

Late Cretaceous-early Paleogene extensional ancestry of the Harcuvar and Buckskin-Rawhide metamorphic core complexes, western Arizona

Martin S. Wong¹, John S. Singleton², Nikki M. Seymour^{2*}, Phillip B. Gans³, and Alexander J. Wrobel^{1†}

¹Department of Earth and Environmental Geosciences, Colgate University, 13 Oak Drive, Hamilton, New York, 13346 USA.

² Department of Geosciences, Colorado State University, 1482 Campus Delivery, Fort Collins, Colorado 80523, USA.

³Department of Earth Science, University of California, Santa Barbara, California, 93105, USA

Contents of this file

Figures S1 to S2
Table S2

Additional Supporting Information (Files uploaded separately)

Table S1

Introduction

The supporting information includes detailed information about the sample locations and their structural and deformation characteristics (Table S1), grain size analysis (Figure S1), ⁴⁰Ar/³⁹Ar analyses (Table S2), and U-Pb geochronology (Figure S2).

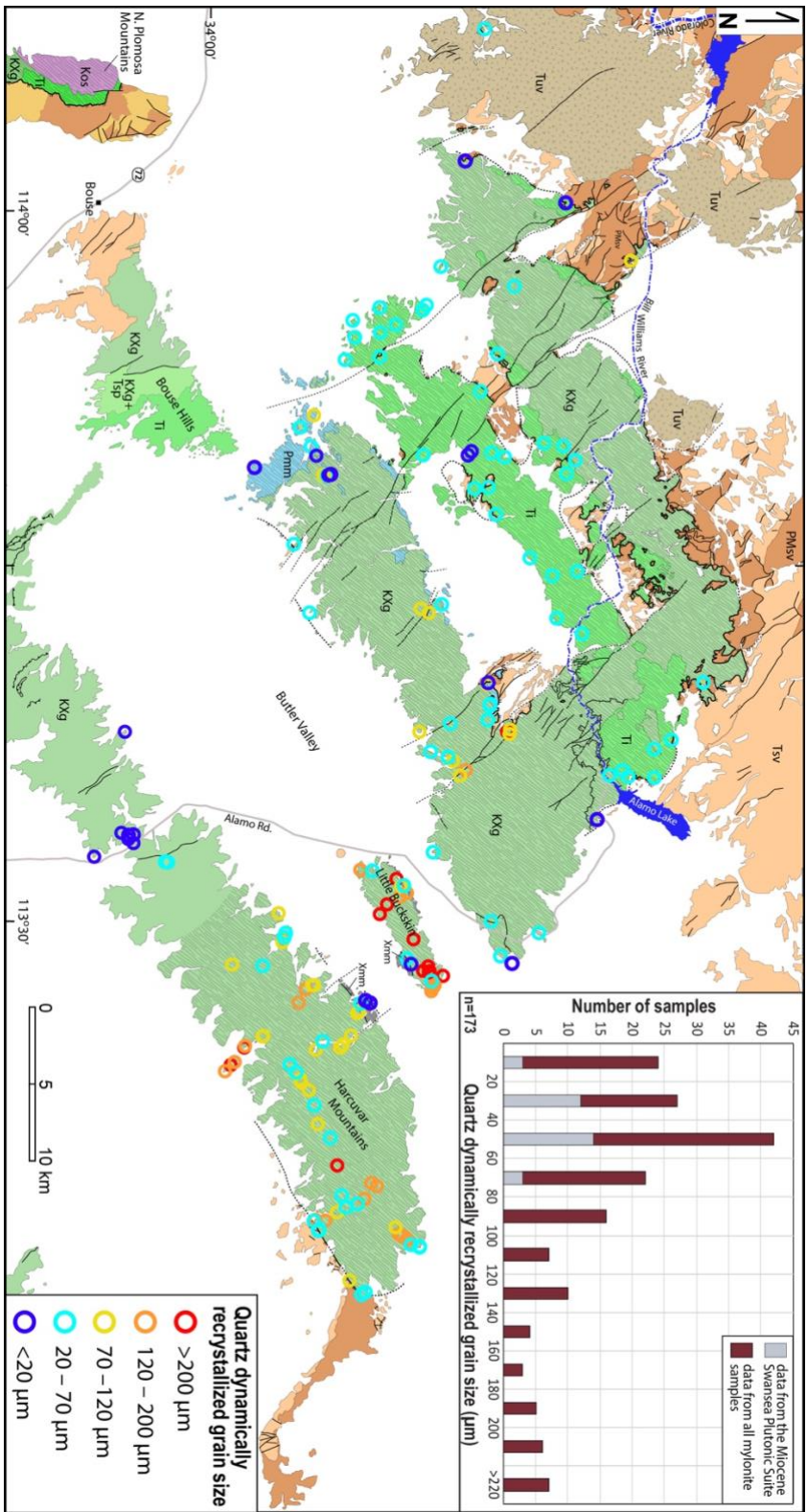


Figure S1. Map and associated histogram (upper-right insert) of measured average grain size for dynamically recrystallized quartz in mylonitic samples.

