Data Repository Items for Kapp et al.

Sample Locations

Sample	*Lat.*	*Long.*	*Elev. [m]*
6-7-05-2	31°34.723	83°32.309	5147
6-7-05-3	31°34.701	83°32.382	*5130*
6-9-05-2	31°48.943	83°39.452	*4841*
6-11-05-1A	31°36.624	83°32.302	*5199*
6-11-05-1B	31°36.624	83°32.302	*5199*
6-15-05-3	31°28.765	83°34.167	5028

U-Pb Method and Data Table

U-Pb geochronology of zircons was conducted by laser ablation multicollector inductively coupled plasma mass spectrometry (LA-MC-ICPMS) at the Arizona LaserChron Center. The analyses involve ablation of zircon with a New Wave DUV193 Excimer laser (operating at a wavelength of 193 nm) using a spot diameter of 35 microns. The ablated material is carried in helium into the plasma source of a GVI Isoprobe, which is equipped with a flight tube of sufficient width that U, Th, and Pb isotopes are measured simultaneously. All measurements are made in static mode, using Faraday detectors for 238U, 232Th, 208-206Pb, and an ion-counting channel for 204Pb. Ion yields are ~1.0 mv per ppm. Each analysis consists of one 20-second integration on peaks with the laser off (for backgrounds), 20 one-second integrations with the laser firing, and a 30 second delay to purge the previous sample and prepare for the next analysis. The ablation pit is approximately 15 microns in depth.

For each analysis, the errors in determining 206Pb/ 238U and 206Pb/ 204Pb result in a measurement error of 1-2% (at 2-sigma level) in the 206Pb/ 238U age. The errors in measurement of 206Pb/ 207Pb and 206Pb/ 204Pb also result in 1-2% (at 2-sigma level) uncertainty in age for grains that are >1.0 Ga, but are substantially larger for younger grains due to low intensity of the 207Pb signal. For most analyses, the cross-over in precision of 206Pb/ 238U and 206Pb/ 207Pb ages occurs at 0.8-1.0 Ga.

Common Pb correction is accomplished by using the measured 204Pb and assuming an initial Pb composition from Stacey and Kramers (1975) (with uncertainties of 1.0 for 206Pb/ 204Pb and 0.3 for 207Pb/ 204Pb). Our measurement of 204Pb is unaffected by the presence of 204Hg because backgrounds are measured on peaks (thereby subtracting any background 204Hg and 204Pb), and because very little Hg is present in the argon gas.

Inter-element fractionation of Pb/U is generally 20%, whereas fractionation of Pb isotopes is generally 2%. In-run analysis of fragments of a large zircon crystal (every fifth measurement for detrital zircon analyses; every third measurement for analyses of igneous samples) with known age of 564 ± 4 Ma (2-sigma error) is used to correct for this fractionation. The uncertainty resulting from the calibration correction is generally 1-2% (2-sigma) for both 206Pb/ 207Pb and 206Pb/ 238U ages.

Analyses that are >30% discordant (by comparison of 206Pb/ 238U and 206Pb/ 207Pb ages) or >5% reverse discordant are excluded from the data table and not considered further.

The U-Pb ages cited in the text are interpreted crystallization ages based on the weighted mean 206Pb/ 238U age of the youngest population of ages. Older zircon grains are interpreted to be inherited. The cited uncertainty is the quadratic sum of the weighted mean error plus the total systematic error for the set of analyses. The systematic error includes contributions from the standard calibration, age of the calibration standard, composition of common Pb, and 238U decay constant.

The analytical data are reported in Table DR1. Uncertainties shown in these tables are at the 1-sigma level, and include only measurement errors.

Stacey, J.S., and Kramers, J.D., 1975, Approximation of terrestrial lead isotope evolution by a two-stage model: Earth and Planetary Science Letters, v. 26, p. 207-221.

