	0.1056 ± 0.0080
BE4876	3.30 ± 2.12%	1.313 ± 2.89%	1.1967 ± 0.26%	32.7	0.22090 ± 8.80%	18.5	2.52	0.1046 ± 0.0092
BE4878	3.55 ± 3.66%	2.458 ± 2.07%	1.2324 ± 0.32%	17.5	0.18302 ± 20.5%	14.9	1.26	0.0866 ± 0.0178
BE4879	4.21 ± 3.80%	2.133 ± 4.55%	1.4182 ± 0.57%	20.2	0.17629 ± 27.3%	12.4	0.98	0.0834 ± 0.0228
BE4881	18.38 ± 0.92%	2.596 ± 2.39%	5.6804 ± 0.20%	16.6	0.25101 ± 20.2%	4.4	6.90	0.1188 ± 0.0240
BE4882	2.34 ± 4.27%	2.372 ± 2.28%	0.9553 ± 0.47%	18.1	0.26427 ± 11.5%	27.7	0.90	0.1251 ± 0.0144
			Arithmetic mean K/Ca (n = 12)	21.8 ± 7.9	Arithmetic mean age (n = 12)			0.1005 ± 0.0152
					Weighted mean age (n = 12)			0.1041 ± 0.0044

λ = 5.543 x 10^{-10} a^{-1} Fluence monitor: Sanidine from Fish Canyon Tuff, reference age 28.1 Ma (Spell & McDougall, 2003)

$(^{36}Ar/^{37}Ar)_{Ca}$ = 2.64 x 10^{-4} $(^{39}Ar/^{37}Ar)_{Ca}$ = 6.73 x 10^{-4} $(^{40}Ar/^{39}Ar)_K$ = 8.6 x 10^{-4}

$^{40}Ar^*$ – radiogenic ^{40}Ar $^{39}Ar_K$ – K-derived ^{39}Ar

Quoted error for each age includes estimated error in J

Irradiated for one hour in CLICIT facility, Triga reactor, Oregon State University

Analyses by B. Singer and B. Jicha, Department of Geology, University of Wisconsin, Wisconsin, USA

Supplementary Table 10. Magnetic measurements on the Naibar Tuff and the White Tuff of the Koobi Fora Formation

Demagnetization Field (mT)	Declination. (degrees)	Inclination (degrees)	M (emu)	X(N) (emu)	Y(E) (emu)	Z(down) (emu)
Naibar Tuff (K09-680; 4.0966°N, 36.2796°E; Il Naibar, Koobi Fora region, northern Kenya						
0	357.6	-20.6	5.29E-05	4.95E-05	-2.05E-06	-1.86E-05
10	281.5	-56.7	8.89E-06	9.70E-07	-4.78E-06	-7.43E-06
18	198.0	-14.3	1.15E-05	-1.06E-05	-3.46E-06	-2.84E-06
25	182.3	-20.0	1.57E-05	-1.48E-05	-5.85E-07	-5.37E-06
35	195.4	8.3	1.84E-05	-1.75E-05	-4.81E-06	2.65E-06
45	186.8	6.8	1.60E-05	-1.58E-05	-1.90E-06	1.91E-06
55	162.9	-23.4	1.63E-05	-1.43E-05	4.40E-06	-6.47E-06
65	160.7	-16.5	1.38E-05	-1.25E-05	4.38E-06	-3.93E-06
77	195.7	-22.2	8.48E-06	-7.56E-06	-2.13E-06	-3.21E-06
89	178.9	-11.0	2.05E-05	-2.01E-05	3.94E-07	-3.90E-06
100	184.1	-7.0	6.35E-06	-6.28E-06	-4.48E-07	-7.77E-07
White Tuff (K09-685; 3.9623°N, 36.3109°E; Area 104, Koobi Fora region, northern Kenya						
0	20.3	-66.1	2.97E-05	1.13E-05	4.17E-06	-2.72E-05
5	192.9	-51.3	2.02E-05	-1.23E-05	-2.82E-06	-1.57E-05
10	200.1	-22.4	2.65E-05	-2.30E-05	-8.45E-06	-1.01E-05
12	191.2	-14.0	2.25E-05	-2.14E-05	-4.24E-06	-5.43E-06
20	201.7	-13.5	1.91E-05	-1.73E-05	-6.87E-06	-4.45E-06
30	194.1	-10.1	1.94E-05	-1.85E-05	-4.66E-06	-3.40E-06
40	195.8	-9.5	1.72E-05	-1.63E-05	-4.61E-06	-2.83E-06
50	197.4	-6.3	1.49E-05	-1.41E-05	-4.43E-06	-1.63E-06
65	203.6	3.2	1.41E-05	-1.29E-05	-5.61E-06	7.86E-07
80	198.1	-5.7	1.24E-05	-1.17E-05	-3.83E-06	-1.23E-06
100	204.8	0.5	1.11E-05	-1.01E-05	-4.66E-06	9.87E-08

