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Geology and thermochronology of Tertiary Cordilleran-style metamorphic core complexes in the Saghand region of central Iran, by C. Verdel et al.; *GSA Bulletin*; v. 117, doi: 10.1130/B26102.1

TABLE S1. U-Pb DATA

Sample Fract'ns[†]	Pb_c[‡] (pg)	Pb*[‡] / Pb_c	Th/U	$^{206}Pb/^{204}Pb$[§]	$^{208}Pb/^{206}Pb$[#]	Ratios: $^{206}Pb/^{238}U$[††]	error (2σ%)	$^{207}Pb/^{235}U$[††]	error (2σ%)	$^{207}Pb/^{206}Pb$[††]	error (2σ%)	Age (Ma): $^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	corr. coef.
Mylonitic gneiss – Neybaz Mountain (2604)															
32° 29.952' N, 55° 6.343' E															
z2	0.7	48	0.52	2944.4	0.166	0.007686	(.09)	0.04984	(.17)	0.04704	(.15)	**49.35**	**49.39**	**51.1**	0.521
z4	0.3	63	0.52	3848.4	0.166	0.007661	(.06)	0.04972	(.14)	0.04707	(.12)	**49.20**	**49.27**	**53.0**	0.494
z1	0.6	34	0.40	2137.8	0.128	0.007650	(.11)	0.04963	(.29)	0.04706	(.26)	**49.12**	**49.19**	**52.3**	0.451
z3	0.7	96	0.37	6080.9	0.120	0.007630	(.06)	0.04954	(.13)	0.04709	(.12)	**49.00**	**49.10**	**53.8**	0.477
z5	0.7	41	0.53	2509.4	0.170	0.007625	(.09)	0.04950	(.17)	0.04708	(.14)	**48.97**	**49.06**	**53.3**	0.551
z6	0.3	107	0.52	6489.2	0.166	0.007634	(.05)	0.04957	(.10)	0.04709	(.09)	**49.02**	**49.12**	**53.9**	0.517

[†] All analyses are annealed and chemically treated single zircon grains.
[‡] Pb_c is total common Pb in analysis. Pb* is radiogenic Pb concentration.
[§] Measured ratio corrected for spike and fractionation only.
[#] Radiogenic Pb ratio.
[††] Corrected for fractionation, spike, blank, and initial common Pb. Mass fractionation correction of 0.25%/amu ± 0.04%/amu (atomic mass unit) was applied to single-collector Daly analyses. Total procedural blank was less than 0.7 pg for Pb and less than 0.1 pg for U. Blank isotopic composition: 206Pb/204Pb = 18.27 ± 0.1, 207Pb/204Pb =15.59 ± 0.1, 208Pb/204Pb = 38.12 ± 0.1.
Corr. coef. = correlation coefficient.
Age calculations are based on the decay constants of Steiger and Jäger (1977).

TABLE S2. $^{40}Ar/^{39}Ar$ data for western domain samples

Sample Run ID	Power (W)	^{40}Ar (nA)	σ (nA)	^{39}Ar (nA)	σ (nA)	^{38}Ar (nA)	σ (nA)	^{37}Ar (nA)	σ (nA)	^{36}Ar (nA)	σ (nA)	$^{40}Ar^*/^{39}Ar_K$	σ	$\%^{40}Ar^*$	Age (Ma)	σ Ma
Sample 1604, biotite																
32° 25.849' N, 55° 9.516' E																
34183-01	5	1.00664	0.00102	0.08679	0.00022	0.00128	0.00002	0.00440	0.00005	0.00081	0.00001	8.8459	0.0603	76.27	41.56	0.28
34183-02	5	1.48920	0.00096	0.14991	0.00038	0.00207	0.00003	0.00152	0.00005	0.00048	0.00001	8.9835	0.0412	90.44	42.20	0.19
34183-03	5	12.12987	0.00531	0.08692	0.00022	0.00849	0.00004	0.00149	0.00004	0.03813	0.00005	9.9132	1.0836	7.10	46.51	5.02
34183-04	5	0.92257	0.00133	0.05141	0.00017	0.00098	0.00002	0.00253	0.00005	0.00162	0.00001	8.6378	0.1218	48.13	40.59	0.57
34183-05	5	0.36978	0.00053	0.03632	0.00013	0.00054	0.00002	0.00149	0.00005	0.00018	0.00001	8.7524	0.0827	85.96	41.13	0.38
34183-06	5	1.31457	0.00143	0.12734	0.00026	0.00179	0.00002	0.00437	0.00007	0.00065	0.00002	8.8185	0.0552	85.42	41.43	0.26
34183-07	5	0.68070	0.00090	0.07099	0.00022	0.00099	0.00002	0.00106	0.00004	0.00025	0.00001	8.5315	0.0520	88.98	40.10	0.24
34183-08	5	0.68510	0.00100	0.05976	0.00015	0.00101	0.00002	0.00124	0.00004	0.00061	0.00002	8.4544	0.0928	73.75	39.74	0.43
34183-09	5	0.65149	0.00113	0.05718	0.00021	0.00086	0.00002	0.00295	0.00005	0.00055	0.00001	8.5656	0.0739	75.19	40.26	0.34
34183-10	5	0.77398	0.00104	0.06435	0.00012	0.00103	0.00002	0.00221	0.00005	0.00075	0.00002	8.6000	0.0989	71.51	40.42	0.46
Sample 1304, plagioclase																
32° 26.779' N, 55° 9.707' E																
34187-01B	0.6	0.30214	0.00132	0.01339	0.00013	0.00031	0.00004	0.06957	0.00039	0.00063	0.00003	9.0081	0.7937	39.77	42.31	3.68
34187-01C	0.9	0.44673	0.00129	0.02925	0.00013	0.00049	0.00004	0.21280	0.00073	0.00068	0.00003	8.9763	0.3534	58.49	42.17	1.64
34187-01D	1.2	0.66043	0.00202	0.04975	0.00018	0.00077	0.00004	0.39962	0.00139	0.00081	0.00003	9.1415	0.2127	68.48	42.93	0.99
34187-01E	1.7	0.65136	0.00164	0.04940	0.00018	0.00076	0.00004	0.45224	0.00159	0.00084	0.00003	8.9209	0.2129	67.23	41.91	0.99
34187-01F	2.2	0.09436	0.00079	0.00757	0.00010	0.00015	0.00004	0.09685	0.00074	0.00013	0.00003	8.5925	1.3303	68.29	40.38	6.18
34187-01G	2.7	0.05402	0.00083	0.00421	0.00008	0.00008	0.00003	0.05682	0.00052	0.00005	0.00003	10.2622	2.2736	79.33	48.13	10.52
34187-01H	3.2	0.06241	0.00079	0.00504	0.00009	0.00008	0.00003	0.06581	0.00053	0.00007	0.00003	9.5098	1.9512	76.14	44.64	9.05

