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Title of article Late Cretaceous extension in the hinterland of the Sevier thrust belt, northwest Utah and southern Idaho

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Table 1. $^{40}Ar/^{39}Ar$ analytical data for incremental heating experiments on muscovite concentrates from the Raft River-Albion-Grouse Creek Complex, Utah-Idaho.

Release temp (°C)	$(^{40}Ar/^{39}Ar)^*$	$(^{36}Ar/^{39}Ar)^*$	$(^{37}Ar/^{39}Ar)^c$	^{39}Ar % of total	$\%^{40}Ar$ non-atmos.$^+$	$^{36}Ar_{Ca}$ %	Apparent Age (Ma)**
			Raft River Mountains				
Sample 1: J = 0.009705							
450	7.94	0.01552	0.372	0.60	42.53	0.65	58.2 ± 2.9
550	4.25	0.00171	0.417	1.47	88.73	6.61	64.8 ± 1.1
650	5.03	0.00091	0.021	4.28	94.58	0.62	81.5 ± 0.5
700	5.11	0.00040	0.005	19.04	97.59	0.33	85.3 ± 0.1
740	4.77	0.00020	0.007	16.94	98.68	0.95	80.6 ± 0.2
780	4.63	0.00025	0.009	11.38	98.27	0.97	77.9 ± 0.3
820	4.73	0.00031	0.013	7.41	97.93	1.11	79.4 ± 0.8
865	4.77	0.00031	0.010	10.97	97.99	0.93	80.0 ± 0.5
925	4.87	0.00018	0.007	15.23	98.79	1.08	82.3 ± 0.2
Fusion	5.00	0.00034	0.011	12.69	97.90	0.91	83.7 ± 0.3
Total	4.88	0.00042	0.017	100.00	97.56	0.93	81.3 ± 0.3
Total without 450-550°C				97.94			81.7 ± 0.2
Sample 2: J = 0.009735							
500	6.47	0.00922	0.423	1.47	58.33	1.25	65.1 ± 1.8
600	4.81	0.00137	0.271	3.29	91.90	5.37	76.1 ± 0.8
675	5.40	0.00144	0.011	13.24	92.04	0.21	85.2 ± 0.4
715	5.25	0.00068	0.007	20.30	96.06	0.29	86.5 ± 0.4
750	5.32	0.00062	0.014	8.92	96.48	0.64	87.9 ± 0.9
790	5.25	0.00065	0.016	9.35	96.27	0.69	86.6 ± 0.5
830	5.33	0.00066	0.021	6.58	96.28	0.87	87.9 ± 0.6
880	5.35	0.00057	0.010	15.03	96.78	0.50	88.8 ± 0.3
Fusion	5.38	0.00029	0.008	21.82	98.29	0.75	90.6 ± 0.3
Total	5.33	0.00082	0.026	100.00	95.50	0.70	87.1 ± 0.4
Total without 500-600°C				95.24			87.8 ± 0.3

Table 1. Continued (page 2).

Sample 3: J = 0.009655

500	5.63	0.00632	0.018	2.47	66.76	0.08	64.3 ± 0.4
575	4.56	0.00053	0.008	1.95	96.47	0.42	75.1 ± 0.4
625	4.72	0.00035	0.025	2.81	97.72	1.93	78.5 ± 0.5
665	5.08	0.00065	0.014	6.21	96.11	0.58	83.1 ± 0.3
705	5.42	0.00065	0.015	7.63	96.35	0.64	88.8 ± 0.5
740	5.41	0.00041	0.010	16.12	97.68	0.69	89.7 ± 0.6
775	5.33	0.00043	0.012	12.12	97.55	0.77	88.3 ± 0.6
810	5.43	0.00036	0.011	10.71	97.95	0.86	90.3 ± 0.5
850	5.46	0.00036	0.015	13.68	97.99	1.17	90.9 ± 0.3
900	5.55	0.00030	0.002	14.34	98.28	0.22	92.6 ± 0.2
975	5.54	0.00035	0.014	10.87	98.07	1.14	92.2 ± 0.3
1050	6.13	0.00415	0.134	0.93	80.07	0.88	83.6 ± 1.3
Fusion	28.35	0.07343	1.061	0.16	23.74	0.39	113.7 ± 9.2
Total	5.44	0.00071	0.015	100.00	96.59	0.77	88.7 ± 0.4
Total without 500-665°C, 1050°C and fusion				85.47			90.4 ± 0.3