The samples were measured at the University of Utah, Department of Geology & Geophysics, on a 760 DC-SQUID magnetometer manufactured by 2G Enterprises. Demagnetization utilized a 1-axis degausser (2G Enterprises) with a maximum peak field of 2kG. All work was performed in a shielded room, where the residual field ranges from a few 10s of gammas to about 200 gammas.

Inside the mu-metal shield surrounding the AF demagnetizing coil, the field is 2-5 gammas.

Repeat demagnetization at 100mT revealed only trivial ARM.

Minor AR was detected at the highest three demagnetization steps of sample K09-685.

Supplementary Table 11. Analyses of glasses and locations of samples of the Orange Tuff of the Koobi Fora Formation, Tuff J from the type area of the Shungura Formation, and the Kayle Tuff-1 and Kayle Tuff-2 of the Konso Formation. All compositional data are in weight percent latitude and longitude are in decimal degrees

	M,N	No	SiO_2	TiO_2	ZrO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	F	Cl	Sum	less O	mp H_2O	Total	N. lat.	E. long
Kayle Tuff-2, Konso Formation (from WoldeGabriel et al., 2005)																				
956-6 (EMX)		13	70.08	0.42		9.69	6.16	0.29	0.04	0.36	3.96	3.03			94.03				--	--
1σ			0.56	0.05		0.07	0.09	0.04	0.01	0.02	0.71	0.71			1.05					
956-6 (DCP)			68.82	0.42	0.10	9.97	6.18	0.34	0.02	0.37	3.60	3.85			93.67				--	--
1 σ			--	--		--	--	--	--	--	--	--			--					
Kayle Tuff-1, Konso Formation (from WoldeGabriel et al., 2005)																				
956-7 (EMX)		33	70.25	0.09		11.41	1.97	0.05	0.00	0.34	3.79	4.54			92.42				--	--
1 σ			0.58	0.05		0.09	0.09	0.02	0.00	0.01	0.29	0.21			0.81					
956-7 (DCP)			71.86	0.09	0.05	11.66	1.89	0.06	0.03	0.34	4.11	4.68			94.76				--	--
1 σ			--	--		--	--	--	--	--	--	--			--					
Orange Tuff and Tuff J																				
Principal mode																				
Samples of Tuff J, Shungura Formation																				
ETH08-233	1,2	19	73.09	0.09	0.08	11.77	1.97	0.06	0.01	0.33	4.10	3.62	0.26	0.22	95.63	0.18	6.23	101.68	5.0431	35.9933
1 σ	1,2	19	0.60	0.03	0.05	0.30	0.06	0.02	0.01	0.01	0.40	0.40	0.03	0.01	0.91	0.01	0.90	0.41		
ETH08-234	1,2	12	73.47	0.08	0.08	11.87	2.01	0.05	0.01	0.33	4.11	3.67	0.26	0.23	96.25	0.18	4.81	100.88	5.0431	35.9933
1 σ	1,2	12	0.31	0.02	0.05	0.15	0.05	0.03	0.01	0.01	0.24	0.38	0.03	0.01	0.89	0.01	0.84	0.27		
ETH08-235	1,2	28	73.30	0.08	0.08	11.99	1.89	0.05	0.01	0.33	4.09	3.66	0.24	0.21	95.98	0.17	5.80	101.62	5.0431	35.9933
1 σ	1,2	28	0.52	0.03	0.04	0.32	0.08	0.02	0.01	0.02	0.39	0.35	0.03	0.01	1.13	0.01	1.06	0.33		
ETH08-237	4,4	1.00	72.78	0.12	0.07	11.78	2.04	0.06	0.02	0.35	3.93	3.46	0.25	0.20	95.12	0.17	5.90	100.85	5.0431	35.9933
	4,4--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--			
Samples of Orange Tuff, Koobi Fora Formation																				
K80- 236	1,2	15	73.06	0.09	0.05	11.66	2.00	0.06	0.01	0.33	3.53	4.51	0.11	0.22	95.69	0.12	4.13	99.70	3.8175	36.2617
1 σ	1,2	15	0.24	0.03	0.04	0.08	0.06	0.02	0.01	0.01	0.21	0.51	0.08	0.01	0.83	0.03	0.96	0.35		
K86-2492	1,3	8	72.62	0.09	--	11.67	2.02	0.06	0.01	0.33	2.76	4.35	--	0.23	94.15	--	--	--	4.177	36.426
1 σ	1,3	8	0.86	0.02	--	0.15	0.10	0.02	0.01	0.01	1.03	1.03	--	0.02	2.69	--	--	--		
K84-1816	1,2	18	73.49	0.09	0.06	11.93	2.01	0.06	0.01	0.34	4.20	3.80	0.09	0.23	96.36	0.11	3.77	100.02	4.1256	36.3913
1 σ	1,2	18	0.46	0.04	0.03	0.11	0.07	0.02	0.01	0.02	0.13	0.77	0.10	0.01	1.03	0.04	1.08	0.28		
K04-343	1,2	11	72.72	0.10	0.10	11.64	1.94	0.04	0.01	0.32	4.11	4.61	0.17	0.23	96.07	0.14	3.69	99.62	4.1787	36.4248