TABLE S2, continued. $^{40}Ar/^{39}Ar$ data for western domain samples

Sample Run ID	Power (W)	^{40}Ar (nA)	σ (nA)	^{39}Ar (nA)	σ (nA)	^{38}Ar (nA)	σ (nA)	^{37}Ar (nA)	σ (nA)	^{36}Ar (nA)	σ (nA)	$^{40}Ar^{*}/^{39}Ar_{K}$	σ	%^{40}Ar*	Age (Ma)	σ Ma
Sample 1304, plagioclase																
32° 26.779' N, 55° 9.707' E																
34187-02B	0.4	0.17395	0.00076	0.00364	0.00007	0.00012	0.00003	0.00995	0.00020	0.00050	0.00003	7.5722	2.5565	15.81	35.64	11.91
34187-02C	0.6	0.29381	0.00094	0.00998	0.00009	0.00023	0.00003	0.04958	0.00032	0.00071	0.00003	8.8459	0.9521	29.94	41.56	4.42
34187-02D	0.9	0.36705	0.00110	0.02455	0.00012	0.00035	0.00003	0.17074	0.00075	0.00054	0.00003	8.9863	0.3875	59.83	42.21	1.80
34187-02E	1.2	0.70299	0.00192	0.04745	0.00020	0.00087	0.00004	0.34992	0.00110	0.00105	0.00003	8.9026	0.2173	59.78	41.82	1.01
34187-02F	1.5	0.90571	0.00211	0.06439	0.00024	0.00111	0.00004	0.52063	0.00140	0.00131	0.00003	8.7347	0.1671	61.75	41.04	0.78
34187-02G	1.8	0.73461	0.00173	0.04732	0.00020	0.00090	0.00004	0.42391	0.00111	0.00117	0.00003	8.9623	0.2202	57.38	42.10	1.02
34187-02H	2.2	0.43084	0.00116	0.02987	0.00017	0.00052	0.00004	0.32917	0.00083	0.00063	0.00003	9.1683	0.3291	63.08	43.06	1.53
34187-02I	3.5	0.15289	0.00081	0.01039	0.00009	0.00016	0.00003	0.13484	0.00087	0.00024	0.00003	9.0646	0.9086	61.03	42.58	4.22
34187-02J	7	0.29046	0.00093	0.00707	0.00009	0.00024	0.00003	0.08577	0.00046	0.00078	0.00003	9.5838	1.3943	23.13	44.98	6.46
Sample 1404, alkali feldspar																
32° 26.599' N, 55° 9.830' E																
34190-02	4	0.35877	0.00059	0.00388	0.00003	0.00029	0.00001	0.00308	0.00009	0.00111	0.00001	8.2742	1.0551	8.93	38.90	4.91
34190-03	4	0.12340	0.00044	0.00774	0.00007	0.00015	0.00001	0.03317	0.00024	0.00021	0.00001	8.1706	0.2620	51.08	38.42	1.22
34190-04	4	0.04751	0.00036	0.00284	0.00004	0.00006	0.00001	0.05492	0.00023	0.00008	0.00001	9.7939	0.6852	57.79	45.96	3.17
34190-05	4	0.60345	0.00067	0.00530	0.00004	0.00045	0.00001	0.00341	0.00008	0.00191	0.00001	7.4245	1.0795	6.52	34.95	5.03
34190-06	4	0.48638	0.00093	0.01001	0.00008	0.00041	0.00001	0.01475	0.00012	0.00135	0.00001	8.8744	0.4743	18.25	41.69	2.20
34190-07	4	0.33082	0.00076	0.00773	0.00007	0.00026	0.00001	0.09542	0.00034	0.00093	0.00001	8.2171	0.4738	19.02	38.64	2.20
34190-10	4	0.42792	0.00059	0.00744	0.00007	0.00040	0.00001	0.00309	0.00009	0.00123	0.00001	8.7855	0.6084	15.27	41.28	2.83
34190-11	4	0.05779	0.00033	0.00461	0.00005	0.00009	0.00001	0.07763	0.00030	0.00008	0.00001	8.9412	0.4044	70.52	42.00	1.88

