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Supplemental Material

1. Supplemental Figures

Figure S1. (a) SiO₂ versus La and (b) Rb versus Th diagrams, showing trends of S-type granites.

Figure S2. Major and trace elements versus B correlations.

Figure S3. (a) Pressure–temperature conditions for partial melting of crustal rocks; (b) La/Yb vs Sr/Y binary plot.

Figure S4. (a) Rb/Sr versus Sr and (b) Rb/Sr versus Ba diagrams.

2. Supplemental Tables

Table S1. SIMS U-Pb data

Table S2. Major (wt%) and trace element (ppm) and Sr-Nd-B isotope data for the Diancangshan-Ailaoshan strongly peraluminous granites

Table S3. In situ zircon Hf-O isotope data

1. SUPPLEMENTAL FIGURES

Figure S1. (a) SiO₂ versus La and (b) Rb versus Th diagrams from Chappell (1999), showing trends of S-type granites.

Figure S2. Major and trace elements versus B correlation for the Diancangshan-Ailaoshan strongly peraluminous granites.

Figure S3. (a) Pressure–temperature conditions for partial melting of crustal rocks after Wang et al. (2016). Curves or lines for melting or mineral stability: (1) H₂O-saturated or wet solidus curve of crustal rocks (Patiño Douce, 2005; Xiong et al., 2005); (2) dehydration solidi curve for crustal rocks (Patiño Douce and Harris, 1998); (3) dry solidus curve (Qian and Hermann, 2013); (4) garnet-in/out curve during dehydration melting of metabasalts (Nair and Chacko, 2008; Patiño Douce, 2005; Patiño Douce and Harris, 1998; Rapp and Watson, 1995; Rapp et al., 2003; Xiong et al., 2005); (5) garnet proportion contours (5 and 20 wt %) in the residue of metabasalt melting (Nair and Chacko, 2008); (6) rutile-in/out curve (Xiong et al., 2005); (7) plagioclase-in (beneath curve)/out (above curve) curve during dehydration melting (Qian and Hermann, 2013; Rapp et al., 2003); (8) orthopyroxene-in (beneath curve)/out (above curve) curve during dehydration melting (Qian and Hermann, 2013); (9) the boundary line for garnet-bearing (above line) and cordierite-rich (beneath line) melts during dehydration melting of metasedimentary rocks (Clemens and Wall, 1981; Green, 1977); (10) upper thermal stability of F-free mica in pelite, wacke, mica schist and tonalite (Patiño Douce, 2005; Patiño Douce and Harris, 1998). (b) La/Yb vs Sr/Y binary plot after Wang et al. (2016). This diagram indicates the effects of residual garnet (Grt) and plagioclase (Pl) during partial melting. Field 1: adakitic melts derived from eclogitic rocks in the stability field of garnet with little or no plagioclase; Field 2: crustal melts in the stability field of plagioclase and garnet; Field 3: crustal melts in the stability field of plagioclase with little or no garnet.

Figure S4. (a) Rb/Sr versus Sr and (b) Rb/Sr versus Ba (Inger and Harris, 1993; Weinberg and Hasalová, 2015) diagrams, showing the trend of vapor-absent muscovite-dehydration melting.

2. SUPPLEMENTAL TABLES

Table S1. SIMS U-Pb data for the Diancangshan-Ailaoshan strongly peraluminous granites.

