APPENDIX

For the early AHe analyses (samples with no determination of Sm content in Table 1) protocols followed laboratory routines for resistance furnace heating He extraction from multiple grains (Farley, 2000). Only clear and euhedral grains with average grain radii in a close size range were selected. Grains were then immersed in ethanol and checked under polarised light to detect possible mineral inclusions. Samples were loaded into stainless steel capsules after grain characteristics had been imaged, measured and recorded. Grains were then outgassed at ~870°C for 20 minutes, spiked with ^{3}He and the gas volume determined using a Balzers quadrupole mass spectrometer. A hot blank was run after each sample to verify complete outgassing of the apatites. Following outgassing, samples were removed from their capsules and sent to the former CSIRO, North Ryde, Sydney laboratory for analysis. They were dissolved in HNO_3 and spiked with mixed Laser Spike (15 ppb ^{235}U and 15 ppb ^{230}Th). U and Th contents were then determined at the University of Technology, Sydney with a Perkin Elmer Sciex 5000a ICP-MS using the isotope ratio application. Standards used contained 25 µl of Laser JM mixed standard, i.e. ^{238}U Johnson Matthey (0.25 ppm) and ^{232}Th Johnson Matthey (0.25 ppm) with spike addition. Ages were calculated using the approach described by Farley et al. (1996).

Analytical protocols for later AHe analyses (for samples showing Sm content in Table 1) followed an established laboratory routine for laser He extraction from single to a few grains (House et al. 2000). Samples were loaded into platinum capsules and outgassed under vacuum at ~900°C for 5 minutes, using a fibre-optically coupled diode laser with a 820 nm wavelength, spiked with ^{3}He and gas volumes were determined using a Balzers quadrupole mass spectrometer. U-Th-Sm data used in the age calculations were acquired via total dissolution of outgassed apatite in HNO_3 and analysed using a recently released Varian quadrupole ICP-MS housed in the School of Earth Sciences, University of Melbourne.

All apparent (U-Th)/He ages were calculated and corrected for α-emission following the approach of Farley et al. (1996). Analytical uncertainties for the University of Melbourne (U-Th)/He facility are assessed to be ~6.2% ($\pm 1\sigma$), which incorporates the α-correction-related constituent and takes into account an estimated 5 μm uncertainty in grain size measurements, gas analysis and ICP-MS uncertainties. Durango apatite standard was run as an internal standard with each batch of samples analysed and served as a check on analytical accuracy.

References

<jrn>Farley, K.A., 2000, Helium diffusion from apatite: General behavior as illustrated by Durango apatite: Journal of Geophysical Research, v. 105, p. 2903–2914, doi: 10.1029/1999JB900348.</jrn>

<jrn>Farley, K.A., Wolf, R.A., and Silver, L.T., 1996, The effects of long alpha-stopping distances on (U-Th)/ He ages: Geochimica et Cosmochimica Acta, v. 60, p. 4223–4229, doi: 10.1016/S0016-7037(96)00193-7.</jrn>

<jrn>House, M., Farley, K.A., and Stockli, D., 2000, Helium chronometry of apatite and titanite using Nd-YAG laser heating: Earth and Planetary Science Letters, v. 183, no. 3–4, p. 365–368, doi: 10.1016/S0012-821X(00)00286-7.</jrn>

TABLE DR 1. APATITE (U-Th)/He DATA FROM THE EASTERN RIFT FLANK.
ONLY AGES THAT REPLICATE WITHIN ERROR LIMITS WERE USED AS A BASIS FOR THERMAL HISTORY MODELLING