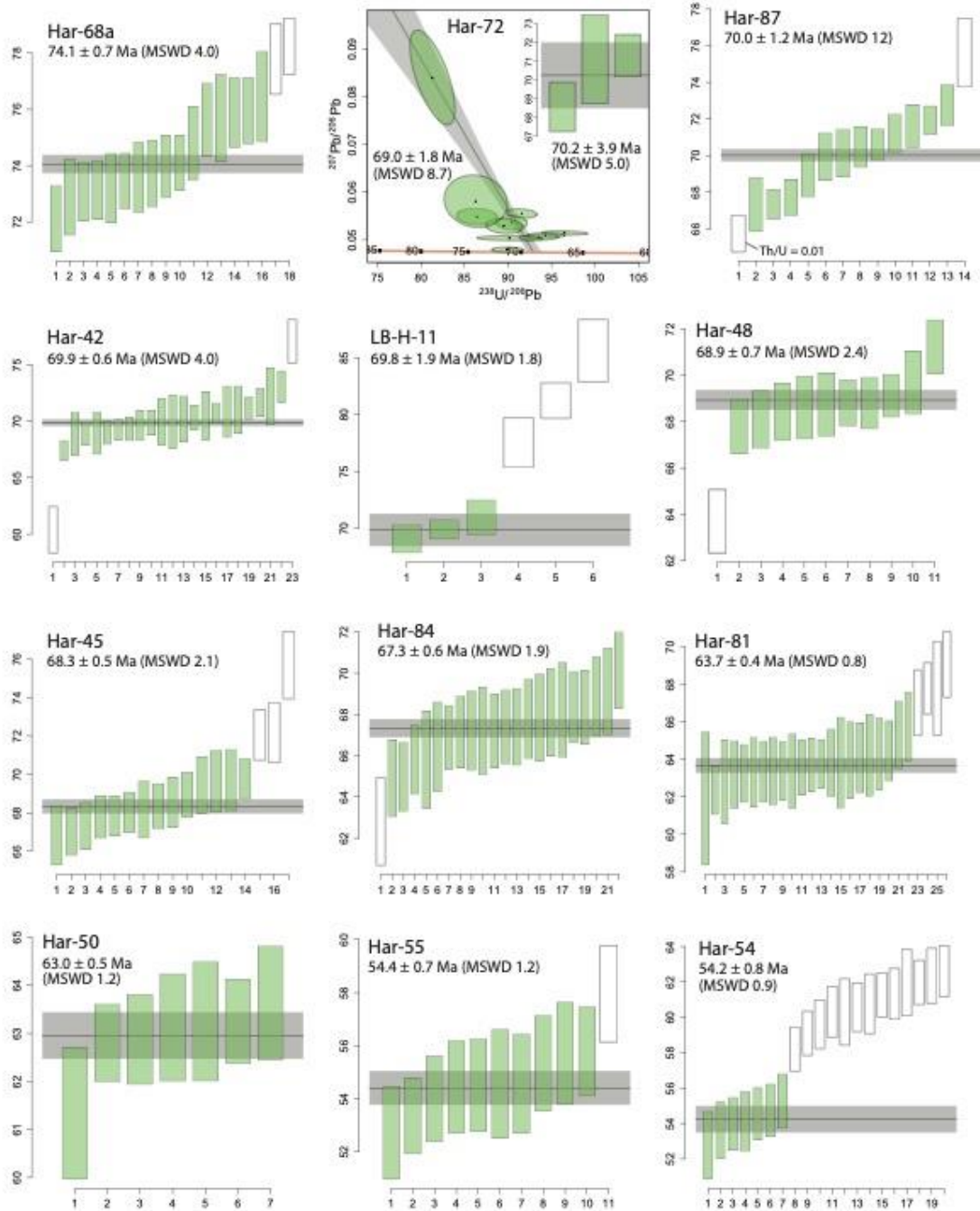


Figure S2. U-Pb geochronologic results showing the $^{238}\text{U}/^{206}\text{Pb}$ spot ages for each dated sample and the calculated weighted mean age (horizontal gray bar). Spot analyses that yielded ages with $>5\%$ discordance are not shown here. The inverse concordia plot and lower intercept age for Har-72 is shown due to the higher fraction of discordant ages in that sample. Ages included in the weighted mean age calculation are

filled green. Plots were generated using IsoplotR program (Vermeesch, 2018) and we allowed the program to reject outlier ages for weighted mean age calculations.