ANALYSIS	Content (ppm)		Th/U	Isotopic ratios						Isotopic ages (Ma)						
	Th	U		²⁰⁷ Pb/ ²⁰⁶ Pb	±1□(%)	²⁰⁷ Pb/ ²³⁵ U	±1□(%)	²⁰⁶ Pb/ ²³⁸ U	±1□(%)	²⁰⁷ Pb/ ²⁰⁶ Pb	±1□	²⁰⁷ Pb/ ²³⁵ U	±1□	²⁰⁶ Pb/ ²³⁸ U	±1□	
Two mica granite																
XD31@01	241	852	0.28	0.05142	0.48	0.29024	1.70	0.04094	1.63	260	11	259	4	259	4	
XD31@03	628	339	1.85	0.05857	0.52	0.63412	1.98	0.07852	1.91	551	11	499	8	487	9	
XD31@04	60	244	0.24	0.05189	1.82	0.28751	2.36	0.04018	1.50	281	41	257	5	254	4	
XD31@05	91	474	0.19	0.05141	1.09	0.28340	1.89	0.03998	1.54	259	25	253	4	253	4	
XD31@06	103	502	0.21	0.05164	0.86	0.27542	1.73	0.03868	1.50	269	20	247	4	245	4	
XD31@07	96	340	0.28	0.05121	0.78	0.28092	1.75	0.03979	1.56	250	18	251	4	252	4	
XD31@10	141	338	0.42	0.15929	0.65	5.15494	3.32	0.23471	3.25	2448	11	1845	29	1359	40	
XD31@11	54	306	0.18	0.05131	0.87	0.27298	1.79	0.03859	1.56	255	20	245	4	244	4	
XD31@12	149	395	0.38	0.05120	0.99	0.27113	2.24	0.03841	2.01	250	23	244	5	243	5	
XD31@13	340	228	1.49	0.07047	0.51	1.33733	1.66	0.13764	1.58	942	11	862	10	831	12	
XD31@14	80	470	0.17	0.05082	0.95	0.27787	1.94	0.03966	1.69	233	22	249	4	251	4	
XD31@15	38	144	0.26	0.08805	3.35	2.57976	5.08	0.21248	3.83	1384	63	1295	38	1242	43	
Two mica granite																
XD48@01	119	666	0.18	0.05142	0.66	0.28111	1.65	0.03965	1.51	260	15	252	4	251	4	
XD48@02	69	332	0.21	0.05100	1.50	0.27660	2.13	0.03934	1.51	241	34	248	5	249	4	
XD48@03	70	392	0.18	0.05141	0.84	0.28015	1.72	0.03952	1.51	259	19	251	4	250	4	
XD48@04	206	484	0.42	0.06178	0.49	0.74430	1.60	0.08737	1.52	667	11	565	7	540	8	
XD48@05	387	751	0.52	0.05122	0.61	0.27740	1.62	0.03928	1.50	251	14	249	4	248	4	
XD48@06	103	590	0.17	0.05127	0.70	0.27444	1.65	0.03882	1.50	253	16	246	4	246	4	
XD48@07	285	895	0.32	0.05133	0.59	0.27761	1.62	0.03923	1.51	256	14	249	4	248	4	
XD48@08	233	482	0.48	0.05059	0.78	0.27212	1.70	0.03901	1.51	222	18	244	4	247	4	
XD48@09	170	1045	0.16	0.05091	0.52	0.27793	1.59	0.03960	1.50	237	12	249	4	250	4	
XD48@10	263	530	0.50	0.05500	0.58	0.48038	1.61	0.06335	1.50	412	13	398	5	396	6	
XD48@11	110	496	0.22	0.05101	0.79	0.27240	1.70	0.03873	1.50	241	18	245	4	245	4	
XD48@12	149	427	0.35	0.10610	0.40	4.17626	1.58	0.28547	1.53	1734	7	1669	13	1619	22	
XD48@15	280	2317	0.12	0.05114	0.42	0.28737	1.58	0.04076	1.52	247	10	256	4	258	4	
XD48@16	231	337	0.69	0.06318	0.96	0.93684	1.87	0.10755	1.60	714	20	671	9	659	10	
XD48@17	98	837	0.12	0.05121	0.50	0.28354	1.73	0.04016	1.66	250	11	253	4	254	4	
XD48@18	421	3734	0.11	0.15834	1.16	9.15935	2.02	0.41954	1.65	2438	20	2354	19	2258	32	
XD48@19	44	264	0.17	0.05141	1.12	0.27149	1.87	0.03830	1.50	259	26	244	4	242	4	
XD48@21	103	671	0.15	0.05132	0.57	0.28126	1.61	0.03975	1.50	255	13	252	4	251	4	
XD48@22	151	695	0.22	0.05145	0.55	0.29593	1.87	0.04172	1.79	261	13	263	4	263	5	
XD48@23	202	698	0.29	0.05111	2.96	0.27029	3.32	0.03836	1.51	246	67	243	7	243	4	