TABLE S3. $^{40}Ar/^{39}Ar$ data for eastern domain samples

Sample 1704, biotite, 1.50 mg, J = 0.00151862 ± 0.0952%
32° 30.712' N, 55° 33.490 E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	650	12	1.185	0.489	0.234	0.123	355.438	5.2	0.1	14.559186	159.044460	390.30	63.44
2	725	12	1.174	0.142	0.236	0.933	377.176	12.3	0.6	0.55502762	47.501559	125.66	5.75
3	790	12	6.450	0.583	1.280	6.770	2330.42	21.5	4.4	0.31401927	74.009831	192.16	2.14
4	850	12	5.760	0.484	1.429	25.468	3750.04	56.6	16.7	0.06929389	83.637632	215.72	1.02
5	905	12	0.666	0.286	0.367	18.285	1695.17	90.0	12.0	0.05703138	76.650557	198.65	0.67
6	960	12	0.676	0.363	0.364	19.795	1802.18	90.6	12.9	0.06686444	82.111305	212.00	0.71
7	1015	12	0.692	0.592	0.458	25.864	2329.33	92.6	16.9	0.08345883	83.238422	214.75	0.67
8	1055	12	0.566	7.725	0.548	32.568	3071.00	95.6	21.3	0.86507904	90.257038	231.74	0.75
9	1095	12	0.435	11.578	0.260	13.478	1237.73	92.0	8.8	3.13511068	83.669016	215.79	0.69
10	1135	12	0.228	2.297	0.092	4.805	421.639	89.9	3.1	1.74393691	73.373017	190.59	0.65
11	1180	12	0.289	2.719	0.109	2.372	254.683	74.1	1.6	4.18481533	70.228433	182.82	0.71
12	1250	12	0.272	3.454	0.089	0.979	151.366	55.9	0.6	12.9139448	68.771262	179.21	1.50
13	1400	12	0.527	8.581	0.116	1.436	621.574	78.8	0.9	21.9318247	327.440483	728.19	3.44
								Cumulative %39Ar released =	100.0		Total gas age =	218.27	0.51

Sample 1804, biotite, 0.80 mg, J = 0.00149439 ± 0.1458%
32 30.554' N, 55 31.001' E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	650	12	1.796	0.074	0.343	0.046	522.880	2.2	0.1	5.95967947	318.279303	701.94	130.97
2	725	12	0.813	0.270	0.187	0.235	253.190	9.7	0.6	4.25424452	99.455224	249.98	15.85
3	790	12	2.886	1.506	0.553	1.425	929.788	12.1	3.9	3.91284014	78.089842	199.13	6.23
4	840	12	11.986	2.349	2.338	4.194	3852.95	11.6	11.5	2.07250874	107.299564	268.30	5.57
5	890	12	0.657	0.462	0.175	3.853	630.711	73.4	10.5	0.44347792	116.639294	289.87	1.33
6	940	12	0.473	1.198	0.178	7.582	1024.44	89.1	20.7	0.58441382	118.678318	294.55	1.10
7	990	12	0.382	4.314	0.165	8.278	1093.15	92.3	22.6	1.92831363	120.332481	298.33	1.03
8	1040	12	0.362	8.471	0.126	5.903	857.919	90.8	16.1	5.31528882	129.773723	319.78	1.13
9	1100	12	0.284	6.263	0.080	3.317	501.455	88.6	9.1	6.9971508	129.026930	318.09	2.15
10	1180	12	0.157	3.610	0.034	0.727	144.996	83.2	2.0	18.4650128	131.332632	323.29	5.00
11	1400	12	0.593	9.159	0.134	1.005	314.117	44.8	2.7	34.046981	122.095747	302.36	3.17
								Cumulative %39Ar released =	100.0		Total gas age =	295.36	1.08