Table S1. Additional information on sample locations, kinematics, microstructures, deformation category and grain size (file attached separately).

Table S2. $^{40}\text{Ar}/^{39}\text{Ar}$ geochronologic analyses

$^{40}\text{Ar}/^{39}\text{Ar}$ analytical details

All $^{40}\text{Ar}/^{39}\text{Ar}$ analyses were conducted at the $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology laboratory at UC Santa Barbara. Samples were step-heated in a Staudecher-type furnace and analyzed on a Nier source MAP 216 mass spectrometer. Samples were irradiated at the Oregon State University research reactor in the CLICIT facility and J-values were monitored using Taylor Creek Rhyolite sanidine using an assumed age of 27.92 Ma.

Hornblende data:

Sample: SB66-59 Har-71 hbl J=0.0041480

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
700	14	1.6e-14	58.7182	5.5e-5	1.2997	0.1413	0.38	0.00251	0.289	122.7 ± 3.9
780	14	1.6e-14	42.3941	1.4e-3	1.3428	0.1127	0.36	0.00593	0.214	66.8 ± 2.8
850	14	2.1e-14	43.3787	4.3e-4	2.1768	0.1213	0.23	0.01026	0.174	55.6 ± 2.6
910	14	2.8e-14	30.9949	4.2e-4	3.9596	0.0750	0.12	0.01826	0.285	64.9 ± 1.3
950	14	2.3e-14	19.4007	1.4e-3	5.0907	0.0375	0.096	0.02885	0.429	61.3 ± 0.9
990	14	6.2e-14	16.0089	1.0e-3	4.3187	0.0273	0.11	0.06369	0.496	58.4 ± 0.4
1030	14	1.9e-13	16.3035	3.3e-4	3.9042	0.0268	0.13	0.16836	0.515	61.8 ± 0.2
1060	14	2.5e-13	12.7139	0.0e+0	3.6392	0.0138	0.13	0.34136	0.678	63.4 ± 0.2
1090	14	8.1e-14	11.0249	0.0e+0	3.6760	0.0075	0.13	0.40762	0.798	64.7 ± 0.2
1120	14	1.3e-13	12.9022	0.0e+0	3.7004	0.0137	0.13	0.50038	0.686	65.0 ± 0.2
1150	14	3.3e-13	12.3657	3.4e-4	3.6465	0.0122	0.13	0.73762	0.709	64.4 ± 0.1
1150	14	1.4e-13	11.5555	0.0e+0	3.6738	0.0097	0.13	0.84268	0.752	63.8 ± 0.2
1180	14	1.7e-13	11.0256	0.0e+0	3.6180	0.0082	0.14	0.97875	0.779	63.2 ± 0.2
1210	14	1.3e-14	11.1569	4.6e-4	4.2519	0.0093	0.12	0.98908	0.754	61.8 ± 0.7
1300	14	1.5e-14	12.0825	0.0e+0	5.6733	0.0123	0.086	1.00000	0.699	62.1 ± 0.7

Total fusion age, TFA= 63.65 ± 0.13 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ 39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB66-62 JS-H-12 hbl J=0.0041358

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
700	14	1.3e-14	43.7451	0.0e+0	3.8877	0.0710	0.13	0.00647	0.521	162.4 ± 2.9
780	14	1.2e-14	43.1053	2.4e-3	1.7443	0.0822	0.28	0.01270	0.436	135.1 ± 3.1
850	14	7.6e-15	20.7441	1.0e-3	2.2319	0.0473	0.22	0.02063	0.326	49.8 ± 2.6
920	14	1.2e-14	13.1212	9.2e-4	5.1216	0.0223	0.096	0.04005	0.498	48.1 ± 1.0
970	14	3.2e-14	8.7524	1.9e-3	5.0953	0.0079	0.096	0.11840	0.732	47.2 ± 0.3
1000	14	5.5e-14	9.4668	1.7e-3	5.0213	0.0079	0.098	0.24437	0.754	52.5 ± 0.2
1030	14	4.5e-14	10.2254	1.2e-3	4.8338	0.0074	0.10	0.33949	0.786	59.0 ± 0.3