XD48@24	157	762	0.21	0.05114	0.54	0.27916	1.71	0.03959	1.62	247	12	250	4	250	4	
XD48@25	80	490	0.16	0.05206	0.75	0.28115	1.94	0.03917	1.79	288	17	252	4	248	4	
Tourmaline-bearing granite																
XD43@01	92	315	0.29	0.07498	3.34	1.16148	3.77	0.11235	1.73	1068	66	783	21	686	11	
XD43@02	58	360	0.16	0.05136	0.92	0.26907	1.87	0.03800	1.62	257	21	242	4	240	4	
XD43@03	990	1324	0.75	0.05113	0.49	0.28147	1.58	0.03993	1.50	247	11	252	4	252	4	
XD43@04	134	1008	0.13	0.05123	0.49	0.27846	1.62	0.03942	1.55	251	11	249	4	249	4	
XD43@05	89	328	0.27	0.05121	0.80	0.27468	1.71	0.03890	1.51	250	18	246	4	246	4	
XD43@06	237	1023	0.23	0.05993	0.58	0.81557	1.65	0.09871	1.54	601	12	606	8	607	9	
XD43@07	67	432	0.16	0.05119	1.14	0.27602	1.89	0.03910	1.51	250	26	247	4	247	4	
XD43@08	67	314	0.21	0.05115	0.83	0.27927	1.76	0.03960	1.55	248	19	250	4	250	4	
XD43@09	106	460	0.23	0.05143	0.68	0.27968	1.65	0.03944	1.50	260	16	250	4	249	4	
XD43@10	61	349	0.17	0.05105	0.90	0.27256	1.75	0.03873	1.50	243	21	245	4	245	4	
XD43@12	63	360	0.17	0.05048	0.77	0.28110	1.76	0.04038	1.58	217	18	252	4	255	4	
XD43@13	211	564	0.37	0.07588	1.72	1.86656	2.37	0.17842	1.64	1092	34	1069	16	1058	16	
XD43@14	73	368	0.20	0.05103	0.77	0.27703	1.71	0.03937	1.53	242	18	248	4	249	4	
XD43@15	95	480	0.20	0.05099	0.73	0.27604	1.83	0.03926	1.68	240	17	248	4	248	4	
XD43@16	128	334	0.38	0.07006	0.72	1.10805	2.12	0.11471	2.00	930	15	757	11	700	13	
XD43@17	107	461	0.23	0.05134	0.85	0.27625	1.81	0.03903	1.60	256	19	248	4	247	4	
XD43@18	177	1589	0.11	0.05661	79.39	0.40818	79.40	0.05229	1.54	476	1176	348	266	329	5	
Biotite granite																
XD57@1	140	412	0.34	0.05148	0.63	0.28875	1.67	0.04068	1.54	263	14	258	4	257	4	
XD57@02	141	460	0.31	0.05096	0.69	0.28706	1.71	0.04086	1.57	239	16	256	4	258	4	
XD57@03	66	171	0.39	0.05111	0.98	0.28300	1.79	0.04016	1.50	246	22	253	4	254	4	
XD57@04	116	446	0.26	0.05139	0.63	0.28227	1.81	0.03983	1.70	259	14	252	4	252	4	
XD57@05	82	245	0.34	0.05158	0.82	0.28411	1.77	0.03995	1.57	267	19	254	4	253	4	
XD57@06	130	357	0.36	0.05136	0.75	0.28311	1.68	0.03998	1.50	257	17	253	4	253	4	
XD57@07	69	199	0.35	0.05117	1.19	0.28029	1.92	0.03973	1.50	248	27	251	4	251	4	
XD57@08	144	453	0.32	0.05128	0.60	0.28760	1.62	0.04068	1.50	253	14	257	4	257	4	
XD57@09	65	175	0.37	0.05148	1.24	0.27650	2.04	0.03896	1.62	262	28	248	4	246	4	
XD57@10	104	334	0.31	0.05127	0.73	0.28162	1.86	0.03984	1.71	253	17	252	4	252	4	
XD57@11	116	387	0.30	0.05140	0.66	0.29290	1.65	0.04133	1.51	259	15	261	4	261	4	
XD57@12	156	572	0.27	0.05129	0.56	0.28726	1.62	0.04062	1.52	254	13	256	4	257	4	
XD57@13	89	240	0.37	0.05134	0.83	0.28528	1.72	0.04030	1.51	256	19	255	4	255	4	
XD57@14	135	332	0.41	0.05155	0.74	0.28184	1.80	0.03965	1.65	265	17	252	4	251	4	
XD57@15	96	267	0.36	0.05076	1.19	0.27931	1.97	0.03991	1.57	230	27	250	4	252	4	