Table DR1. U-Pb (zircon) geochronologic analyses by Laser-Ablation Multicollector ICP Mass Spectrometery

				Isotopic ratios						Apparent ages (Ma)				
#	U	206Pb	U/Th	207Pb*	±	206Pb*	±	error	206Pb*	±	207Pb*	±	206Pb*	±
	(ppm)	204Pb		235U	(%)	238U	(%)	corr.	238U	(Ma)	235U	(Ma)	207Pb*	(Ma)
67052														
1	6556	3564	9.7	0.00860	4.7	0.00135	1.1	0.23	8.7	0.1	8.7	0.4	14.4	109.9
2	5373	2032	5.3	0.00947	10.4	0.00136	2.4	0.23	8.7	0.2	9.6	1.0	222.8	235.7
3	5533	3090	10.2	0.00867	3.1	0.00136	2.0	0.65	8.8	0.2	8.8	0.3	2.6	56.0
4	7749	4019	6.5	0.00870	3.5	0.00138	2.1	0.61	8.9	0.2	8.8	0.3	-14.9	67.2
5	975	874	3.4	0.00754	16.0	0.00138	1.4	0.09	8.9	0.1	7.6	1.2	-381.8	417.2
6	7153	2962	9.2	0.00889	3.4	0.00140	2.6	0.77	9.0	0.2	9.0	0.3	5.2	52.9
7	5773	1580	3.2	0.00896	10.5	0.00142	4.5	0.43	9.1	0.4	9.1	0.9	-6.2	229.2
8	2021	1569	2.2	0.00855	8.8	0.00142	3.2	0.37	9.2	0.3	8.6	0.8	-135.7	203.3
9	2710	2432	2.6	0.00874	5.2	0.00143	2.0	0.38	9.2	0.2	8.8	0.5	-85.1	118.4
10	2591	2348	3.0	0.00856	17.1	0.00144	13.5	0.79	9.3	1.2	8.7	1.5	-155.3	262.6
11	2650	781	1.0	0.01149	12.1	0.00147	3.0	0.25	9.5	0.3	11.6	1.4	480.9	259.5
12	302	191	2.3	0.00688	33.6	0.00152	10.9	0.32	9.8	1.1	7.0	2.3	-885.7	938.5
13	2220	1338	0.9	0.00982	5.4	0.00153	2.9	0.54	9.9	0.3	9.9	0.5	21.5	109.1
14	3670	1513	0.4	0.00992	10.4	0.00156	2.5	0.24	10.0	0.2	10.0	1.0	8.1	242.8
15	1078	1004	3.1	0.00919	9.2	0.00158	2.5	0.27	10.1	0.3	9.3	0.9	-209.6	223.6
16	306	319	1.3	0.00589	46.6	0.00158	11.6	0.25	10.2	1.2	6.0	2.8	-1487.6	1560.5
17	1675	1477	1.2	0.00910	11.4	0.00159	2.8	0.24	10.2	0.3	9.2	1.0	-248.6	279.5
18	1702	1850	1.1	0.00976	11.3	0.00162	3.0	0.27	10.4	0.3	9.9	1.1	-127.9	268.4
19	1488	999	0.4	0.01041	10.6	0.00162	3.3	0.32	10.4	0.3	10.5	1.1	28.4	241.2
20	4595	4822	5.1	0.01060	3.8	0.00163	2.5	0.65	10.5	0.3	10.7	0.4	51.9	69.6
21	158	250	1.4	0.00617	47.1	0.00164	16.6	0.35	10.6	1.7	6.2	2.9	-1460.2	1512.7
22	3996	3621	5.0	0.01073	10.2	0.00165	9.7	0.95	10.7	1.0	10.8	1.1	49.9	73.8
23	2637	3154	4.2	0.01066	6.9	0.00173	5.1	0.74	11.2	0.6	10.8	0.7	-77.0	112.9
24	2029	1019	0.8	0.01062	6.9	0.00176	3.2	0.47	11.4	0.4	10.7	0.7	-129.3	150.5
25	1505	1732	7.2	0.01231	13.8	0.00202	8.2	0.60	13.0	1.1	12.4	1.7	-103.7	271.5
26	3968	4444	9.1	0.01278	7.3	0.00203	6.3	0.86	13.1	0.8	12.9	0.9	-18.2	89.1