1050	14	2.7e-14	9.1387	1.5e-3	4.8144	0.0047	0.10	0.40281	0.848	56.9 ± 0.3
1070	14	4.1e-14	9.1804	1.2e-3	4.7671	0.0046	0.10	0.49920	0.851	57.4 ± 0.2
1100	14	2.2e-14	9.7373	9.0e-4	5.0140	0.0055	0.098	0.54880	0.832	59.5 ± 0.4
1120	14	4.5e-14	10.0400	1.8e-3	4.9329	0.0053	0.099	0.64620	0.843	62.0 ± 0.3
1140	14	1.0e-13	9.8635	1.2e-3	4.7843	0.0043	0.10	0.87559	0.872	63.0 ± 0.2
1160	14	3.9e-14	9.7253	1.2e-3	4.7942	0.0037	0.10	0.96256	0.888	63.3 ± 0.3
1190	14	1.2e-14	9.8423	2.5e-3	5.1334	0.0044	0.095	0.98817	0.868	62.6 ± 0.7
1230	14	3.7e-15	10.9731	5.4e-3	7.3783	0.0085	0.066	0.99552	0.771	62.0 ± 2.3
1300	14	2.7e-15	13.2248	4.3e-3	10.4957	0.0177	0.047	1.00000	0.604	58.6 ± 3.8

Total fusion age, TFA= 59.59 ± 0.14 Ma (including J)

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB66-74 **Har-27 hbl** **J=0.0040847**

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
780	14	2.8e-14	51.9054	0.0e+0	1.0894	0.0791	0.45	0.00519	0.550	198.9 ± 1.6
850	14	8.6e-15	19.9746	1.3e-3	1.4579	0.0455	0.34	0.00931	0.327	47.5 ± 1.8
920	14	2.1e-14	12.3770	9.6e-4	2.9308	0.0151	0.17	0.02594	0.639	57.4 ± 0.5
970	14	8.8e-14	10.1942	5.3e-4	3.1407	0.0049	0.16	0.10852	0.859	63.4 ± 0.2
1000	14	1.5e-13	10.2480	4.3e-4	3.1060	0.0038	0.16	0.24506	0.891	66.1 ± 0.2
1030	14	2.3e-13	9.9482	6.4e-4	3.1141	0.0027	0.16	0.46998	0.920	66.2 ± 0.1
1050	14	1.5e-13	9.3120	7.1e-4	3.1190	0.0014	0.16	0.62750	0.956	64.4 ± 0.1
1070	14	8.3e-14	9.3429	2.9e-4	3.1284	0.0013	0.16	0.71243	0.959	64.9 ± 0.2
1100	14	2.6e-14	10.1003	3.5e-4	3.3362	0.0025	0.15	0.73716	0.928	67.7 ± 0.3
1120	14	2.9e-14	10.9114	9.9e-4	3.7016	0.0034	0.13	0.76270	0.907	71.5 ± 0.3
1140	14	9.3e-14	10.9450	4.4e-4	3.3816	0.0032	0.14	0.84456	0.914	72.3 ± 0.2
1160	14	1.5e-13	10.2330	4.3e-4	3.1380	0.0023	0.16	0.98137	0.934	69.1 ± 0.2
1190	14	1.3e-14	10.2909	5.5e-4	3.2500	0.0033	0.15	0.99371	0.905	67.3 ± 0.5
1300	14	6.8e-15	10.3211	2.6e-3	3.9992	0.0047	0.12	1.00000	0.864	64.6 ± 0.9

Total fusion age, TFA= 67.13 ± 0.14 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB66-66 **JS-H-24 hbl** **J=0.0041141**

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
780	14	1.4e-14	29.3337	0.0e+0	1.0423	0.0419	0.47	0.01050	0.578	121.6 ± 1.6
850	14	3.7e-15	11.8976	0.0e+0	1.8673	0.0250	0.26	0.01761	0.380	33.3 ± 2.0
920	14	5.3e-15	12.0297	0.0e+0	6.8682	0.0244	0.071	0.02758	0.400	35.3 ± 1.3
970	14	7.2e-15	8.2807	1.3e-4	7.2366	0.0128	0.068	0.04743	0.545	33.2 ± 0.8
1000	14	1.5e-14	6.9012	8.2e-4	5.8825	0.0076	0.083	0.09774	0.676	34.3 ± 0.3
1030	14	3.6e-14	5.8219	4.2e-4	5.6819	0.0053	0.086	0.23644	0.730	31.3 ± 0.1
1050	14	2.9e-14	6.1050	1.4e-4	5.2720	0.0033	0.093	0.34326	0.843	37.8 ± 0.2
1070	14	2.5e-14	7.6320	2.5e-4	5.1047	0.0034	0.096	0.41900	0.867	48.4 ± 0.2
1100	14	1.9e-14	7.2805	5.7e-5	5.3079	0.0047	0.092	0.47936	0.808	43.1 ± 0.3
1120	14	2.3e-14	7.6280	1.8e-7	5.4532	0.0052	0.090	0.54782	0.799	44.7 ± 0.3
1140	14	3.7e-14	7.6985	2.9e-4	5.3580	0.0046	0.091	0.65834	0.822	46.4 ± 0.2
1160	14	6.3e-14	7.0909	5.2e-4	5.2298	0.0031	0.094	0.86163	0.871	45.3 ± 0.1
1190	14	3.3e-14	6.8820	4.5e-4	5.2251	0.0027	0.094	0.97078	0.883	44.5 ± 0.2
1300	14	9.3e-15	7.2023	0.0e+0	5.6205	0.0042	0.087	1.00000	0.829	43.8 ± 0.5