TABLE S3, continued. $^{40}Ar/^{39}Ar$ data for eastern domain samples

Sample 1904, biotite, 1.40 mg, J = 0.00151068 ± 0.0997%
32° 31.949' N, 55° 28.705' E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	670	12	2.619	0.074	0.505	0.085	760.456	2.0	0.3	3.29046746	199.846312	475.97	76.49
2	750	12	1.167	1.361	0.272	2.426	400.266	18.3	8.5	2.11962627	28.717012	76.62	1.71
3	810	12	8.146	0.950	1.618	3.833	2590.26	10.7	13.4	0.9360999	72.270577	186.94	4.28
4	860	12	1.858	0.754	0.368	2.841	836.066	38.0	10.0	1.00241183	109.783520	276.83	2.03
5	910	12	0.284	1.139	0.118	3.425	541.73	89.3	12.0	1.25615248	136.359062	337.91	1.52
6	960	12	0.336	3.017	0.119	3.520	617.767	88.2	12.4	3.23944637	150.548182	369.70	1.69
7	1010	12	0.400	8.050	0.256	5.937	843.91	89.4	20.8	5.12759068	124.761893	311.51	1.14
8	1060	12	0.248	6.288	0.123	3.689	533.269	91.3	12.9	6.44852923	127.512595	317.81	1.56
9	1120	12	0.199	6.095	0.131	1.914	292.433	88.3	6.7	12.0675928	121.608253	304.27	1.72
10	1190	12	0.152	2.269	0.029	0.465	113.326	77.9	1.6	18.5272295	139.225482	344.38	9.22
11	1400	12	0.564	1.633	0.115	0.360	215.684	13.0	1.3	17.2163975	70.060261	181.50	10.22
								Cumulative %39Ar released =	100.0		Total gas age =	281.32	1.17

Sample 2304, biotite, 1.40 mg, J = 0.0053346 ± 0.1091%
32° 31.914' N, 55° 28.775' E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	680	12	2.871	0.025	0.541	0.382	816.288	-0.1	0.2	0.2535515	-2.737221	-7.61	-16.88
2	760	12	3.065	0.212	0.655	7.524	1167.750	25.9	4.1	0.10915855	39.781554	107.12	1.06
3	810	12	9.132	0.373	2.014	22.983	3845.67	32.7	12.4	0.06287337	54.849739	146.09	1.08
4	855	12	3.572	0.314	1.071	29.818	2716.07	63.2	16.1	0.04079556	57.564565	153.02	0.65
5	900	12	0.632	0.223	0.564	33.838	2156.4	92.8	18.3	0.02553054	58.971072	156.61	0.50
6	945	12	1.104	0.626	1.057	62.222	3799.98	92.4	33.7	0.03897552	56.539535	150.41	0.48
7	990	12	0.339	0.362	0.265	15.118	968.434	92.5	8.2	0.09276471	58.218381	154.69	0.54
8	1035	12	0.195	0.298	0.109	5.923	404.808	92.1	3.2	0.19492001	59.550334	158.08	0.65
9	1085	12	0.117	0.775	0.066	3.081	217.681	96.0	1.7	0.97475115	60.499413	160.49	1.12
10	1150	12	0.107	0.689	0.043	1.641	128.919	95.0	0.9	1.62734494	55.533265	147.84	0.99
11	1400	12	0.376	1.726	0.092	2.271	242.653	57.0	1.2	2.94689669	45.989171	123.28	1.96
								Cumulative %39Ar released =	100.0		Total gas age =	149.75	0.46

TABLE S3, continued. $^{40}Ar/^{39}Ar$ data for eastern domain samples

Sample 2404, biotite, 1.40 mg, J = 0.0015473 ± 0.1123%
32° 32.028' N, 55° 24.747' E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	690	12	3.406	0.024	0.639	0.635	991.380	2.2	0.3	0.32679748	35.408661	96.23	11.56
2	770	12	1.193	0.060	0.306	6.072	638.441	48.8	2.6	0.08543369	49.847487	134.04	0.92
3	810	12	6.691	0.108	1.513	18.082	2947.75	35.8	7.8	0.05163956	58.354398	155.95	1.07
4	850	12	2.619	0.144	0.983	33.458	2686.04	73.0	14.4	0.03721053	58.575993	156.52	0.60
5	890	12	0.164	0.041	0.332	23.681	1430.37	98.5	10.2	0.01496871	59.000941	157.61	0.52
6	930	12	0.393	0.089	0.928	64.871	3879.12	97.8	28.0	0.0118615	58.610905	156.61	0.48
7	970	12	0.241	0.024	0.317	22.562	1369.27	96.8	9.7	0.00919673	58.185798	155.52	0.55
8	1050	12	0.301	0.059	0.448	30.953	1918.05	96.8	13.3	0.01647972	59.750226	159.52	0.49
9	1140	12	0.141	0.051	0.375	26.447	1605.70	99.1	11.4	0.01667226	59.428109	158.70	0.48
10	1400	12	0.348	0.097	0.150	5.271	417.979	80.7	2.3	0.15911019	54.983769	147.30	0.69
								Cumulative %39Ar released =	100.0		Total gas age =	156.20	0.40
											Plateau age (steps 3-6) =	156.86	0.58