27	415	352	0.6	0.01097	31.5	0.00240	6.4	0.20	15.5	1.0	11.1	3.5	-867.1	905.4
28	1063	1705	0.3	0.01486	8.4	0.00252	1.9	0.22	16.2	0.3	15.0	1.3	-182.5	205.5
29	2310	2468	0.3	0.01623	3.2	0.00255	1.9	0.58	16.4	0.3	16.3	0.5	3.7	62.6
30	2164	3739	1.3	0.01626	4.1	0.00258	2.0	0.48	16.6	0.3	16.4	0.7	-20.9	87.5
31	453	722	2.5	0.01295	24.3	0.00261	5.3	0.22	16.8	0.9	13.1	3.2	-631.5	656.3
32	1473	1972	5.4	0.01759	9.6	0.00281	9.0	0.94	18.1	1.6	17.7	1.7	-37.8	79.9
33	642	1415	1.0	0.01896	14.8	0.00328	8.7	0.59	21.1	1.8	19.1	2.8	-226.8	301.9
34	613	1812	0.9	0.02927	19.5	0.00486	17.8	0.91	31.2	5.5	29.3	5.6	-127.0	197.7
35	370	920	1.6	0.03406	12.1	0.00546	5.5	0.46	35.1	1.9	34.0	4.0	-42.4	261.2
36	538	982	0.5	0.03225	20.7	0.00551	13.4	0.64	35.4	4.7	32.2	6.6	-197.8	399.0
37	615	2948	3.7	0.04489	7.4	0.00675	5.6	0.76	43.4	2.4	44.6	3.2	111.3	114.5
38	460	2460	2.6	0.05399	7.0	0.00835	1.7	0.24	53.6	0.9	53.4	3.7	42.6	163.4
39	1703	10203	1.5	0.07550	13.2	0.01071	12.9	0.97	68.7	8.8	73.9	9.4	245.5	69.9
67053														
1	3859	525	0.7	0.00664	22.2	0.00130	7.6	0.34	8.4	0.6	6.7	1.5	-553.3	567.9
2	2691	1357	4.1	0.00891	16.0	0.00133	4.8	0.30	8.5	0.4	9.0	1.4	135.1	360.9
3	4579	3412	3.4	0.00876	3.3	0.00137	2.6	0.79	8.9	0.2	8.9	0.3	8.5	49.6
4	2861	2306	2.4	0.00925	8.6	0.00138	6.9	0.80	8.9	0.6	9.4	0.8	121.7	120.9
5	6806	4555	12.6	0.00889	4.0	0.00139	2.3	0.58	9.0	0.2	9.0	0.4	10.4	77.7
6	7670	5615	13.2	0.00868	4.1	0.00141	2.3	0.55	9.1	0.2	8.8	0.4	-67.3	84.7
7	2793	2111	1.0	0.00880	9.6	0.00143	6.5	0.67	9.2	0.6	8.9	0.9	-76.1	174.3
8	2705	2531	4.9	0.00862	10.7	0.00145	7.4	0.69	9.4	0.7	8.7	0.9	-165.7	193.1
9	3502	1207	1.2	0.01074	21.7	0.00150	5.6	0.26	9.6	0.5	10.8	2.3	285.6	485.4
10	3516	3420	7.3	0.00988	4.2	0.00159	2.4	0.58	10.3	0.2	10.0	0.4	-55.2	82.4
11	3654	1388	5.9	0.01022	4.7	0.00163	3.4	0.73	10.5	0.4	10.3	0.5	-29.8	78.7
12	1033	755	6.8	0.00959	14.4	0.00165	8.7	0.60	10.6	0.9	9.7	1.4	-221.5	289.1
13	2465	1860	9.3	0.01518	25.5	0.00192	9.8	0.38	12.4	1.2	15.3	3.9	505.3	524.3
14	424	576	1.3	0.01181	21.2	0.00208	14.4	0.68	13.4	1.9	11.9	2.5	-281.9	399.9
15	945	1368	3.4	0.01657	14.4	0.00255	9.2	0.64	16.4	1.5	16.7	2.4	56.2	265.2
16	5252	6565	4.2	0.01754	4.2	0.00281	2.6	0.62	18.1	0.5	17.7	0.7	-37.7	80.8
17	492	829	0.5	0.01423	30.2	0.00284	19.9	0.66	18.3	3.6	14.4	4.3	-603.9	626.3