TABLE S2. MAJOR (WT%) AND TRACE ELEMENT (PPM) AND SR-ND-B ISOTOPE DATA FOR THE DIANCANGSHAN-AILAOSHAN STRONGLY PERALUMINOUS GRANITES

Sample	XD31	XD33	XD34	XD48	17DL-4B	17DL-4C	17DL-4D	17DL-4E	17DL-4F	17DL-4G	17DL-4H
	TMG*	TMG	TMG	TMG	TMG	TMG	TMG	TMG	TMG	TMG	TMG
Latitude (°N)	25.57	25.567	25.564	23.546	25.564	25.56	25.56	25.56	25.56	25.56	25.56
Longitude (°E)	100.15	100.148	100.132	101.917	100.132	100.14	100.14	100.14	100.14	100.14	100.14
SiO ₂	74.93	70.66	75.38	73.05	74.57	73.12	74.47	76.01	76.34	74.44	75.16
TiO ₂	0.38	0.63	0.33	0.50	0.30	0.32	0.37	0.26	0.19	0.39	0.33
Al ₂ O ₃	12.66	15.13	12.45	12.95	13.23	13.36	13.63	12.58	12.71	13.03	12.71
Fe ₂ O ₃ ^T	3.30	5.20	2.84	3.68	2.63	3.05	2.83	2.67	2.20	3.12	2.82
MnO	0.08	0.04	0.07	0.07	0.06	0.07	0.05	0.06	0.06	0.07	0.07
MgO	0.71	1.97	0.61	0.86	0.45	0.58	0.74	0.39	0.32	0.66	0.61
CaO	1.15	1.11	1.14	1.23	0.94	1.36	0.43	0.55	0.42	0.90	0.80
Na ₂ O	2.26	1.70	2.11	1.96	2.01	2.70	1.94	1.99	1.74	1.94	2.07
K ₂ O	4.39	3.40	4.94	5.56	5.66	5.30	5.40	5.37	5.92	5.32	5.28
P ₂ O ₅	0.14	0.15	0.13	0.14	0.15	0.14	0.15	0.13	0.09	0.13	0.14
LOI	0.49	1.51	0.43	0.33	0.62	0.65	1.03	0.76	0.66	0.75	0.87
Total	99.44	99.70	99.34	99.38	99.69	99.79	100.00	99.64	99.74	99.77	99.69
A/NK	1.50	2.35	1.42	1.41	1.41	1.32	1.52	1.39	1.38	1.46	1.40
A/CNK	1.20	1.78	1.14	1.13	1.19	1.06	1.39	1.25	1.27	1.23	1.20
K ₂ O/Na ₂ O	1.94	2.00	2.34	2.84	2.81	1.97	2.79	2.70	3.40	2.74	2.54
Ti	2176	3584	1861	2876	1793	1894	2225	1572	1163	2363	1986
V	31	87	24	40	23	28	27			36	26
Cr	69	66	23	30	21	47	33			30	27
Co	5.0	9.9	3.9	6.0	3.4	4.4	3.9			4.9	3.3
Ni	8	23	7	10	5	8	7			8	6
Cu	11.0	19.2	7.9	13.1	6.2	7.9	6.7			6.5	2.6
Zn	47.7	70.1	47.7	53.1	36.8	24.3	14.0			32.0	22.1
Ga	16.5	18.7	15.6	16.8	17.7	17.9	19.0			18.0	17.5
Rb	237	155	257	275	312	313	293			312	341
Sr	65	104	60	72	55	55	56			74	45
Y	38.55	23.94	35.44	35.71	40.88	39.42	42.78			41.39	40.26
Zr	108.00	139.70	77.04	119.30	147.83	154.85	147.15			154.72	127.52
Nb	10.54	14.11	9.45	11.45	9.79	9.90	10.94			11.72	10.45
Cs	12.52	9.39	12.70	10.49	16.41	14.44	16.55			16.20	24.52
Ba	507.40	573.20	533.70	648.60	484.83	572.79	576.62			574.81	377.00
La	39.30	40.20	32.82	39.84	31.02	33.04	31.00			38.83	31.01
Ce	79.61	80.56	67.25	81.90	63.24	64.90	59.83			74.95	62.47
Pr	9.25	9.27	7.71	9.34	7.04	7.41	6.85			8.61	6.93
Nd	33.63	34.38	27.96	34.05	26.72	26.43	25.91			31.74	26.01
Sm	6.79	6.49	5.81	6.92	6.14	5.58	5.85			6.69	6.12
Eu	0.97	1.28	0.84	1.01	0.79	0.89	0.99			0.97	0.92
Gd	6.72	5.80	5.73	6.64	5.78	6.07	5.55			6.53	5.30
Tb	1.13	0.84	0.99	1.07	1.12	1.04	0.97			1.11	0.98
Dy	6.72	4.64	5.98	6.35	7.02	6.72	7.02			7.30	6.88
Ho	1.34	0.88	1.22	1.26	1.29	1.23	1.31			1.37	1.24
Er	3.60	2.26	3.32	3.35	3.73	3.61	4.12			3.89	3.81
Tm	0.50	0.32	0.47	0.48	0.53	0.55	0.60			0.57	0.56
Yb	3.05	2.03	2.83	2.91	3.38	3.40	3.64			3.60	3.64
Lu	0.44	0.31	0.41	0.42	0.49	0.50	0.53			0.53	0.53
Hf	3.54	4.24	2.58	3.63	4.25	4.64	4.30			4.76	3.58
Ta	0.95	1.14	0.86	0.98	1.04	0.97	1.08			1.23	1.23
Pb	27.77	21.26	31.63	34.33	34.35	22.05	18.96			28.08	19.13
Th	25.62	17.54	22.49	26.37	22.04	22.36	24.11			26.54	22.80
U	5.31	3.32	5.40	4.96	5.19	5.52	4.68			5.08	5.75
Eu/Eu*	0.44	0.64	0.44	0.45	0.40	0.47	0.53			0.45	0.50
Sr/Y	1.69	4.34	1.69	2.00	1.36	1.40	1.32			1.79	1.13
La/Yb	12.91	19.78	11.59	13.68	9.18	9.71	8.53			10.79	8.51
Tzr(°C)	727	795	689	725	727	728	729			767	744
B	20.80	64.97	8.86	7.58							
δ ¹¹ B	-9.8	-9.8	-13.3	-14.5							
⁸⁷ Sr/ ⁸⁶ Sr	0.756991	0.744154	0.762708	0.760004	0.777487	0.775387	0.767662			0.755795	
2σ	0.000009	0.000009	0.000011	0.000012	0.000006	0.000007	0.000006			0.000008	
(⁸⁷ Sr/ ⁸⁶ Sr) _i	0.7194	0.7288	0.7187	0.7205	0.7170	0.7179	0.7099			0.7027	
¹⁴³ Nd/ ¹⁴⁴ Nd	0.511970	0.511830	0.511957	0.511950	0.512028	0.512002	0.511997			0.511997	
2σ	0.000005	0.000005	0.000004	0.000005	0.000004	0.000004	0.000005			0.000005	
(¹⁴³ Nd/ ¹⁴⁴ Nd) _i	0.511769	0.511642	0.511750	0.511748	0.511804	0.511775	0.511788			0.511774	
εNd(t)	-10.69	-13.16	-11.04	-11.12	-10.05	-10.61	-10.35			-10.63	