1 σ	1,2	11	0.39	0.02	0.04	0.13	0.05	0.02	0.01	0.01	0.17	0.33	0.11	0.00	0.71	0.05	0.97	0.33		
OMR08-5	1,2	24	72.78	0.09	0.07	11.74	1.85	0.04	0.01	0.32	4.31	3.75	0.21	0.22	95.44	0.16	5.64	100.93	3.8189	36.2608
1 σ	1,2	24	0.47	0.02	0.05	0.15	0.19	0.02	0.01	0.01	0.20	0.63	0.03	0.02	0.95	0.02	0.98	0.58		
OMR08-6	1,1	9	72.56	0.09	0.07	11.74	1.95	0.05	0.01	0.33	4.14	4.73	0.08	0.23	96.03	0.11	4.87	100.79	3.8189	36.2616
1 σ	1,1	9	0.59	0.02	0.04	0.24	0.05	0.01	0.01	0.01	0.22	0.42	0.09	0.02	0.93	0.04	0.97	0.22		
OMR08-7	1,2	21	72.51	0.09	0.08	11.73	1.89	0.04	0.01	0.33	4.21	4.50	0.13	0.22	95.78	0.12	4.47	100.13	3.8189	36.2616
1 σ	1,2	21	0.48	0.02	0.05	0.16	0.08	0.02	0.01	0.01	0.24	0.48	0.09	0.02	0.83	0.04	1.03	0.76		
OMR08-9	1,1	28	72.77	0.10	0.07	11.78	1.90	0.05	0.01	0.34	4.03	4.71	0.07	0.22	96.10	0.10	3.82	99.82	3.8165	36.2594
1 σ	1,1	28	0.65	0.04	0.05	0.13	0.08	0.02	0.01	0.03	0.42	0.43	0.08	0.01	0.86	0.03	0.94	0.87		
OMR08-11	1,2	21	72.87	0.09	0.08	11.87	1.93	0.05	0.01	0.33	4.41	4.12	0.09	0.22	96.11	0.11	3.63	99.64	3.8364	36.2560
1 σ	1,2	21	0.70	0.03	0.05	0.26	0.05	0.02	0.01	0.03	0.28	0.55	0.10	0.02	0.85	0.04	1.50	1.04		
	Secondary Mode 1																			
	Samples of Orange Tuff, Koobi Fora Formation																			
OMR08-5	2,2	7	64.93	0.39	0.13	14.79	3.51	0.10	0.25	1.11	4.72	5.21	0.11	0.10	95.43	0.10	5.84	101.18	3.8189	36.2608
1 σ	2,2	7	0.40	0.05	0.04	0.27	0.09	0.03	0.04	0.06	0.15	0.33	0.02	0.01	0.66	0.01	1.06	0.59		
OMR08-7	2,2	5	65.79	0.36	0.09	14.54	3.38	0.09	0.20	1.02	5.01	5.31	0.07	0.11	96.05	0.09	4.60	100.56	3.8189	36.2616
1 σ	2,2	5	0.34	0.04	0.07	0.38	0.08	0.03	0.06	0.08	0.20	0.14	0.02	0.02	0.59	0.01	1.33	0.81		
OMR08-11	2,2	6	66.20	0.33	0.09	14.45	3.29	0.07	0.16	0.97	4.94	5.09	0.06	0.11	95.85	0.08	3.36	99.13	3.8364	36.2560
1 σ	2,2	6	1.30	0.07	0.05	0.26	0.15	0.01	0.07	0.11	0.14	0.32	0.03	0.01	0.75	0.01	0.88	0.51		
K86-2492	2,3	4	67.45	0.3214.60		3.50	0.11	0.12	0.97	3.48	5.360.1296.03		4.177	36.426						
1 σ	2,3	4	0.84	0.060.30		0.06	0.03	0.06	0.08	0.59	0.220.011.09									
K84-1816	2,2	2	67.12	0.32	0.15	14.66	3.50	0.12	0.13	0.96	4.38	4.84	0.09	0.12	96.49	0.10	4.24	100.63	4.1256	36.3913
1 σ	2,2	2	1.18	0.11	0.11	0.18	0.01	0.01	0.03	0.02	0.01	0.90	0.01	0.00	0.18	0.01	0.32	0.13		
K80- 236	2,2	2	65.72	0.40	0.09	14.80	3.61	0.15	0.27	1.10	3.65	5.29	0.06	0.11	95.44	0.09	5.03	100.39	3.8175	36.2617
1 σ	2,2	2	0.83	0.05	0.10	0.01	0.08	0.03	0.06	0.05	0.53	0.54	0.01	0.00	1.78	0.00	2.13	0.35		
	Secondary mode 2																			
	Samples of Tuff J, Shungura Formation																			
ETH08-233	2,2	22	70.87	0.41	0.21	10.58	4.65	0.19	0.17	0.21	3.31	2.95	0.24	0.13	94.02	0.18	7.39	101.24	5.0431	35.9933
1 σ	2,2	22	1.09	0.06	0.08	0.47	0.17	0.03	0.04	0.03	0.82	0.37	0.05	0.03	1.14	0.02	0.81	0.59		
ETH08-234	2,2	5	70.71	0.44	0.16	10.81	5.03	0.24	0.18	0.23	3.57	3.13	0.27	0.15	95.03	0.20	6.05	100.89	5.0431	35.9933
1 σ	2,2	5	0.80	0.07	0.03	0.33	0.18	0.02	0.05	0.03	0.60	0.17	0.06	0.06	0.98	0.03	0.62	0.36		