Total fusion age, TFA= 42.45 ± 0.11 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB66-68 JS-H-32 hbl J=0.0041075

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
800	14	1.4e-14	15.131	0.0e+0	1.3731	0.0215	0.36	0.02348	0.580	63.9 ± 0.8
880	14	4.7e-15	6.9724	0.0e+0	2.6303	0.0127	0.19	0.04063	0.463	23.8 ± 0.8
950	14	8.9e-15	8.3698	2.1e-3	8.1244	0.0128	0.060	0.06770	0.549	33.7 ± 0.6
990	14	3.9e-14	6.8105	2.3e-3	7.1755	0.0075	0.068	0.21184	0.676	33.8 ± 0.2
1030	14	6.8e-14	6.7225	1.7e-3	6.0340	0.0055	0.081	0.46862	0.760	37.5 ± 0.1
1060	14	6.2e-15	7.3869	2.2e-3	5.8005	0.0074	0.084	0.48984	0.705	38.2 ± 0.8
1100	14	1.8e-14	7.5828	6.5e-4	5.5737	0.0056	0.088	0.54891	0.780	43.3 ± 0.3
1130	14	2.7e-14	7.9456	2.5e-3	5.6789	0.0057	0.086	0.63610	0.787	45.8 ± 0.2
1160	14	7.5e-14	7.3301	2.0e-3	5.3863	0.0037	0.091	0.89607	0.851	45.7 ± 0.1
1190	14	1.9e-14	7.1893	1.5e-3	5.4388	0.0039	0.090	0.96385	0.839	44.2 ± 0.2
1300	14	1.0e-14	7.2636	2.0e-3	5.8460	0.0046	0.084	1.00000	0.813	43.2 ± 0.4

Total fusion age, TFA= 41.11 ± 0.10 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ 39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB64=162 HAR-43 Hbl J=0.0037467

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
700	14	1.5e-14	300.099	1.5e-2	3.5066	0.2696	0.14	0.00096	0.735	1086.1 ± 12.9
800	14	1.2e-14	110.978	5.0e-3	1.6420	0.0724	0.30	0.00291	0.807	522.0 ± 4.1
860	14	3.5e-15	36.3059	0.0e+0	1.5014	0.0416	0.33	0.00471	0.661	155.4 ± 3.4
900	14	1.7e-15	20.4857	2.4e-3	2.7863	0.0364	0.18	0.00624	0.475	64.5 ± 4.1
940	14	1.3e-15	16.3865	1.2e-3	2.0255	0.0309	0.24	0.00769	0.442	48.3 ± 3.8
980	14	1.5e-15	13.2861	2.5e-3	2.7871	0.0229	0.18	0.00977	0.490	43.4 ± 3.0
1020	14	2.6e-15	11.2722	2.7e-3	3.3195	0.0164	0.15	0.01413	0.569	42.8 ± 1.5
1060	14	7.6e-15	8.1162	1.5e-3	4.3069	0.0086	0.11	0.03167	0.687	37.3 ± 0.5
1100	14	2.5e-14	6.8449	1.5e-3	3.9192	0.0041	0.13	0.09921	0.821	37.6 ± 0.2
1140	14	6.4e-14	6.5762	1.6e-3	3.8082	0.0025	0.13	0.28112	0.887	39.0 ± 0.1
1180	14	5.6e-14	6.8135	1.4e-3	3.6539	0.0015	0.13	0.43519	0.933	42.5 ± 0.1
1230	14	6.2e-14	6.9478	1.4e-3	3.6987	0.0017	0.13	0.60107	0.927	43.0 ± 0.1
1290	14	1.4e-13	6.8175	1.1e-3	3.6563	0.0011	0.13	0.98981	0.954	43.4 ± 0.1
1350	14	2.2e-15	7.8790	4.4e-3	4.5909	0.0045	0.11	0.99504	0.831	43.7 ± 1.3
1450	14	2.4e-15	9.1902	0.0e+0	6.0951	0.0076	0.08	1.00000	0.755	46.3 ± 1.4

Total fusion age, TFA= 44.58 ± 0.09 Ma (including J)

Weighted mean plateau age, WMPA= 43.30 ± 0.10 Ma (including J)

Inverse isochron age = 43.72 ± 0.46 Ma. (MSWD = 3.91; 40Ar/36Ar = 244.9 ± 52.4)

Steps used: 1230, 1290, 1350, (12–14/15 or 56% Σ 39Ar

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ 39Ar is cumulative, 40Ar* = rad fraction.