TABLE S2. (Continued.)

Sample	17DL-5A	17DL-5B	17DL-5D	17DL-5E	17DL-5F	17DL-5G	17DL-5I	17DL-5J	XD57	XD58	XD43	XD44
	TMG	TMG	TMG	TMG	TMG	TMG	TMG	TMG	BG [†]	BG	TG [§]	TG
Latitude (°N)	25.56	25.56	25.56	25.56	25.56	25.56	25.56	25.56	22.80	22.81	23.95	22.943
Longitude (°E)	100.13	100.13	100.13	100.13	100.13	100.13	100.13	100.13	102.49	102.48	101.49	101.50
SiO ₂	73.35	73.51	75.18	74.77	72.80	73.95	72.71	71.53	73.16	69.58	77.42	77.00
TiO ₂	0.43	0.50	0.39	0.37	0.37	0.32	0.59	0.62	0.47	0.60	0.13	0.11
Al ₂ O ₃	13.43	13.03	12.93	12.69	13.97	13.06	12.95	14.01	13.22	14.23	12.42	13.23
Fe ₂ O ₃ ^T	3.40	3.86	2.99	3.14	2.90	2.93	4.45	4.79	3.91	4.60	1.60	1.68
MnO	0.06	0.07	0.07	0.07	0.06	0.07	0.08	0.08	0.07	0.07	0.05	0.04
MgO	0.84	0.93	0.75	0.67	0.62	0.59	1.19	1.47	1.36	2.04	0.15	0.18
CaO	1.03	1.37	0.54	1.26	0.99	1.24	1.69	1.20	1.77	1.92	0.12	0.06
Na ₂ O	2.51	2.17	1.81	2.13	1.90	2.21	2.17	1.50	2.11	2.10	2.51	2.00
K ₂ O	4.82	4.42	5.20	4.78	6.26	5.48	4.02	4.64	3.79	4.67	5.47	5.56
P ₂ O ₅	0.14	0.15	0.14	0.14	0.15	0.13	0.15	0.16	0.14	0.18	0.12	0.14
LOI	0.61	0.49	0.75	0.55	0.60	0.45	0.58	1.08	0.94	1.59	0.59	1.28
Total	100.30	100.33	99.90	100.27	100.24	100.24	99.56	99.70	99.87	99.78	99.34	99.33
A/NK	1.44	1.56	1.51	1.47	1.42	1.37	1.64	1.88	1.75	1.68	1.24	1.43
A/CNK	1.20	1.20	1.35	1.16	1.19	1.10	1.18	1.45	1.22	1.18	1.21	1.41
K ₂ O/Na ₂ O	1.92	2.04	2.87	2.25	3.29	2.48	1.86	3.09	1.79	2.22	2.18	2.78
Ti	2582	2975	2336	2196	2198	1936	3522	3699	2614	3443	821	606
V	39	44		31	32	28	59	66	51	72	7	7
Cr	36	45		31	28	58	44	48	30	41	14	12
Co	5.1	5.9		5.2	4.3	4.3	8.4	9.0	6.9	10.0	1.1	0.7
Ni	10	11		9	9	8	16	15	9	13	2	2
Cu	8.7	10.3		8.1	8.4	8.4	14.6	8.9	8.5	14.0	4.8	6.2
Zn	27.8	48.9		40.2	38.3	33.3	60.0	40.8	58.1	63.0	37.7	34.9
Ga	17.7	17.7		17.6	18.2	17.1	18.3	21.2	16.3	17.6	16.9	17.1
Rb	205	237		253	305	249	208	251	167	201	430	407
Sr	92	71		65	77	78	84	54	158	212	32	33
Y	36.61	41.01		38.23	40.82	35.70	36.79	38.51	27.65	26.62	40.36	50.61
Zr	149.40	165.14		137.20	142.26	152.12	157.42	229.69	136.00	172.50	100.90	81.14
Nb	10.82	13.13		10.35	10.72	9.18	13.51	19.52	12.90	13.94	11.72	8.77
Cs	29.29	12.71		14.00	15.58	11.01	13.72	15.79	10.72	10.74	11.20	9.15
Ba	762.05	505.82		522.16	766.70	741.57	580.81	639.32	581.80	911.50	112.90	153.00
La	44.29	46.65		36.23	40.27	36.39	46.27	48.19	48.52	49.78	17.79	19.03