780-5J	1,1	16	68.30	0.43	0.16	10.97	4.83	0.23	0.21	0.25	1.82	2.67	0.11	0.11	90.23	0.12	10.20	100.31	5.044	35.994
1 σ	1,1	16	0.90	0.05	0.03	0.13	0.06	0.02	0.01	0.02	0.26	0.11	0.04	0.01	1.02	0.02	0.99	1.01		
	Secondary mode 3																			
	Sample of Tuff J, Shungura Formation																			
ETH86-293	1,1	6	65.89	0.51	0.04	13.49	5.36	0.25	0.36	1.09	2.20	2.68	-0.13	0.09	92.09	0.02	7.94	100.01	5.044	35.994
1 σ	1,1	6	1.32	0.15	0.04	0.47	0.18	0.02	0.16	0.43	0.72	0.30	0.00	0.02	1.09	0.00	1.13	0.72		
ETH08-237	2,4	9	64.48	0.64	0.09	13.73	5.55	0.23	0.39	1.20	4.26	3.34	0.19	0.09	94.35	0.16	6.98	101.17	5.0431	35.9933
1 σ	2,4	9	0.70	0.08	0.03	0.28	0.10	0.04	0.06	0.17	1.13	0.53	0.04	0.01	2.16	0.02	1.34	1.18		
	Secondary mode 4																			
	Sample of Tuff J, Shungura Formation																			
ETH08-237	1,4	10	68.40	0.38	0.15	11.43	5.83	0.27	0.06	0.44	2.62	2.53	0.21	0.15	92.62	0.18	8.53	100.97	5.0431	35.9933
1 σ	1,4	10	0.77	0.04	0.05	0.22	0.12	0.02	0.01	0.03	0.25	0.13	0.05	0.01	1.12	0.02	0.53	0.85		
	Secondary mode 5																			
	Sample of Orange Tuff, Koobi Fora Formation																			
K86-2492	3,3	3	73.14	0.13		10.61	3.12	0.13	0.04	0.17	1.76	3.52		0.19	92.82				4.177	36.426
1 σ	3,3	3	0.91	0.02		0.23	0.05	0.02	0.00	0.01	1.54	1.43		0.01	3.65					
	Secondary mode 6																			
	Sample of Tuff J, Shungura Formation																			
ETH08-235	2,2	12	72.17	0.35	0.22	10.39	4.34	0.16	0.14	0.19	3.28	3.11	0.27	0.13	94.85	0.19	6.82	101.48	5.0431	35.9933
1 σ	2,2	12	1.66	0.05	0.07	0.43	0.17	0.03	0.04	0.03	1.14	0.55	0.06	0.02	1.42	0.03	1.25	0.50		
	Secondary mode 7																			
	Sample of Tuff J, Shungura Formation																			
ETH08-237	3,4	2	70.09	0.44	0.22	10.79	4.95	0.25	0.21	0.25	3.20	3.02	0.22	0.11	93.87	0.17	6.69	100.39	5.0431	35.9933
1 σ	3,4	2	0.58	0.02	0.02	0.24	0.09	0.03	0.01	0.02	0.37	0.54	0.00	0.01	1.33	0.00	0.89	0.44		