Sample 2504, biotite, 1.80 mg, J = 0.00152694 ± 0.0993%
32° 30.865' N, 55° 21.087' E

Step	T (C)	t (min.)	36Ar	37Ar	38Ar	39Ar	40Ar	%40Ar*	% 39Ar released	Ca/K	40Ar*/39ArK	Age (Ma)	1 s.d.
1	770	12	3.697	1.031	0.730	3.543	1178.11	10.6	4.8	1.21176812	37.252676	99.81	2.18
2	810	12	10.177	1.758	1.973	5.023	3212.25	9.8	6.8	1.45753771	63.094333	165.94	4.32
3	850	12	3.093	0.796	0.699	6.586	1255.83	30.1	8.9	0.50318861	57.018796	150.61	1.32
4	890	12	0.265	0.551	0.132	6.623	475.911	86.7	9.0	0.3463505	60.406719	159.17	0.52
5	930	12	0.341	1.193	0.237	11.971	818.517	90.7	16.2	0.41489475	60.692591	159.89	0.63
6	970	12	0.415	6.291	0.259	14.750	1004.91	90.4	20.0	1.7763699	60.653963	159.79	0.58
7	1050	12	0.565	30.581	0.310	15.826	1211.34	88.8	21.5	8.06318088	67.369872	176.65	0.63
8	1140	12	0.310	21.154	0.152	6.708	586.271	89.0	9.1	13.1792775	75.506441	196.86	0.72
9	1400	12	0.540	8.639	0.138	2.641	367.089	66.8	3.6	13.6726099	82.230342	213.39	1.84
								Cumulative %39Ar released =	100.0		Total gas age =	165.38	0.53
											Pseudo plateau age (steps 4-6) =	159.57	0.65

TABLE S4. (U-Th)/He analytical data for western domain samples

Apatite (U-Th)/He data, western domain							
Sample	No. of grains	U (ppm)	Th (ppm)	He (nmol/g)	F_T	Age (Ma) Raw	Age (Ma) Corrected
G30, Diorite, Daranjir Diorite							
32° 23.613' N, 55° 0.583' E							
	4	33	112	3.8	0.754	11.8	15.6
	1	45	122	5.3	0.678	13.2	19.4
	1	43	142	3.5	0.738	8.2	11.1
Mean							15.4
2σ							8.4
G27, Granite, Khoshoumi Granite							
32° 26.973' N, 55° 5.002' E							
	1	24	59	3.5	0.770	16.7	21.6
	1	26	59	4.1	0.780	18.7	23.9
Mean							22.8
2σ							3.3
0504, Non-mylonitic biotite gneiss, Chapedony complex							
32° 50.702' N, 55° 13.578' E							
	4	31	39	3.6	0.770	16.4	21.3
	2	27	28	2.4	0.778	13.2	17.0
	3	29	30	3.4	0.761	17.2	22.6
Mean							20.3
2σ							5.8

TABLE S4, continued. (U-Th)/He analytical data for western domain samples

Zircon (U-Th)/He data, western domain							
Sample	No. of grains	U (ppm)	Th (ppm)	He (nmol/g)	F_T	Age (Ma) Raw	Age (Ma) Corrected
G30, Diorite, Daranjir Diorite							
32° 23.613' N, 55° 0.583' E							
	1	872	1075	198	0.757	32.4	42.7
	1	504	667	104	0.774	28.8	37.2
	1	574	517	133	0.824	35.1	42.6
	1	240	322	56	0.816	32.6	39.9
Mean							40.6
2σ							5.2
G27, Granite, Khoshoumi Granite							
32° 26.973' N, 55° 5.002' E							
	1	862	237	169	0.768	33.8	43.9
	1	1128	251	187	0.783	29.0	36.9
	1	502	176	92	0.777	31.1	40.0
	1	594	165	112	0.791	32.6	41.2
Mean							40.5
2σ							5.8
0504, Non-mylonitic biotite gneiss, Chapedony complex							
32° 50.702' N, 55° 13.578' E							
	1	316	185	57	0.759	29.2	38.5
	1	241	269	49	0.785	29.2	37.2
	1	392	501	99	0.810	35.6	43.9
	1	343	322	71	0.784	31.1	39.7
	5	183	151	44	0.787	37.1	47.0
	1	208	124	43	0.781	33.5	42.9
	1	265	370	73	0.808	38.2	47.3
	1	290	399	77	0.777	36.9	47.5
	1	324	211	70	0.794	34.2	43.0
Mean							43.0
2σ							7.8
G18, Gneiss, Chapedony complex							
32° 50.039' N, 55° 18.538' E							
	1	962	472	249	0.848	42.5	50.1
	1	827	212	173	0.852	36.1	42.4
	1	597	167	178	0.865	51.3	59.3
	1	787	233	170	0.852	37.0	43.4
Mean							48.8
2σ							15.6