Sample no.	Location	Elevation (m)	No of grains	^{4}He (ncc)	Mass (mg)	U (ppm)	Th (ppm)	Sm (ppm)	Th/U	Raw age (Ma)	^aF_T factor	Corrected age (Ma)	Error ± 1σ
89Ky-15	Mathews Range	1140	8	1.530	0.0367	5.6	6.8	n.a.	1.25	48.0	0.74	**64.6**	4.0
			8	0.601	0.0132	6.8	8.0	n.a.	1.22	43.5	0.64	**68.2**	4.2
89Ky-05	Kipsing Gap	1240	8	2.868	0.0471	7.5	8.4	n.a.	1.15	53.2	0.79	**67.5**	4.2
			7	2.201	0.0524	5.1	5.6	n.a.	1.13	54.3	0.79	**68.4**	4.2
89Ky-09	Lolokwe	1560	2	2.339	0.0216	13.1	11.8	153.7	0.90	55.0	0.80	**68.8**	4.3
			2	0.576	0.0106	8.0	7.0	114.1	0.87	45.6	0.75	**61.2**	3.8
			1	0.630	0.0034	25.5	23.0	249.3	0.90	48.2	0.71	**67.8**	4.2
89Ky-07	Lolokwe	1760	8	1.011	0.0205	5.1	10.3	n.a.	2.06	54.0	0.71	**76.1**	4.7
89Ky-41	Karisia Hills	1900	2	0.542	0.0048	17.2	1.3	12.0	0.07	52.5	0.70	**75.3**	4.7
89Ky-49	Karisia Hills	1225	2	1.362	0.0107	20.1	3.8	n.a.	0.20	50.3	0.78	**64.9**	4.0
			2	5.729	0.0220	35.9	11.9	n.a.	0.34	55.8	0.82	**67.7**	4.2
			7	1.974	0.0153	23.1	5.9	n.a.	0.27	43.8	0.69	**63.4**	3.9
			7	2.417	0.0218	23.0	9.6	n.a.	0.43	36.5	0.72	**50.8**	3.2
89Ky-48	Karisia Hills	1200	1	0.083	0.0022	5.5	4.0	24.8	0.73	48.9	0.66	**73.8**	4.6
89Ky-35	Karisia Hills	1100	2	0.312	0.0074	4.2	15.0	n.a.	3.67	45.0	0.71	**63.7**	4.0
			8	0.719	0.0162	5.9	13.4	n.a.	2.33	40.4	0.66	**61.1**	3.8
91Ky-77	Nyiru Range	935	7	0.495	0.0278	3.0	0.6	n.a.	0.20	47.6	0.74	**64.1**	4.0
			8	0.325	0.0201	3.3	1.1	n.a.	0.36	38.2	0.70	**54.6**	3.4
			1	0.234	0.0144	2.8	0.8	2.9	0.29	43.8	0.76	**57.4**	3.6
91Ky-76	Ndoto Mountains	810	8	1.355	0.0989	3.2	0.9	n.a.	0.31	33.7	0.83	**40.8**	2.5
			8	0.520	0.0544	2.4	0.2	n.a.	0.10	32.0	0.80	**40.1**	2.5
91Ky-75	Ndoto Mountains	810	7	0.417	0.0608	2.1	0.1	n.a.	0.04	26.4	0.82	**32.2**	2.0
			8	0.233	0.0409	1.6	0.2	n.a.	0.14	28.5	0.78	**36.7**	2.3
91Ky-44	E of Mathews Range	765	8	0.899	0.0468	3.2	2.7	n.a.	0.88	41.3	0.78	**53.2**	3.3
			12	0.655	0.0490	2.7	2.5	n.a.	0.98	33.7	0.75	**45.3**	2.8
			11	0.612	0.0340	5.7	5.1	n.a.	0.93	21.7	0.75	**29.1**	1.8
			2	0.141	0.0155	1.5	1.7	9.2	1.12	38.4	0.79	**48.3**	3.0
			2	0.152	0.0123	1.9	1.2	9.4	0.63	45.9	0.76	**60.0**	3.7
			2	0.241	0.0086	4.2	3.8	20.6	0.91	44.7	0.75	**59.6**	3.7
			2	0.107	0.0142	1.8	1.9	12.2	1.03	27.5	0.78	**35.1**	2.2
			1	0.108	0.0144	1.3	1.3	8.5	0.99	37.0	0.78	**47.8**	3.0
			1	0.171	0.0123	2.5	2.0	11.9	0.79	38.1	0.77	**49.6**	3.1

^aF_T is the α-ejection correction after Farley et al. (1996).