18	746	1248	0.3	0.01553	23.5	0.00294	13.1	0.56	18.9	2.5	15.6	3.7	-462.3	520.1
19	150	1027	1.0	0.08093	19.0	0.01189	11.4	0.60	76.2	8.6	79.0	14.5	164.6	358.1
611051B														
1	19381	17276	4.3	0.01481	9.9	0.00214	6.4	0.64	13.7	0.9	14.9	1.5	208.5	176.3
2	21005	16498	11.9	0.01454	9.9	0.00220	4.7	0.48	14.2	0.7	14.7	1.4	90.6	205.6
3	19049	5890	14.3	0.01767	17.3	0.00221	3.6	0.21	14.3	0.5	17.8	3.0	526.0	373.0
4	17767	15752	9.7	0.01540	9.5	0.00223	8.3	0.88	14.4	1.2	15.5	1.5	196.5	105.0
5	8076	6373	28.7	0.01954	10.9	0.00224	9.8	0.90	14.4	1.4	19.6	2.1	716.5	100.7
6	9771	13705	30.8	0.01885	6.6	0.00228	5.8	0.88	14.7	0.8	19.0	1.2	601.5	68.5
7	12392	13648	27.4	0.01704	4.5	0.00231	3.6	0.79	14.8	0.5	17.2	0.8	354.6	61.7
8	11421	14067	21.9	0.01755	4.0	0.00231	2.4	0.61	14.9	0.4	17.7	0.7	412.2	70.6
9	12635	10355	14.5	0.01751	11.2	0.00233	7.7	0.69	15.0	1.2	17.6	2.0	393.1	181.6
10	15354	15159	21.1	0.01571	4.4	0.00234	2.2	0.49	15.1	0.3	15.8	0.7	130.4	90.9
11	15710	18448	18.7	0.01658	6.5	0.00235	1.9	0.30	15.1	0.3	16.7	1.1	246.3	143.0
12	10522	6742	24.5	0.01869	5.3	0.00236	3.2	0.60	15.2	0.5	18.8	1.0	512.6	92.4
13	16512	15834	23.8	0.01622	7.0	0.00236	5.9	0.85	15.2	0.9	16.3	1.1	188.7	86.9
14	6902	4439	21.5	0.02249	9.0	0.00236	4.5	0.50	15.2	0.7	22.6	2.0	900.5	160.8
15	8938	11552	27.1	0.01828	5.9	0.00236	2.0	0.35	15.2	0.3	18.4	1.1	455.7	122.7
16	10819	12420	23.0	0.01857	4.6	0.00238	3.2	0.69	15.3	0.5	18.7	0.9	475.3	74.0
17	11925	10569	24.5	0.01718	12.1	0.00240	11.0	0.91	15.5	1.7	17.3	2.1	277.6	116.0
18	9710	4853	28.7	0.01593	10.9	0.00246	1.7	0.16	15.8	0.3	16.0	1.7	52.2	257.6
19	15646	12121	11.7	0.02025	7.0	0.00278	6.1	0.87	17.9	1.1	20.4	1.4	319.4	77.5
69052														
1	1436	5810	2.0	0.12595	5.2	0.01904	4.1	0.79	121.6	4.9	120.5	5.9	97.8	75.3
2	1662	7738	0.4	0.15146	5.2	0.02211	4.8	0.91	141.0	6.7	143.2	7.0	180.4	49.6
3	187	264	0.5	0.29876	24.5	0.02226	8.2	0.33	141.9	11.5	265.4	57.4	1573.9	438.8
4	190	1292	1.0	0.18323	29.5	0.02259	15.5	0.52	144.0	22.0	170.8	46.5	560.8	556.4
5	401	1448	0.9	0.17601	14.7	0.02269	2.1	0.14	144.6	3.1	164.6	22.4	462.8	325.0
6	212	1640	1.0	0.16785	6.6	0.02290	2.4	0.37	146.0	3.5	157.6	9.6	335.7	138.7
7	235	2492	0.7	0.16536	9.7	0.02334	5.2	0.54	148.8	7.7	155.4	14.0	257.7	189.0
8	315	2929	0.9	0.16653	4.6	0.02348	3.0	0.66	149.6	4.4	156.4	6.6	260.2	79.0
9	539	10191	0.8	0.15480	4.0	0.02348	1.3	0.31	149.6	1.9	146.1	5.5	89.8	91.2
10	321	5542	0.9	0.16283	4.3	0.02353	1.6	0.37	149.9	2.3	153.2	6.1	204.2	93.2