Biotite data:

Sample: SB64-166 Har-68A Bio J=0.0037117

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
650	14	2.3e-15	34.8697	1.3e-2	1.1011	0.1164	0.44	0.00345	0.014	3.1 ± 5.5
730	14	3.9e-15	14.2670	1.8e-3	0.2372	0.0247	2.1	0.01788	0.488	46.0 ± 1.1
800	14	1.4e-14	10.7635	0.0e+0	0.0663	0.0061	7.4	0.08695	0.832	59.0 ± 0.3
850	14	2.4e-14	10.3321	0.0e+0	0.0239	0.0023	21	0.20710	0.936	63.6 ± 0.2
900	14	2.8e-14	10.1879	0.0e+0	0.0165	0.0012	30	0.35203	0.966	64.7 ± 0.2
950	14	1.4e-14	10.3452	0.0e+0	0.0440	0.0018	11	0.42355	0.949	64.6 ± 0.2
1000	14	9.6e-15	10.5074	0.0e+0	0.1300	0.0023	3.8	0.47169	0.936	64.7 ± 0.3
1050	14	1.2e-14	10.6228	0.0e+0	0.3523	0.0027	1.4	0.53167	0.926	64.7 ± 0.3
1100	14	1.9e-14	10.7732	0.0e+0	0.6253	0.0021	0.78	0.62581	0.942	66.7 ± 0.2
1150	14	5.0e-14	10.5889	4.5e-4	1.1273	0.0014	0.43	0.87717	0.961	66.9 ± 0.2

1210	14	2.1e-14	10.3976	0.0e+0	0.4510	0.0017	1.1	0.98636	0.951	65.0 ± 0.2
1270	14	3.0e-15	11.5861	0.0e+0	1.7218	0.0062	0.28	1.00000	0.841	64.1 ± 0.9

Total fusion age, TFA= 64.46 ± 0.12 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: Har-102 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
680	12	3.4e-14	8.7666	0.0e+0	0.0087	0.0029	56	0.18009	0.901	45.4 ± 0.1
760	12	5.8e-14	8.4019	0.0e+0	0.0080	0.0009	61	0.50251	0.967	46.7 ± 0.1
840	12	2.2e-14	8.3841	0.0e+0	0.0276	0.0014	18	0.62535	0.950	45.8 ± 0.2
920	12	1.4e-14	8.5047	0.0e+0	0.0202	0.0021	24	0.70295	0.928	45.4 ± 0.2
1000	12	1.5e-14	8.6231	0.0e+0	0.0004	0.0016	1096	0.78492	0.944	46.7 ± 0.2
1080	12	3.2e-14	8.5979	0.0e+0	0.0082	0.0011	60	0.95661	0.963	47.6 ± 0.2
1160	12	7.7e-15	8.9832	0.0e+0	0.0140	0.0021	35	0.99673	0.930	48.0 ± 0.3
1250	12	9.5e-16	13.5178	6.0e-4	0.3267	0.0218	1.5	1.00000	0.524	40.8 ± 4.2

Total fusion age, TFA= 46.43 ± 0.12 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: SB61-42 Har-26 bio J=0.0033127