Ce	89.45	93.26		72.84	78.86	72.49	92.20	95.05	91.46	98.11	36.32	40.72
Pr	9.92	10.32		8.18	8.92	8.14	10.18	10.84	10.66	11.58	4.44	4.98
Nd	37.43	39.17		30.15	33.06	29.92	38.05	39.35	39.63	43.37	16.02	18.73
Sm	7.53	8.07		6.90	7.46	6.61	8.32	8.40	7.55	7.68	4.18	4.88
Eu	1.20	1.04		0.94	1.11	1.19	1.24	1.26	1.25	1.46	0.26	0.35
Gd	6.39	7.16		6.19	6.82	5.78	7.12	7.57	6.75	6.63	4.31	5.57
Tb	1.06	1.19		1.09	1.11	1.04	1.14	1.20	0.94	0.91	0.95	1.18
Dy	6.51	7.25		6.47	6.88	6.39	6.64	6.76	4.90	4.89	6.46	7.62
Ho	1.19	1.30		1.18	1.30	1.09	1.22	1.19	0.89	0.95	1.34	1.54
Er	3.42	3.74		3.53	3.74	3.24	3.47	3.53	2.29	2.52	3.75	4.24
Tm	0.49	0.54		0.50	0.55	0.47	0.49	0.52	0.31	0.36	0.57	0.62
Yb	2.99	3.28		3.26	3.46	2.95	3.29	3.40	1.89	2.27	3.50	3.71
Lu	0.43	0.47		0.46	0.49	0.43	0.48	0.50	0.29	0.36	0.48	0.52
Hf	4.27	4.68		4.10	4.20	4.45	4.72	6.45	4.20	5.16	4.07	3.40
Ta	0.92	1.06		0.98	0.96	0.84	1.12	5.31	0.92	0.92	1.81	1.36
Pb	37.38	25.92		29.94	40.52	37.66	29.74	19.40	27.99	24.85	25.26	26.43
Th	25.41	29.39		24.21	26.19	23.52	26.86	27.70	19.70	21.14	19.55	17.25
U	4.00	3.81		4.35	4.13	3.97	4.10	4.25	2.46	2.22	7.08	9.92
Eu/Eu*	0.53	0.42		0.44	0.48	0.59	0.49	0.48	0.53	0.63	0.19	0.21
Sr/Y	2.51	1.73		1.70	1.88	2.19	2.28	1.39	5.72	7.97	0.80	0.65
La/Yb	14.82	14.20		11.10	11.65	12.34	14.05	14.18	25.64	21.93	5.08	5.13
Tzr(°C)	745	746		749	750	747	759	829	750	762	725	721
B									34.84	16.95	107.60	50.31
δ ¹¹ B									-10.0	-15.4	-11.8	-12.7
⁸⁷ Sr/ ⁸⁶ Sr	0.753795	0.753514		0.761369	0.762221	0.760324			0.726034	0.724280	0.840492	0.835523
2σ	0.000010	0.000008		0.000007	0.000007	0.000007			0.000010	0.000010	0.000011	0.000022
(⁸⁷ Sr/ ⁸⁶ Sr) _i	0.7311	0.7195		0.7207	0.7151	0.7000			0.7150	0.7145	0.7041	0.7087
¹⁴³ Nd/ ¹⁴⁴ Nd	0.511967	0.511968		0.511971	0.511974	0.511967			0.511958	0.511943	0.512062	0.512057
2σ	0.000006	0.000005		0.000005	0.000005	0.000007			0.000005	0.000004	0.000004	0.000004
(¹⁴³ Nd/ ¹⁴⁴ Nd) _i	0.511769	0.511765		0.511759	0.511760	0.511742			0.511765	0.511766	0.511804	0.511800
εNd(t)	-10.76	-10.83		-11.28	-10.95	-10.94			-10.66	-10.69	-10.05	-10.13

*Two-mica granites

†Biotite granites.

§Tourmaline-bearing granites.

Table S3. In situ zircon Hf-O isotope data for the Diancangshan-Ailaoshan strongly peraluminous granites.