TABLE S5. (U-Th)/He analytical data for eastern domain samples

Apatite (U-Th)/He data, eastern domain

Sample	No. of grains	U (ppm)	Th (ppm)	He (nmol/g)	F_T	Age (Ma) Raw	Corrected
2404, Metapelitic schist, Boneh-Shurow complex							
32° 32.028' N, 55° 24.747' E							
	3	6	3	0.3	0.702	6.7	9.6
	4	7	5	0.5	0.661	12.2	18.4
	1	10	8	1.2	0.689	18.7	27.0
	1	5	3	0.4	0.739	11.7	15.8
	1	9	6	0.8	0.655	13.3	20.3
	1	6	5	0.3	0.735	8.9	12.1
	1	6	2	0.6	0.697	17.6	25.2
Mean							18.3
2σ							12.9
2104, Graywacke, Tashk Formation							
32° 31.917' N, 55° 28.776' E							
	4	31	33	2.4	0.731	11.4	15.6
	3	9	6	0.9	0.692	15.9	23.0
	4	11	11	1.0	0.705	13.8	19.5
	3	25	29	2.6	0.631	14.5	23.0
Mean							20.3
2σ							7.0
1804, Graywacke, Tashk Formation							
32° 30.554' N, 55° 31.001' E							
	2	11	7	1.4	0.726	21.0	29.0
	2	8	5	0.7	0.780	14.5	18.6
	1	18	9	1.3	0.788	12.1	15.4
	1	16	5	1.0	0.851	10.1	11.9
	1	16	13	0.9	0.756	8.9	11.8
Mean							17.3
2σ							14.2

TABLE S5, continued. (U-Th)/He analytical data for eastern domain samples

Zircon (U-Th)/He data, eastern domain							
Sample	No. of grains	U (ppm)	Th (ppm)	He (nmol/g)	F_T	Age (Ma) Raw	Age (Ma) Corrected
2304, Schist, Boneh-Shurow complex							
32° 31.914' N, 55° 28.775' E							
	1	283	144	94	0.710	54.2	76.1
	1	177	102	74	0.710	67.3	94.5
	1	637	360	307	0.716	77.6	108.1
	1	265	153	102	0.746	62.2	83.2
	4	348	195	221	0.744	102.2	136.8
Mean							99.7
2σ							48.0
G12, Quartz diorite, Boneh-Shurow complex							
32° 35.714' N, 55° 26.642' E							
	3	292	167	203	0.792	111.4	140.1
	4	452	274	284	0.783	100.1	127.5
Mean							133.8
2σ							17.9
2104, Graywacke, Tashk Formation							
32° 31.917' N, 55° 28.776' E							
	1	128	58	75	0.758	96.8	127.3
	1	146	47	83	0.745	95.8	128.1
	1	125	28	75	0.759	104.2	136.9
	1	308	99	106	0.753	58.7	77.7
	1	288	130	77	0.749	44.5	59.3
	5	231	83	93	0.738	68.0	92.0
	5	256	63	99	0.752	67.1	89.1
Mean							101.5
2σ							59.0
2004, Leucogranite							
32° 31.936' N, 55° 28.728' E							
	5	86	85	48	0.754	82.6	109.2
	5	96	99	58	0.774	88.3	113.9
	5	67	73	35	0.790	75.9	95.9
Mean							106.3
2σ							18.6

TABLE S5, continued. (U-Th)/He analytical data for eastern domain samples

Zircon (U-Th)/He data, eastern domain							
Sample	No. of grains	U (ppm)	Th (ppm)	He (nmol/g)	F_T	Age (Ma) Raw	Corrected
1804, Graywacke, Tashk Formation							
32° 30.554' N, 55° 31.001' E							
	1	85	30	59	0.754	117.5	155.2
	1	171	91	102	0.796	96.9	121.5
	1	322	95	177	0.815	93.6	114.5
	1	279	146	154	0.776	89.4	114.8
	1	139	107	73	0.759	81.4	107.0
	5	212	95	110	0.751	85.7	113.7
Mean							121.1
2σ							34.7
G40, Tuffaceous rock, Tashk Formation							
32° 31.169' N, 55° 34.034' E							
	1	473	102	290	0.790	106.4	134.2
	1	425	338	223	0.739	80.9	109.2
Mean							121.7
2σ							35.3
G28, Rhyodacite, CVSU							
32° 27.465' N, 55° 36.338' E							
	1	148	108	115	0.806	120.3	148.9
	1	104	77	57	0.790	85.0	107.3
	1	105	67	77	0.831	116.3	139.7
	1	166	116	89	0.799	84.6	105.6
Mean							125.4
2σ							44.3