Sample (780-5J) is a collection of small pumices made in 1966 before Tuff J was defined; Haileab (1988) recollected and analysed a sample of the tuff itself (ETH86-293) and found it compositionally distinct. To reconcile these differences, new samples from the type locality were collected in 2008. Three samples in ascending order (ETH08-233, -237, -234) were taken from the 1.2 m gray vitric tuff described by de Heinzelin & Haesaerts (1983), and another sample (ETH08-235) was taken from a distinctly tuffaceous layer 3 m above the base of the vitric tuff. These samples were analysed by electron microprobe following techniques described in Brown & McDougall (2008). Samples of the Orange Tuff from Area 109 at Koobi Fora were also analysed (K80-236, OMR-5, -6, -7, -9, and -11). In addition, a sample (K04-343) from the type locality of the Orange Tuff in Area 130 at Koobi Fora was analysed as well as a sample (K86-2492) from the same area collected by C. Feibel.

Glass shards of many different compositions are present within these samples. Here we list seven compositional types which are supported by three or more individual analyses within a sample, although it is likely that some samples contain at least 11 modes. The dominant mode in the Orange Tuff and in most samples of Tuff J has an iron content of about 2% (as Fe_2O_3). Samples ETH08-233 and -234 have this as the dominant mode, but only a single shard of this composition was analysed from the intervening sample ETH08-237 in which the dominant mode has an iron content of ~6% (as Fe_2O_3), and a second mode that compositionally is similar to sample ETH86-293 reported by Haileab (1988). The second mode in samples ETH08-233 and -234 corresponds instead to the composition of glass in the pumice sample 780-5J. Of the four remaining modes, one is present in three samples of the Orange Tuff, and the other three are known from a single sample each.