11	314	3698	0.8	0.15994	4.1	0.02353	1.7	0.42	149.9	2.6	150.6	5.7	162.3	86.6
12	566	3614	1.0	0.16307	4.5	0.02357	2.1	0.47	150.2	3.1	153.4	6.4	203.7	91.3
13	411	8701	0.9	0.17851	24.5	0.02358	1.8	0.07	150.3	2.7	166.8	37.7	408.0	554.8
14	2514	25114	2.2	0.16229	1.8	0.02361	1.3	0.71	150.4	1.9	152.7	2.5	188.6	28.8
15	571	3637	0.9	0.16855	5.9	0.02367	2.5	0.43	150.8	3.8	158.2	8.6	269.5	121.6
16	283	5122	1.0	0.15500	3.9	0.02370	1.3	0.33	151.0	1.9	146.3	5.3	71.0	86.5
17	494	6018	1.1	0.16792	5.7	0.02371	3.7	0.64	151.1	5.5	157.6	8.3	257.2	100.2
18	274	384	0.8	0.24700	14.1	0.02380	4.4	0.31	151.6	6.5	224.1	28.5	1075.6	271.3
19	334	4873	1.0	0.15884	7.3	0.02382	4.2	0.57	151.7	6.2	149.7	10.2	117.2	142.3
20	110	3537	1.1	0.15736	12.3	0.02400	3.4	0.28	152.9	5.2	148.4	17.0	77.3	282.5
21	253	1157	0.6	0.17121	8.6	0.02404	4.1	0.47	153.1	6.2	160.5	12.8	270.4	174.8
22	1114	11936	1.2	0.16065	2.9	0.02407	2.3	0.78	153.3	3.4	151.3	4.1	119.5	43.5
23	110	2878	0.9	0.15744	6.7	0.02408	4.1	0.61	153.4	6.2	148.5	9.2	70.8	125.4
24	430	4479	0.8	0.15971	6.5	0.02415	5.6	0.87	153.8	8.6	150.5	9.0	97.4	75.3
25	1453	862	0.6	0.23101	18.0	0.02429	10.3	0.58	154.7	15.8	211.0	34.3	897.9	304.9
26	145	2159	0.9	0.15708	7.0	0.02443	4.6	0.65	155.6	7.0	148.1	9.7	30.7	128.3
27	129	2300	1.1	0.15428	8.1	0.02447	3.0	0.37	155.9	4.6	145.7	10.9	-17.1	181.5
28	695	8903	0.5	0.16550	2.7	0.02454	2.2	0.82	156.3	3.4	155.5	3.9	143.7	35.8
29	292	3924	1.2	0.17362	5.2	0.02458	2.7	0.52	156.5	4.2	162.6	7.8	251.4	101.6
30	173	2032	0.9	0.16260	5.2	0.02485	2.2	0.43	158.2	3.5	153.0	7.4	72.2	112.6
31	1199	1223	1.2	0.21116	7.3	0.02498	6.0	0.82	159.1	9.4	194.5	12.9	649.8	90.8
32	366	2326	0.7	0.18036	7.8	0.02509	4.6	0.58	159.7	7.2	168.4	12.2	291.5	145.7
33	459	4713	1.0	0.16736	4.9	0.02513	3.4	0.70	160.0	5.4	157.1	7.1	113.7	82.6
34	242	5182	0.9	0.16570	8.6	0.02516	6.5	0.76	160.2	10.3	155.7	12.4	87.2	132.9
35	1560	1446	0.7	0.19641	13.1	0.02525	4.7	0.36	160.7	7.5	182.1	21.9	469.0	272.1
36	608	2359	0.7	0.19498	12.8	0.02570	3.7	0.29	163.6	6.0	180.9	21.1	413.3	273.9
37	2363	4476	0.8	0.18349	10.5	0.02578	2.7	0.26	164.1	4.4	171.1	16.6	268.8	233.5
38	518	607	0.8	0.24201	12.4	0.02582	2.5	0.20	164.3	4.0	220.1	24.5	868.1	252.2
39	902	3523	1.3	0.18712	6.1	0.02605	2.7	0.44	165.8	4.4	174.2	9.7	289.6	124.2
40	430	5887	1.0	0.17238	7.0	0.02621	4.6	0.66	166.8	7.6	161.5	10.5	84.8	124.8
41	756	1006	1.2	0.24131	16.5	0.02675	2.7	0.17	170.2	4.6	219.5	32.6	788.2	344.3
42	135	153	1.1	0.60511	36.5	0.02926	15.0	0.41	185.9	27.5	480.5	140.5	2346.0	586.9