Sample 4: J = 0.009721

500	8.76	0.01465	2.325	2.30	52.67	4.32	79.3 ± 1.4
600	5.15	0.00083	0.058	5.02	95.24	1.90	84.0 ± 0.4
660	5.62	0.00154	0.020	12.24	91.81	0.34	88.3 ± 0.2
700	5.23	0.00029	0.007	20.13	98.25	0.67	88.0 ± 0.2
733	5.26	0.00022	0.018	9.85	98.67	2.20	88.8 ± 0.5
770	5.32	0.00040	0.021	9.40	97.70	1.40	89.0 ± 0.6
815	5.33	0.00059	0.021	9.16	96.63	0.97	88.1 ± 0.3
860	5.34	0.00058	0.025	7.43	96.74	1.17	88.3 ± 0.4
915	5.33	0.00053	0.015	9.55	96.99	0.76	88.5 ± 0.4
990	5.36	0.00043	0.018	13.55	97.53	1.13	89.4 ± 0.3
Fusion	6.73	0.00566	0.113	1.36	75.20	0.55	86.6 ± 2.2
Total	5.43	0.00097	0.073	100.00	95.46	1.13	88.0 ± 0.4
Total without 500-600°C and fusion				91.32			88.5 ± 0.3

Table 1. Continued (page 3).

Black Pine Mts.

Sample 8: J = 0.008532

425	26.28	0.05369	0.120	0.21	39.65	0.06	153.6 ± 40.2
440	15.84	0.04038	0.018	0.21	24.63	0.01	59.0 ± 43.1
455	11.75	0.02194	0.017	0.31	44.77	0.02	79.2 ± 20.1
480	10.37	0.01154	0.034	1.28	67.09	0.08	104.0 ± 3.5
500	8.47	0.00223	0.017	3.20	92.17	0.21	116.3 ± 4.6
520	9.40	0.00296	0.011	10.14	90.63	0.10	126.5 ± 6.8
540	11.47	0.00218	0.099	10.82	88.62	0.22	137.2 ± 4.3
560	10.80	0.00380	0.002	15.36	89.55	0.02	143.1 ± 1.4
575	10.24	0.00126	0.003	6.93	96.30	0.07	145.7 ± 1.7
595	10.26	0.00153	0.004	5.50	95.55	0.06	144.9 ± 1.1
610	10.23	0.00155	0.001	4.23	95.48	0.02	144.4 ± 2.2
635	10.30	0.00243	0.007	2.66	93.10	0.06	140.4 ± 3.9
665	10.29	0.00213	0.025	2.71	93.86	0.32	142.8 ± 4.7
700	10.15	0.00117	0.003	4.91	96.53	0.06	144.8 ± 2.6
750	10.25	0.00139	0.002	27.80	95.93	0.03	145.4 ± 0.7
Fusion	15.45	0.01728	0.014	3.73	66.91	0.02	152.4 ± 5.3
Total	10.57	0.00416	0.016	100.00	89.26	0.08	138.1 ± 4.1
Total without 425-540°C and fusion				70.10			144.3 ± 1.5

*measured.

[c]corrected for post-irradiation decay of ^{37}Ar (35.1 day 1/2-life).

+$[^{40}Ar_{tot.} - (^{36}Ar_{atmos.})(295.5)] / {}^{40}Ar_{tot.}$

**calculated using correction factors of Dalrymple et al. (1981); two sigma, intralaboratory errors.

Table 2. $^{40}Ar/^{39}Ar$ analytical data for incremental heating experiments on whole-rock slate samples from the Raft River-Albion-Grouse Creek Complex, Utah-Idaho.