APPENDIX A. ANALYTICAL METHODS FOR U-Pb GEOCHRONOLOGY

Zircon was separated from bulk rock samples by standard crushing, heavy liquid, and magnetic separation techniques, and was subsequently handpicked using a binocular microscope, with selection based on clarity and crystal morphology. All grains were pre-treated to minimize the effects of Pb loss, by the method of thermal annealing and chemical leaching (chemical abrasion or CA-TIMS technique: Mattinson, 2005; Mundil et al., 2004) designed to preferentially remove the high-U parts of the zircon crystal that are most susceptible to Pb loss. Zircon grains are first annealed at 900°C for 60 hours and leached in 29M HF inside high-pressure Parr® vessels at 180°C for 12 hours. The partially dissolved sample is then fluxed successively with hot 4N HNO_3 and 6N HCl and thoroughly rinsed with ultra-pure water in between. Pre-treated and rinsed zircons were spiked with a mixed ^{205}Pb-^{233}U-^{235}U tracer solution and dissolved completely in 29M HF inside Parr® vessels at 220°C for 48-60 hours.

Dissolved Pb and U were chemically separated using a miniaturized HCl-based ion-exchange chromatography procedure modified after Krogh (1973), using 50 µl columns of AG1x8 anion-exchange resin. Both Pb and U were loaded with a silica gel - H_3PO_4 emitter solution (Gerstenberger and Haase, 1997) on single degassed Re filaments and their isotopic compositions were measured on the VG Sector 54 multi-collector thermal ionization mass spectrometer at MIT. Lead isotopic measurements were made in a peak-switching mode by ion counting using a Daly photomultiplier detector with a ^{206}Pb ion beam intensity of 0.5 to 2.0 x 10^{-13} Amps usually maintained in the course of data acquisition. Uranium isotopes were measured as oxide ions on three Faraday detectors in a static mode with an average $^{235}U^{16}O_2^+$ ion-beam intensity of 8.0 x 10^{-13} Amps.

Measured isotopic ratios were corrected for mass-dependent isotope fractionation in the mass spectrometer, as well as for U and Pb contributions from the spike, laboratory blanks and initial Pb in the sample. Details of fractionation and blank corrections are given in Table S1. The U-Pb data reduction, age calculation and error propagation follow the algorithm of Ludwig (1980) and the program ISOPLOT (Ludwig, 1991; version 3.14, 2004). All U-Pb dates are reported at 95% confidence levels.

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APPENDIX B. ANALYTICAL METHODS FOR $^{40}Ar/^{39}Ar$ GEOCHRONOLOGY

Berkeley Geochronology Center

Samples analyzed at the Berkeley Geochronology Center were irradiated in the cadmium-lined in-core irradiation tube (CLICIT) facility at the Oregon State University TRIGA research reactor. Samples were irradiated in wells in an Al disk of the type depicted by Renne et al. (1998) along with crystals of Fish Canyon sanidine. J-values were determined as the weighted mean of values (N=8) determined for each of three wells bracketing the samples, and the arithmetic mean and standard deviation (0.0026345 ±0.0000024) of values for these three positions was used for age calculations. Ages are based on the constants of Steiger and Jäger (1977). Age uncertainties do not include contributions from decay constants or age of the standard.

Samples were degassed with a CO_2 laser either by step-wise power increase or by total fusion. Stepwise heating utilized an integrator lens to enhance uniformity of laser power distribution. Analysis with an MAP 215C mass spectrometer followed methods described by Renne et al. (1998). Procedural blanks were measured between every three unknowns and were similar to values reported by Knight et al. (2004). Blank correction was based on regression of data spanning the runs. Mass discrimination (1.00755 ±0.00185 per amu) was determined from analyses of 12 aliquots from an automated on-line air pipette system, regularly interspersed with the unknowns and standards, and the discrimination correction was applied as a power law function (Renne, 2000). Interfering Ar isotopes from Ca, K and Cl were corrected for using production ratios summarized by Renne et al. (2005).

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University of Nevada, Las Vegas

Samples analyzed by the $^{40}Ar/^{39}Ar$ method at the University of Nevada Las Vegas were wrapped in Al foil and stacked in 6 mm inside diameter Pyrex tubes. Individual packets averaged 3 mm thick and neutron fluence monitors (FC-2, Fish Canyon Tuff sanidine) were placed every 5-10 mm along the tube. Synthetic K-glass and optical grade CaF_2 were included in the irradiation packages to monitor neutron induced argon interferences from K and Ca. Loaded tubes were packed in an Al container for irradiation. Samples irradiated at the Nuclear Science Center at Texas A&M University were in-core for 14 hours in the D3 position on the core edge (fuel rods on three sides, moderator on the fourth side) of the 1MW TRIGA type reactor. Irradiations are performed in a dry tube device, shielded against thermal neutrons by a 5 mm thick jacket of B_4C powder, which rotates about its axis at a rate of 0.7 revolutions per minute to mitigate horizontal flux gradients. Correction factors for interfering neutron reactions on K and Ca were determined by repeated analysis of K-glass and CaF_2 fragments. Measured $(^{40}Ar/^{39}Ar)_K$ values were 0.0002 (± 150%). Ca correction factors were $(^{36}Ar/^{37}Ar)Ca$ = 3.134 (± 7.09%) x 10^{-4} and $(^{39}Ar/^{37}Ar)Ca$ = 7.357 (± 9.92%) x 10^{-4}. J factors were determined by fusion of 4-5 individual crystals of neutron fluence monitors which gave reproducibility's of 0.15% to 0.44% at each standard position. Variation in neutron flux along the 100 mm length of the irradiation tubes was <4%. An error in J of 0.1458% was used in age calculations. No significant neutron flux gradients were present within individual packets of crystals as indicated by the excellent reproducibility of the single crystal flux monitor fusions.