TABLE DR 2. APATITE (U-Th)/He DATA FROM THE WESTERN RIFT FLANK.
ONLY AGES THAT REPLICATE WITHIN ERROR LIMITS WERE USED AS A BASIS FOR THERMAL HISTORY MODELLING

Sample no.	**Location**	**Elevation (m)**	**No of grains**	**^{4}He (ncc)**	**Mass (mg)**	**U (ppm)**	**Th (ppm)**	**Sm (ppm)**	**Th/U**	**Raw age (Ma)**	**^aF_T factor**	**Corrected age (Ma)**	**Error ± 1σ**
89Ky-65	Cherangani Hills	1770	2	0.303	0.0103	6.4	20.7	38.2	3.22	21.3	0.74	**28.9**	1.8
			2	0.975	0.0270	7.9	19.8	38.2	2.50	23.5	0.82	**28.8**	1.8
89Ky-62	Cherangani Hills	1390	2	0.636	0.0109	14.9	36.3	34.3	2.44	20.4	0.74	**27.5**	1.7
			1	0.079	0.0013	19.0	54.2	57.9	2.85	15.8	0.62	**25.4**	1.6
			1	0.257	0.0065	10.7	31.3	23.7	2.92	18.0	0.76	**23.8**	1.5
89Ky-61	Cherangani Hills	1290	2	0.995	0.0118	22.4	54.9	72.4	2.45	19.6	0.76	**25.8**	1.6
			2	0.745	0.0120	16.2	20.4	32.7	1.26	24.3	0.75	**32.2**	2.0
			1	0.481	0.0065	15.8	40.7	35.2	2.57	24.0	0.76	**31.6**	2.0
			1	0.318	0.0035	20.8	44.8	69.0	2.15	24.0	0.73	**32.9**	2.0
89Ky-60	Cherangani Hills	1175	1	0.490	0.0064	32.8	50.4	32.0	1.54	14.2	0.76	**18.6**	1.2
			1	0.245	0.0045	24.2	56.8	39.0	2.34	11.9	0.73	**16.2**	1.0
			1	0.739	0.0552	34.7	56.7	48.2	1.64	22.9	0.74	**30.8**	1.9
			1	0.164	0.0034	31.7	56.1	48.2	1.77	8.1	0.73	**11.1**	0.7
			1	0.460	0.0057	23.5	42.1	41.1	1.79	21.0	0.75	**28.0**	1.7
			1	0.304	0.0083	22.0	32.2	26.7	1.46	10.2	0.78	**13.1**	0.8
			1	1.123	0.0148	20.8	28.3	25.2	1.36	22.7	0.82	**27.5**	1.7

^aF_T is the α-ejection correction after Farley et al. (1996).

TABLE DR 3. APATITE (U-Th)/He MODEL DATA WITH INPUT PARAMETERS, MODELLED PREDICTED AGES AND UNCORRECTED OBSERVED AGES

Sample name	Average grain radius (µm)	Average grain length (µm)	Sphere radius (µm)	Predicted age (Ma)	Observed age (Ma)
89Ky-15	58	180	72	48	48
	44	115	53	43	44
89Ky-05	70	189	84	52	53
	73	169	85	53	54
89Ky-07	54	131	64	53	54
89KY-35	45	133	56	44	44
	49	151	60	45	45
89KY-49	49	148	60	46	44
	64	164	77	50	50
	84	244	103	54	56
91Ky-76	85	209	100	34	34
	70	196	85	31	32
91KY-75	69	147	80	30	29
	76	200	90	32	26
89-KY-61	64	182	77	23	20
	54	199	68	21	24
89-KY-65	56	164	68	20	21
	80	208	96	26	24