Release temp (°C)	$(^{40}Ar/^{39}Ar)^*$	$(^{36}Ar/^{39}Ar)^*$	$(^{37}Ar/^{39}Ar)^c$	^{39}Ar % of total	$\%^{40}Ar$ non-atmos.+	$^{36}Ar_{Ca}$ %	Apparent Age (Ma)**
Raft River Mountains							
Sample 5: J = 0.009365							
350	32.33	0.09297	0.129	1.37	15.04	0.04	80.4 ± 7.4
400	4.17	0.00542	0.064	0.45	61.58	0.32	42.9 ± 3.1
450	3.48	0.00195	0.035	2.92	83.35	0.49	48.3 ± 1.3
490	3.26	0.00120	0.022	5.50	88.99	0.49	48.4 ± 1.0
530	3.31	0.00095	0.008	6.09	91.32	0.23	50.3 ± 0.7
565	3.35	0.00055	0.016	8.90	95.02	0.79	53.0 ± 0.7
605	3.43	0.00024	0.018	6.93	97.77	1.99	55.8 ± 0.6
645	3.61	0.00020	0.043	9.80	98.28	5.82	58.9 ± 0.5
685	3.93	0.00018	0.011	13.33	98.55	1.67	64.2 ± 0.4
725	4.31	0.00014	0.013	11.51	98.90	2.55	70.7 ± 0.6
765	4.57	0.00016	0.015	12.92	98.86	2.50	74.8 ± 0.4
815	4.88	0.00018	0.011	14.84	98.80	1.71	79.7 ± 0.2
Fusion	5.12	0.00061	0.037	4.44	96.41	1.63	81.5 ± 0.9
Total	4.44	0.00173	0.020	100.00	95.09	2.00	65.0 ± 0.6
Black Pine Mts.							
Sample 6: J = 0.009615							
350	26.40	0.07182	0.095	4.42	19.61	0.04	87.7 ± 4.5
400	6.68	0.00226	0.072	7.26	90.01	0.87	101.4 ± 0.6
450	6.41	0.00082	0.083	9.60	96.23	2.74	103.9 ± 0.7
490	5.79	0.00092	0.067	7.24	95.31	2.00	93.2 ± 1.3
530	5.86	0.00043	0.061	9.82	97.83	3.91	96.8 ± 1.9
570	5.80	0.00034	0.065	8.89	98.26	5.22	96.2 ± 1.8
920	5.91	0.00079	0.059	11.26	96.03	2.02	95.8 ± 1.4
670	6.13	0.00099	0.070	13.80	95.24	1.93	98.5 ± 1.3
720	6.29	0.00032	0.076	11.82	98.50	6.43	104.4 ± 0.5
750	6.43	0.00036	0.245	3.53	98.02	2.33	110.3 ± 3.3
850	6.77	0.00030	0.121	6.79	98.04	3.22	113.9 ± 2.4
Fusion	7.54	0.00075	0.146	5.57	97.15	5.30	122.8 ± 2.5
Total	7.14	0.00385	0.084	100.00	93.28	76.45	101.1 ± 1.6

Table 2. Continued (page 2).

Sample 7: J = 0.009095

350	33.95	0.09567	0.080	2.68	16.72	0.02	90.8 ± 5.3
400	6.60	0.00257	0.017	18.17	88.44	0.18	93.4 ± 0.7
450	7.07	0.00061	0.022	18.40	97.41	1.01	109.7 ± 0.6
485	7.22	0.00027	0.023	15.79	98.86	2.31	113.5 ± 0.6
520	7.89	0.00101	0.031	13.35	96.17	0.82	120.4 ± 0.4
555	8.56	0.00108	0.057	7.19	96.27	1.43	130.4 ± 1.2
590	8.86	0.00161	0.080	6.33	94.63	1.35	132.5 ± 1.7
630	8.93	0.00038	0.081	6.02	98.74	5.75	139.1 ± 1.3
680	9.54	0.00076	0.131	3.81	97.69	4.68	146.8 ± 2.1
730	10.18	0.00083	0.302	1.75	97.78	9.94	156.4 ± 3.3
790	10.03	0.00083	0.193	2.07	97.65	6.32	154.0 ± 6.1
870	9.51	0.00036	0.161	3.41	98.95	12.10	148.2 ± 2.3
970	5.11	0.01045	0.399	0.48	98.03	10.01	130.2 ± 3.2
Fusion	21.49	0.06140	1.031	0.56	15.94	0.46	55.4 ± 51.2
Total	8.54	0.00388	0.058	100.00	93.43	2.13	117.2 ± 1.2

Sample 9: J = 0.008510

430	10.14	0.01467	0.007	2.15	57.19	0.01	86.9 ± 26.5
455	7.24	0.00519	0.006	5.59	74.64	0.02	84.1 ± 6.8
480	6.15	0.00152	0.012	15.27	92.60	0.21	85.4 ± 3.4
495	6.35	0.00204	0.003	11.29	90.43	0.04	86.1 ± 3.2
510	6.37	0.00081	0.004	29.50	96.18	0.13	91.7 ± 1.4
535	6.77	0.00072	0.001	22.40	96.76	0.05	97.9 ± 1.9
560	7.77	0.00319	0.004	7.34	87.77	0.04	101.7 ± 4.1
585	11.18	0.00846	0.030	2.73	77.62	0.10	128.6 ± 12.6
625	12.26	0.00742	0.022	1.63	82.09	0.08	148.2 ± 14.3
Fusion	12.37	0.01072	0.006	2.11	74.35	0.01	135.9 ± 21.4
Total	7.20	0.00317	0.005	100.00	90.91	0.09	93.4 ± 5.9

Table 2. Continued (page 3).