615053														
1	973	3883	0.6	0.02197	17.1	0.00316	6.3	0.37	20.4	1.3	22.1	3.7	211.3	371.6
2	1843	6391	0.2	0.02132	11.6	0.00321	4.4	0.38	20.7	0.9	21.4	2.5	104.4	254.5
3	1301	2356	0.5	0.02307	6.8	0.00327	3.4	0.50	21.1	0.7	23.2	1.6	247.4	135.6
4	1023	4202	1.0	0.02641	8.7	0.00331	5.5	0.63	21.3	1.2	26.5	2.3	526.5	147.9
5	657	2064	0.9	0.03253	12.9	0.00333	3.4	0.26	21.5	0.7	32.5	4.1	950.4	256.0
6	761	3906	0.7	0.03012	12.7	0.00334	6.3	0.50	21.5	1.4	30.1	3.8	784.8	232.3
7	1783	3173	0.4	0.02522	9.3	0.00335	1.6	0.17	21.6	0.3	25.3	2.3	396.3	205.1
8	674	15674	1.0	0.02997	14.9	0.00336	5.5	0.37	21.6	1.2	30.0	4.4	762.6	292.9
9	1261	1534	0.3	0.04060	19.7	0.00337	5.1	0.26	21.7	1.1	40.4	7.8	1370.5	369.3
10	1126	1824	0.3	0.02897	8.4	0.00338	2.3	0.27	21.7	0.5	29.0	2.4	680.3	173.2
11	937	2017	1.1	0.03135	12.3	0.00339	4.5	0.37	21.8	1.0	31.3	3.8	839.5	238.9
12	445	3788	0.4	0.02986	11.7	0.00340	5.1	0.44	21.9	1.1	29.9	3.5	733.0	224.1
13	477	1549	0.2	0.03721	30.2	0.00342	8.2	0.27	22.0	1.8	37.1	11.0	1170.4	587.2
14	471	3499	0.7	0.03508	11.7	0.00344	5.6	0.47	22.1	1.2	35.0	4.0	1041.0	209.0
15	582	3457	0.8	0.03517	9.9	0.00346	6.6	0.67	22.2	1.5	35.1	3.4	1036.0	147.8
16	833	2319	1.7	0.03108	10.2	0.00348	3.8	0.37	22.4	0.8	31.1	3.1	765.6	199.1
17	964	3950	1.2	0.03412	12.4	0.00349	6.7	0.54	22.5	1.5	34.1	4.2	952.3	214.3
18	194	3104	0.3	0.13995	654.0	0.00353	18.4	0.03	22.7	4.2	133.0	1123.9	3403.9	237.8
19	788	809	0.3	0.05296	37.6	0.00358	7.9	0.21	23.1	1.8	52.4	19.2	1752.6	697.2
20	1293	3569	0.3	0.02753	7.2	0.00369	4.1	0.58	23.7	1.0	27.6	1.9	375.6	131.7
21	705	756	0.2	0.05809	15.8	0.00371	6.3	0.40	23.9	1.5	57.3	8.8	1857.8	262.7
22	289	4399	1.2	0.04859	28.9	0.00378	12.4	0.43	24.3	3.0	48.2	13.6	1491.1	503.6
23	158	443	0.3	0.09877	16.6	0.00408	7.6	0.46	26.2	2.0	95.6	15.2	2612.8	248.0