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
600	12	6.3e-14	6.7382	1.1e-4	0.0300	0.0132	16	0.06727	0.419	16.8 ± 0.1
660	12	7.3e-14	5.9000	0.0e+0	0.0125	0.0051	39	0.15622	0.746	26.1 ± 0.1
700	12	7.9e-14	5.8996	0.0e+0	0.0085	0.0030	58	0.25250	0.850	29.7 ± 0.1
740	12	9.2e-14	5.8820	0.0e+0	0.0074	0.0020	67	0.36515	0.898	31.3 ± 0.1
780	12	6.2e-14	5.9260	0.0e+0	0.0076	0.0019	65	0.44012	0.905	31.8 ± 0.1
830	12	4.5e-14	6.1454	0.0e+0	0.0106	0.0027	46	0.49303	0.872	31.7 ± 0.1
890	12	5.3e-14	6.1861	0.0e+0	0.0155	0.0030	32	0.55542	0.859	31.5 ± 0.1
950	12	6.0e-14	6.3510	0.0e+0	0.0218	0.0041	23	0.62373	0.808	30.4 ± 0.1
980	12	5.4e-14	6.0664	0.0e+0	0.0126	0.0033	39	0.68740	0.841	30.2 ± 0.1
1010	12	6.1e-14	5.8608	0.0e+0	0.0109	0.0025	45	0.76289	0.876	30.4 ± 0.1
1040	12	7.4e-14	5.8336	0.0e+0	0.0112	0.0019	44	0.85406	0.903	31.2 ± 0.1
1070	12	6.7e-14	5.9455	0.0e+0	0.0241	0.0017	20	0.93505	0.915	32.2 ± 0.1
1120	12	4.1e-14	6.0486	0.0e+0	0.1076	0.0014	4.6	0.98391	0.931	33.3 ± 0.1
1200	12	1.4e-14	6.4271	0.0e+0	0.3173	0.0020	1.5	1.00000	0.909	34.6 ± 0.2

Total fusion age, TFA= 29.81 ± 0.08 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.

Sample: Har-103B bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
680	12	2.2e-14	6.3773	0.0e+0	0.0179	0.0060	27	0.23117	0.721	26.6 ± 0.1
760	12	1.9e-14	6.0537	0.0e+0	0.0041	0.0035	119	0.44072	0.828	28.9 ± 0.1
840	12	8.5e-15	6.5682	0.0e+0	0.0559	0.0057	8.8	0.52583	0.744	28.2 ± 0.2
920	12	9.5e-15	6.6485	0.0e+0	0.0790	0.0065	6.2	0.62037	0.709	27.2 ± 0.2
1000	12	1.6e-14	6.7791	0.0e+0	0.1196	0.0054	4.1	0.77627	0.763	29.9 ± 0.2
1080	12	1.7e-14	6.3157	0.0e+0	0.0833	0.0035	5.9	0.95559	0.836	30.5 ± 0.1
1160	12	4.0e-15	7.2640	0.0e+0	0.1619	0.0053	3.0	0.99219	0.785	32.9 ± 0.5
1250	12	1.3e-15	10.8130	0.0e+0	0.3789	0.0140	1.3	1.00000	0.618	38.5 ± 2.3

Total fusion age, TFA= 28.81 ± 0.09 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.
 $\Sigma^{39}\text{Ar}$ is cumulative, $^{40}\text{Ar}^*$ = rad fraction.

Sample: Har-105 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	$\Sigma^{39}\text{Ar}$	$^{40}\text{Ar}^*$	Age (Ma)
670	12	1.9e-14	4.1147	0.0e+0	0.0209	0.0039	23	0.15363	0.719	17.1 ± 0.1
750	12	2.5e-14	3.3895	0.0e+0	0.0166	0.0011	30	0.40256	0.905	17.8 ± 0.1
870	12	1.2e-14	3.7599	0.0e+0	0.0397	0.0024	12	0.50826	0.813	17.7 ± 0.1
980	12	1.5e-14	4.3154	0.0e+0	0.2169	0.0037	2.3	0.62525	0.746	18.6 ± 0.1
1070	12	2.6e-14	3.7496	0.0e+0	0.1045	0.0016	4.7	0.86262	0.870	18.9 ± 0.1
1250	12	1.4e-14	3.5134	0.0e+0	0.0947	0.0013	5.2	1.00000	0.887	18.0 ± 0.1

Total fusion age, TFA= 18.07 ± 0.05 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced ^{40}Ar .

Ratios are corrected for blanks, decay, and interference.

$\Sigma^{39}\text{Ar}$ is cumulative, $^{40}\text{Ar}^*$ = rad fraction.

Sample: Har-100 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	$\Sigma^{39}\text{Ar}$	$^{40}\text{Ar}^*$	Age (Ma)
670	12	2.3e-14	4.7319	0.0e+0	0.0274	0.0058	18	0.11427	0.636	17.4 ± 0.1
750	12	3.2e-14	3.7562	0.0e+0	0.0138	0.0021	35	0.31565	0.837	18.2 ± 0.1
870	12	2.1e-14	4.6033	0.0e+0	0.0262	0.0050	19	0.42531	0.681	18.1 ± 0.1
980	12	2.4e-14	4.1623	0.0e+0	0.0387	0.0036	13	0.56149	0.747	18.0 ± 0.1
1070	12	4.1e-14	3.5849	0.0e+0	0.0130	0.0015	38	0.83305	0.876	18.2 ± 0.1
1250	12	2.5e-14	3.5839	0.0e+0	0.0470	0.0012	10	1.00000	0.902	18.7 ± 0.1

Total fusion age, TFA= 18.16 ± 0.05 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced ^{40}Ar .