Sample 10: J = 0.008801

425	13.46	0.03561	0.083	2.04	21.73	0.06	45.9 ± 7.2
440	10.10	0.01126	0.038	2.67	67.01	0.09	104.3 ± 3.3
455	9.68	0.00682	0.009	3.28	79.12	0.04	117.6 ± 4.3
470	9.16	0.00106	0.002	6.17	96.51	0.06	135.2 ± 1.4
480	9.92	0.00105	0.004	7.27	96.83	0.11	146.4 ± 2.3
490	10.56	0.00088	0.005	10.35	97.48	0.16	156.4 ± 1.8
500	11.24	0.00138	0.012	2.31	96.32	0.24	164.1 ± 2.9
510	11.23	0.00111	0.006	2.82	97.02	0.15	165.1 ± 2.9
520	11.36	0.00093	0.002	4.90	97.53	0.07	167.8 ± 1.1
535	11.67	0.00046	0.005	21.29	98.79	0.28	174.3 ± 0.6
560	12.32	0.00074	0.004	13.14	98.17	0.15	182.4 ± 0.6
590	12.75	0.00045	0.005	9.67	98.92	0.29	189.9 ± 0.9
625	13.34	0.00120	0.004	4.76	97.31	0.09	195.2 ± 1.3
680	13.91	0.00159	0.015	4.11	96.59	0.25	201.6 ± 3.0
Fusion	18.55	0.01290	0.289	5.21	79.54	0.61	220.3 ± 2.0
Total	11.88	0.00263	0.019	100.00	93.91	0.20	167.9 ± 1.5

*measured.

[c]corrected for post-irradiation decay of ^{37}Ar (35.1 day 1/2-life).

+$[^{40}Ar_{tot.} - (^{36}Ar_{atmos.})(295.5)] / {}^{40}Ar_{tot.}$

**calculated using correction factors of Dalrymple et al. (1981); two sigma, intralaboratory errors.

Table 3. Localities and descriptions of geochronologic samples from the Raft River Mountains, northwest Utah, and the Black Pine Mountains, southern Idaho.

RAFT RIVER MOUNTAINS

Sample #	*Material*	*Sample Description*	*Location*
1	Muscovite	Ordovician Garden City Fm. Calcitic marble. Calcite, minor quartz, muscovite, and opaques.	T14N R12W SW$^1/_4$ NE $^1/_4$ Sec. 34 113° 12' 10" W, 41° 54' 55" N
2	Muscovite	Schist tentatively correlated to lower Garden City Fm. Muscovite, biotite, microcline, quartz, calcite and minor apatite and zircon.	T14 N R12W NE$^1/_4$ NW$^1/_4$ Sec. 34 113° 12' 22" W41° 54' 18" N
3	Muscovite	Ordovician Garden City Fm. Calcitic marble. Calcite, quartz, microcline, and muscovite.	T14N R12W SW$^1/_4$ NW$^1/_4$ Sec. 26 113° 11' 16" W41° 54' 48" N
4	Muscovite	Calcitic marble tectonite separating Ordovician-Silurian dolomite from Pennsylvanian Oquirrh (?) marble. Calcite, muscovite, opaques, and quartz.	T14N R12W SW$^1/_4$ NE$^1/_4$ Sec. 23 113° 10' 55" W41° 55' 49"
5	Whole-rock	Phyllite from Swan Peak Fm., Kanosh equivalent. Muscovite, quartz, biotite, and minor staurolite.	T14N R12W SE$^1/_4$ SE$^1/_4$ Sec.13 113° 10' 00" W 41° 56' 15"

Table 3. Continued (page 2).

BLACK PINE MOUNTAINS

Sample #	*Material*	*Sample Description*	*Location*
6	Whole-rock	Upper Mississippian-Lower Pennsylvanian, Manning Canyon Shale. Carbonaceous, slaty argillite.	T15S R29E SW$^1/_4$ NW$^1/_4$ Sec. 30 113° 6' 52" W42° 6' 10" N
7	Whole-rock	Upper Mississippian-Lower Pennsylvanian, Manning Canyon Shale. Carbonaceous, slaty argillite.	T15S R29E SE$^1/_4$ NW$^1/_4$ Sec. 19 113° 6' 34" W42° 8' 40" N
8	Muscovite	Contact metamorphosed Manning Canyon Shale, with ~ 30% randomly oriented coarse-grained muscovite by volume.	T15S R29E NE$^1/_4$ NE$^1/_4$ Sec. 30 113° 6' 3" W42° 6' 50" N
9	Whole-rock	Upper Mississippian-Lower Pennsylvanian, Manning Canyon Shale. Carbonaceous, slaty argillite. Sample is 2 meters above low-angle fault separating Manning Canyon Shale from Devonian Guilmette (and locally Kinderhookian limestone).	T15S R29E NW$^1/_4$ NW$^1/_4$ Sec. 33 113° 4' 37" W42° 4' 55" N
10	Whole-rock	Upper Mississippian-Lower Pennsylvanian, Manning Canyon Shale. Carbonaceous, slaty argillite.	T15S R29E C. N$^1/_2$ Sec. 28 113° 4' 10" W 42° 6' 37"