Uncertainties are reported at the 1-sigma level, and include only measurement errors. Systematic errors would increase age uncertainties by 1-2%

U concentration and U/Th are calibrated relative to NIST SRM 610 and are accurate to ~20%.

Common Pb correction is from 204Pb, with composition interpreted from Stacey and Kramers (1975) and uncertainties of 1.0 for 206Pb/ 204Pb, 0.3 for 207Pb/ 204Pb, and 2.0 for 208Pb/ 204Pb.

U/Pb and 206Pb/207Pb fractionation is calibrated relative to fragments of a large Sri Lanka zircon of 564 ± 4 Ma (2-sigma).

U decay constants and composition as follows: 238U = 9.8485 x 10 -10, 235U = 1.55125 x 10 -10, 238U/ 235U = 137.88

Table DR2: Lunggar Apatite (U-Th)/He data

Sample	Age [Ma]	± [Ma]	U [ppm]	Th [ppm]	Sm [ppm]	Th/U	He [ncc/μg]	mass [μg]	Ft	stddev
6-7-05-2-Ap1	0.50	0.03	2.7	15.2	210.6	5.7	0.2	1.2	0.57	
6-7-05-2-Ap2	0.66	0.04	0.8	17.5	221.2	23.2	0.5	3.0	0.67	
6-7-05-2-Ap3	0.67	0.04	21.8	52.1	324.5	2.4	1.6	0.7	0.52	
6-7-05-2-Ap4	0.73	0.04	1.0	6.3	191.3	6.4	0.2	1.0	0.57	
6-7-05-2-Ap	***0.64***	***0.02***	***6.6***	***22.8***	***236.9***	***9.4***	***0.6***	***1.5***	***0.58***	***0.10***
6-7-05-03-Ap1*	9.26	0.56	0.6	13.8	159.5	23.6	3.2	0.9	0.56	
6-7-05-03-Ap2	0.56	0.03	7.0	16.4	205.1	2.33	1.6	0.8	0.54	
6-7-05-03-Ap3	0.49	0.03	24.6	49.0	487.7	1.99	1.3	0.7	0.54	
6-7-05-03-Ap4	0.38	0.02	20.8	41.5	362.4	2.0	0.9	1.1	0.59	
6-7-05-03-Ap	***0.48***	***0.02***	***17.5***	***35.7***	***351.7***	***2.1***	***1.3***	***0.9***	***0.55***	***0.09***
6-9-05-2-Ap1*	21.17	1.27	13.6	76.3	293.4	5.6	49.6	1.0	0.57	
6-9-05-2-Ap2	4.10	0.25	9.6	59.2	292.6	6.2	7.6	1.2	0.59	
6-9-05-2-Ap3	5.70	0.34	12.8	74.4	385.4	5.8	13.8	0.8	0.55	
6-9-05-2-Ap4	5.55	0.33	11.1	68.7	342.6	6.2	10.8	0.9	0.53	
6-9-05-2-Ap	***5.12***	***0.18***	***11.2***	***67.4***	***340.2***	***6.1***	***10.7***	***1.0***	***0.55***	***0.9***
6-11-05-1A-Ap1	1.80	0.11	17.5	6.1	143.5	0.3	3.1	2.8	0.70	
6-11-05-1A-Ap2	1.83	0.11	20.3	3.3	76.8	0.2	3.4	3.4	0.71	
6-11-05-1A-Ap3	1.71	0.10	9.3	2.7	48.0	0.3	1.5	3.1	0.70	
6-11-05-1A-Ap4	1.67	0.10	22.7	5.8	57.6	0.3	3.4	2.9	0.69	
6-11-05-1A-Ap	***1.77***	***0.05***	***20.2***	***5.1***	***92.7***	***0.3***	***3.3***	***3.0***	***0.70***	***0.1***

Abbreviations: Ft = alpha ejection correction factor after Farley et al. (1996). The dimensions of the apatite grains in each sample (1-2 grains) were measured to determine the alpha-emission correction (Farley et al., 1996). (U-Th)/He ages were calculated based on absolute He and U-Th-Sm determinations on the same aliquot. Reported ages represent the weighted mean age of n analyses, excluding samples characterized by inclusions (denoted by *).

(U-Th)/He Analytical Procedures

All He and U-Th-Sm determinations were carried out at the (U-Th)/He laboratory at the University of Kansas. For He analyses, samples are first laser-heated at 1070°C using a Nd-YAG laser with samples wrapped in pt foil package (House et al., 2001) to degas all He. Subsequent to gettering and cryogenic purification (cycling between 16 and 34 K), the extracted He is analyzed with a Balzers Prisma quadrupole mass-spectrometer using isotope dilution (^{3}He tracer). The amount of spike is determined to better than 0.5% and with precision on He determinations better than 0.4% (incl. blanks). Grains are then retrieved, dissolved in nitric acid and spiked with an isotopically enriched U, Th, and Sm (^{230}Th-^{235}U-^{149}Sm) HNO_3 solution. U, Th, and Sm concentrations are determined by isotope dilution inductively coupled plasma mass spectrometry (ICP-MS) using a PQ2 Q-ICP-MS. Similar uncertainties apply to the ICP-MS U and Th determinations (<1%). Thus the analytical uncertainties on age determinations are generally better than 6% (±2-σ). All analyses were carried out the (U-Th)/He laboratory of the University Kansas.

References

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Figure DR1. Topographic profile perpendicular to fault scarp traces in the Lunggar rift basin (see Fig. 3 for location). Profile lengths and relative accuracy of RTK GPS positions of data points are accurate to within 3 cm. Red line represents the surface of a Digital Elevation Model (DEM) constructed from > 9000 elevation measurements. Terrace height above the active drainage (black dashed) is indicated.