Irradiated crystals together with CaF_2 and K-glass fragments were placed in a Cu sample tray in a high vacuum extraction line and were fused using a 20 W CO_2 laser. Sample viewing during laser fusion was by a video camera system and positioning was via a motorized sample stage. Samples analyzed by the furnace step heating method utilized a double vacuum resistance furnace similar to the Staudacher et al. (1978) design. Reactive gases were removed by a single MAP and two GP-50 SAES getters prior to being admitted to a MAP 215-50 mass spectrometer by expansion. The relative volumes of the extraction line and mass spectrometer allow 80% of the gas to be admitted to the mass spectrometer for laser fusion analyses and 76% for furnace heating analyses. Peak intensities were measured using a Balzers electron multiplier by peak hopping through 7 cycles; initial peak heights were determined by linear regression to the time of gas admission. Mass spectrometer discrimination and sensitivity was monitored by repeated analysis of atmospheric argon aliquots from an on-line pipette system. Measured $^{40}Ar/^{36}Ar$ ratios were 284.31 ± 0.23% during this work, thus a discrimination correction of 1.03938 (4 AMU) was applied to measured isotope ratios. The sensitivity of the mass spectrometer was ~6 x 10^{-17} mol mV^{-1} with the multiplier operated at a gain of 52 over the Faraday. Line blanks averaged 2.04 mV for mass 40 and 0.002 mV for mass 36 for laser fusion analyses and 33.36 mV for mass 40 and 0.08 mV for mass 36 for furnace heating analyses. Discrimination, sensitivity, and blanks were relatively constant over the period of data collection. Computer automated operation of the sample stage, laser, extraction line and mass spectrometer as well as final data reduction and age calculations were done using LabSPEC software written by B. Idleman (Lehigh University). An age of 28.02 Ma was used for the Fish Canyon Tuff sanidine flux monitor in calculating ages for samples.

For $^{40}Ar/^{39}Ar$ analyses a plateau segment consists of 3 or more contiguous gas fractions having analytically indistinguishable ages (i.e. all plateau steps overlap in age at $\pm 2\sigma$ analytical error) and comprising a significant portion of the total gas released (typically >50%). Total gas (integrated) ages are calculated by weighting by the amount of ^{39}Ar released, whereas plateau ages are weighted by the inverse of the variance. For each sample inverse isochron diagrams are examined to check for the effects of excess argon. Reliable isochrons are based on the MSWD criteria of Wendt and Carl (1991) and, as for plateaus, must comprise contiguous steps and a significant fraction of the total gas released. All analytical data are reported at the confidence level of 1σ (standard deviation).

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APPENDIX C. ANALYTICAL METHODS FOR (U-Th)/He THERMOCHRONOLOGY

Apatites and zircon grains were separated from bulk rock samples by standard crushing, heavy liquid, and magnetic separation techniques and were subsequently handpicked using a binocular microscope. Apatite crystals were selected based on morphology, clarity, and lack of inclusions using a binocular microscope with crossed polars. Zircon selection was based on clarity and crystal morphology. Prior to analysis, grains were photographed and dimensions were measured. Grains were packaged in Pt packets and heated to 1065° C for eight minutes. Extracted He gas was spiked with ^{3}He, purified using cryogenic and gettering methods, and analyzed on a quadrupole mass spectrometer.

Degassed apatites were retrieved, spiked with a ^{235}U-^{230}Th-^{51}V tracer, dissolved in HNO_3 at ~90 °C for 1 hour, and analyzed on a Finnigan Element ICP-MS. Degassed zircons were retrieved, placed in a larger Pt packet with a flux of Li metaborate, heated in a muffle furnace to 1000° C for two hours, and allowed to cool. The resultant bead was spiked with a ^{235}U-^{230}Th-^{51}V tracer, dissolved in HNO_3 and analyzed on a Finnigan Element ICP-MS. A hexagonal prism morphology was used to make an alpha-ejection corrections for each crystal to account for He ejected from crystal margins (Farley et al., 1996). Fragments of the Durango apatite standard were analyzed by the same procedures with the batch of unknowns.

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