Ratios are corrected for blanks, decay, and interference.

$\Sigma^{39}\text{Ar}$ is cumulative, $^{40}\text{Ar}^*$ = rad fraction.

Sample: Har-83 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	$\Sigma^{39}\text{Ar}$	$^{40}\text{Ar}^*$	Age (Ma)
670	12	1.4e-14	3.3529	0.0e+0	0.0284	0.0018	17	0.10312	0.845	16.4 ± 0.1
750	12	2.4e-14	3.0318	0.0e+0	0.0262	0.0006	19	0.29205	0.939	16.5 ± 0.1
870	12	1.4e-14	3.1126	0.0e+0	0.0400	0.0008	12	0.39776	0.920	16.6 ± 0.1
980	12	1.5e-14	3.2091	0.0e+0	0.1083	0.0010	4.5	0.50854	0.906	16.8 ± 0.1
1070	12	3.2e-14	3.0083	0.0e+0	0.0239	0.0005	21	0.76121	0.949	16.5 ± 0.1
1250	12	3.0e-14	3.0365	0.0e+0	0.0616	0.0005	8.0	1.00000	0.953	16.8 ± 0.1

Total fusion age, TFA= 16.61 ± 0.05 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced ^{40}Ar .

Ratios are corrected for blanks, decay, and interference.

$\Sigma^{39}\text{Ar}$ is cumulative, $^{40}\text{Ar}^*$ = rad fraction.

Sample: Har-80 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	$\Sigma^{39}\text{Ar}$	$^{40}\text{Ar}^*$	Age (Ma)
670	12	2.0e-14	3.8073	0.0e+0	0.0236	0.0035	21	0.09607	0.732	16.1 ± 0.1
750	12	2.6e-14	3.1483	0.0e+0	0.0240	0.0011	20	0.24886	0.901	16.4 ± 0.1
870	12	1.6e-14	3.4269	0.0e+0	0.0724	0.0020	6.8	0.33341	0.824	16.4 ± 0.1
980	12	1.9e-14	3.3805	0.0e+0	0.1641	0.0018	3.0	0.43713	0.841	16.5 ± 0.1
1070	12	4.2e-14	3.1169	0.0e+0	0.0139	0.0010	35	0.68581	0.901	16.3 ± 0.1
1250	12	5.3e-14	3.0694	0.0e+0	0.0368	0.0008	13	1.00000	0.919	16.3 ± 0.0

Total fusion age, TFA= 16.33 ± 0.04 Ma (including J)

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced ^{40}Ar .

Ratios are corrected for blanks, decay, and interference.

$\Sigma^{39}\text{Ar}$ is cumulative, $^{40}\text{Ar}^*$ = rad fraction.

Sample: Har-112 bio J=0.0032260

T	t	40(mol)	40/39	38/39	37/39	36/39	K/Ca	Σ 39Ar	40Ar*	Age (Ma)
670	12	2.6e-14	5.5718	0.0e+0	0.0231	0.0113	21	0.12688	0.398	12.9 ± 0.1
750	12	2.7e-14	4.0702	0.0e+0	0.0214	0.0051	23	0.30703	0.629	14.8 ± 0.1
870	12	2.7e-14	6.6346	0.0e+0	0.0561	0.0144	8.7	0.41718	0.357	13.7 ± 0.1
980	12	2.6e-14	5.6117	0.0e+0	0.1449	0.0109	3.4	0.54662	0.425	13.8 ± 0.1
1070	12	2.8e-14	3.9728	0.0e+0	0.0609	0.0050	8.0	0.74265	0.625	14.4 ± 0.1
1250	12	3.1e-14	3.3070	0.0e+0	0.0707	0.0023	6.9	1.00000	0.791	15.2 ± 0.1

Total fusion age, TFA= 14.33 ± 0.05 Ma (including J)

Weighted mean plateau age, WMPA= 14.72 ± 0.05 Ma (including J)

Inverse isochron age =15.34 ± 0.21 Ma. (MSWD =15.49; 40Ar/36Ar=273.6 ± 5.5)

Steps used: 750, 870, 980, 1070, 1250, (2–6/6 or 87% Σ 39Ar

t = dwell time in minutes.

40(mol) = moles corrected for blank and reactor-produced 40.

Ratios are corrected for blanks, decay, and interference.

Σ39Ar is cumulative, 40Ar* = rad fraction.