Sample	t (Ma)	¹⁷⁶ Yb/ ¹⁷⁷ Hf	¹⁷⁶ Lu/ ¹⁷⁷ Hf	¹⁷⁶ Hf/ ¹⁷⁷ Hf	2σ _m	εHf(t)	T _{DM} (Hf)	T _{DM2} (Hf)	f _{LuHf}	δ ¹⁸ O (‰)	2σ _m
XD31											
XD31-01	251	0.037481	0.001082	0.282320	0.000014	-10.7	1319	1619	-0.97	10.4	0.25
XD31-02	251	0.044341	0.001273	0.282172	0.000013	-15.9	1534	1886	-0.96	6.9	0.44
XD31-04	251	0.028328	0.000827	0.282227	0.000012	-13.9	1439	1784	-0.98	10.7	0.44
XD31-05	251	0.067827	0.002006	0.282283	0.000012	-12.1	1404	1692	-0.94	10.5	0.37
XD31-06	251	0.057826	0.001711	0.282261	0.000011	-12.8	1425	1729	-0.95	10.5	0.40
XD31-07	251	0.033042	0.001006	0.282248	0.000012	-13.2	1416	1746	-0.97	11.2	0.32
XD31-09	251	0.074454	0.002198	0.282251	0.000012	-13.3	1458	1751	-0.93	10.3	0.34
XD31-11	251	0.059119	0.001783	0.282265	0.000011	-12.7	1422	1723	-0.95	10.4	0.26
XD31-12	251	0.064300	0.001908	0.282299	0.000014	-11.5	1377	1662	-0.94	11.7	0.38
XD31-13	831	0.031863	0.001008	0.282009	0.000013	-9.2	1748	2009	-0.97		
XD31-14	251	0.099290	0.002946	0.282453	0.000010	-6.3	1191	1395	-0.91	8.6	0.32
XD31-15	1384	0.045547	0.001366	0.282295	0.000012	12.6	1364	1666	-0.96		
XD48											
XD48-1	249	0.104123	0.002972	0.282292	0.000021	-12.0	1429	1684	-0.91	9.9	0.18
XD48-2	249	0.082757	0.002350	0.282281	0.000021	-12.3	1421	1699	-0.93	9.7	0.23
XD48-3	249	0.073399	0.002115	0.282303	0.000020	-11.5	1379	1657	-0.94	10.4	0.25
XD48-5	249	0.078015	0.002258	0.282340	0.000021	-10.2	1332	1593	-0.93	11.6	0.18
XD48-6	249	0.076078	0.002224	0.282350	0.000018	-9.8	1316	1574	-0.93	10.4	0.12
XD48-7	249	0.086253	0.002526	0.282373	0.000018	-9.0	1293	1535	-0.92	10.9	0.15
XD48-8	249	0.041262	0.001237	0.282333	0.000020	-10.3	1306	1598	-0.96	10.3	0.16
XD48-9	249	0.079320	0.002346	0.282375	0.000020	-9.0	1285	1531	-0.93	10.7	0.13
XD48-11	249	0.102955	0.003000	0.282428	0.000019	-7.2	1230	1441	-0.91	10.4	0.21
XD48-12	1734	0.033856	0.001056	0.281708	0.000020	-0.2	2167	2289	-0.97		
XD48-15	249	0.086553	0.002565	0.282375	0.000021	-9.0	1292	1532	-0.92	10.7	0.12
XD48-16	659	0.020444	0.000589	0.282111	0.000019	-9.1	1590	1868	-0.98		
XD48-17	249	0.067077	0.001940	0.282352	0.000017	-9.7	1304	1569	-0.94	7.2	0.61
XD48-18	2438	0.053011	0.001876	0.281101	0.000016	-11.4	3062	3266	-0.94		
XD48-19	249	0.041702	0.001276	0.282158	0.000022	-16.5	1553	1911	-0.96	10.8	0.18
XD48-21	249	0.037471	0.001182	0.282267	0.000016	-12.6	1397	1716	-0.96	9.4	0.14
XD48-22	249	0.066718	0.002020	0.282449	0.000019	-6.3	1166	1395	-0.94	10.6	0.12
XD48-23	249	0.048550	0.001484	0.282324	0.000017	-10.6	1326	1614	-0.96	10.9	0.15
XD48-24	249	0.080368	0.002353	0.282351	0.000018	-9.8	1320	1574	-0.93	11.4	0.18
XD48-25	249	0.065572	0.001954	0.282322	0.000021	-10.8	1347	1623	-0.94	11.3	0.16
XD48-27	249	0.044221	0.001260	0.282240	0.000018	-13.6	1437	1764	-0.96	9.7	0.17
XD48-28	249	0.069097	0.001984	0.282360	0.000018	-9.4	1293	1554	-0.94	10.3	0.18
XD48-29	249	0.069080	0.002011	0.282339	0.000018	-10.2	1324	1592	-0.94	10.2	0.17
XD48-30	249	0.095592	0.002777	0.282392	0.000019	-8.4	1275	1504	-0.92	10.5	0.14
XD48-31	249	0.069669	0.002026	0.282337	0.000017	-10.2	1327	1596	-0.94	10.1	0.19
XD48-32	249	0.071077	0.002076	0.282384	0.000017	-8.6	1262	1512	-0.94	10.3	0.21
XD48-33	249	0.071641	0.002082	0.282358	0.000019	-9.5	1300	1559	-0.94	11.0	0.16
XD48-34	249	0.050019	0.001495	0.282267	0.000018	-12.7	1409	1718	-0.95	11.1	0.15
XD48-37	249	0.075881	0.002312	0.282387	0.000020	-8.5	1266	1509	-0.93	9.9	0.17
XD57											
XD57-01	254	0.067557	0.001273	0.282363	0.000008	-9.1	1264	1541	-0.96	10.7	0.24
XD57-02	254	0.052874	0.001013	0.282253	0.000008	-13.0	1410	1738	-0.97	10.3	0.21
XD57-03	254	0.051430	0.000993	0.282262	0.000008	-12.6	1396	1720	-0.97	10.1	0.29
XD57-04	254	0.062592	0.001191	0.282339	0.000009	-9.9	1296	1585	-0.96	9.9	0.32
XD57-05	254	0.068680	0.001308	0.282349	0.000008	-9.6	1286	1568	-0.96	10.4	0.22
XD57-06	254	0.059239	0.001137	0.282329	0.000008	-10.3	1308	1603	-0.97	10.3	0.17
XD57-07	254	0.044952	0.000803	0.282358	0.000007	-9.2	1256	1548	-0.98	10.1	0.32
XD57-08	254	0.072328	0.001370	0.282310	0.000008	-11.0	1342	1637	-0.96	10.2	0.26
XD57-09	254	0.076579	0.001485	0.282417	0.000008	-7.2	1195	1447	-0.96	10.5	0.24
XD57-10	254	0.072802	0.001377	0.282334	0.000008	-10.2	1309	1596	-0.96	10.5	0.16
XD57-11	254	0.050437	0.000843	0.282381	0.000008	-8.4	1225	1507	-0.97	9.9	0.23
XD57-12	254	0.072325	0.001343	0.282351	0.000008	-9.5	1284	1564	-0.96	8.7	0.38
XD57-13	254	0.065723	0.001262	0.282347	0.000008	-9.7	1286	1570	-0.96	10.2	0.37
XD57-14	254	0.106430	0.001969	0.282399	0.000008	-7.9	1237	1483	-0.94	9.8	0.26
XD57-15	254	0.086914	0.001640	0.282265	0.000010	-12.6	1416	1721	-0.95	9.8	0.31
XD43											
XD43-1	686	0.052269	0.001456	0.282398	0.000023	1.3	1221	1364	-0.96		
XD43-2	248	0.050628	0.001478	0.282363	0.000025	-9.3	1272	1546	-0.96	9.4	0.17
XD43-4	248	0.076314	0.002208	0.282291	0.000021	-11.9	1401	1681	-0.93	6.2	0.22
XD43-5	248	0.033833	0.001005	0.282375	0.000018	-8.8	1239	1520	-0.97	10.2	0.18
XD43-6	607	0.030916	0.000968	0.282242	0.000016	-5.8	1423	1656	-0.97		
XD43-7	248	0.023867	0.000664	0.282139	0.000020	-17.1	1554	1940	-0.98	10.7	0.15
XD43-8	248	0.082426	0.002382	0.282294	0.000016	-11.8	1403	1676	-0.93	10.1	0.22
XD43-9	248	0.077449	0.002252	0.282323	0.000020	-10.8	1356	1623	-0.93	10.1	0.23
XD43-10	248	0.076526	0.002213	0.282385	0.000022	-8.6	1266	1513	-0.93	10.3	0.23
XD43-12	248	0.059142	0.001772	0.282375	0.000018	-8.9	1264	1526	-0.95	10.6	0.21
XD43-13	1058	0.027590	0.000801	0.281815	0.000020	-11.0	2006	2282	-0.98		
XD43-14	248	0.067193	0.001983	0.282321	0.000019	-10.8	1350	1626	-0.94	10.4	0.22
XD43-15	248	0.061527	0.001797	0.282313	0.000017	-11.1	1354	1638	-0.95	11.0	0.28
XD43-16	700	0.023801	0.000709	0.282286	0.000017	-2.1	1352	1544	-0.98		
XD43-17	248	0.082169	0.002372	0.282358	0.000020	-9.6	1310	1562	-0.93	10.6	0.18
XD43-18	329	0.059268	0.001887	0.282320	0.000017	-9.2	1347	1606	-0.94		

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