

# Petrogenesis of Jurassic Xietongmen intrusive rocks at the southern margin of the Lhasa Terrane: implications for intra-oceanic arc evolution

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## SUPPLEMENTARY PAPERS

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### Supplementary papers

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Table S1. GPS data of granitoid samples for the Xietongmen intrusive rocks.

Sample No.	GPS data of sampling			Rock mass	Lithology
	Latitude	Longitude	Elevation (m)		
TD135	29°22'19"N	88°39'53"E	4014	Xietongmen pluton	Hornblende gabbro
TD137	29°22'02"N	88°43'12"E	4014	Xietongmen pluton	Granodiorite

Table S2. Major (wt%) and trace ( $\mu\text{g/g}$ ) element data for the Xietongmen intrusive rocks.

Sample	TD135-1	TD135-2	TD137-1	TD137-2	TD137-3	TD137-4	TD137-5	TD137-6
Lithology	gabbro	gabbro	granodiorite	granodiorite	granodiorite	granodiorite	granodiorite	granodiorite
SiO <sub>2</sub>	51.41	51.92	62.27	62.97	62.25	64.64	64.83	65.08
Al <sub>2</sub> O <sub>3</sub>	20.33	20.01	17.47	17.24	17.38	16.57	16.69	16.76
CaO	7.66	7.66	6.14	6.00	6.20	2.66	4.30	4.55
Fe <sub>2</sub> O <sub>3</sub>	3.42	3.68	2.26	1.89	2.20	1.23	2.49	1.51
FeO	5.06	4.78	2.66	3.07	2.77	2.68	1.55	2.13
K <sub>2</sub> O	0.94	0.92	1.57	1.53	1.49	2.01	2.85	2.72
MgO	3.56	3.64	2.19	2.20	2.21	0.96	1.33	1.35
MnO	0.16	0.15	0.13	0.13	0.13	0.12	0.12	0.12
Na <sub>2</sub> O	3.68	3.75	3.93	3.81	3.84	5.11	3.76	3.96
P <sub>2</sub> O <sub>5</sub>	0.26	0.27	0.15	0.15	0.14	0.19	0.19	0.19
TiO <sub>2</sub>	0.83	0.85	0.47	0.48	0.49	0.29	0.37	0.37
LOI	2.16	2.01	0.86	0.73	0.73	2.63	1.28	1.28
Total	99.47	99.64	100.10	100.20	99.83	99.09	99.76	100.02
Li	27.5	24.3	13.2	15.1	14.4	29.0	6.76	7.03
Be	0.77	0.74	0.81	0.80	0.79	1.40	1.25	1.23
Cr	3.00	2.54	3.28	3.54	4.33	0.87	2.51	1.92
Mn	1148	1058	871	860	886	885	809	803
Co	25.2	23.5	11.9	12.6	12.3	4.90	6.25	5.38
Ni	10.70	9.26	6.04	6.21	6.74	1.22	3.00	2.77
Cu	64.5	58.3	18.3	20.3	21.4	19.5	19.3	20.7
Zn	77.5	69.5	52.1	54.6	56.0	63.7	54.1	56.0
Ga	19.5	18.3	16.3	16.5	17.5	16.3	17.6	17.1
Rb	16.6	14.9	27.7	29.8	27.9	25.0	79.5	65.9
Sr	877	773	366	382	384	496	539	541
Mo	0.10	0.11	0.20	0.17	0.21	0.10	0.17	0.14
Cd	0.07	0.07	<0.05	<0.05	<0.05	0.06	0.06	0.07
In	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cs	2.14	1.81	5.54	5.80	5.6	1.91	1.86	1.45
Ba	296	274	392	338	399	662	833	685
Tl	0.09	0.08	0.21	0.23	0.21	0.13	0.41	0.35
Pb	3.49	3.24	4.74	4.53	5.01	8.96	9.91	8.96
Bi	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.07
Th	0.54	0.50	2.90	2.86	2.81	1.16	5.84	6.02
U	0.15	0.14	0.74	0.79	0.79	0.34	1.62	1.58
Nb	2.42	2.25	3.07	3.57	4.01	2.65	6.01	5.78
Ta	0.16	0.15	0.27	0.30	0.36	0.20	0.47	0.45
Zr	44.3	42.0	109	108	108	88.1	102	104
Hf	1.72	1.64	3.18	3.13	3.18	2.70	3.24	3.40
Sn	0.64	0.66	0.57	0.55	0.62	0.90	0.61	0.60
Sb	0.12	0.11	0.24	0.19	0.17	0.22	0.27	0.28
Ti	5258	5126	2651	2896	2879	1790	2288	2109
W	1.22	1.18	1.38	0.90	1.31	1.02	1.31	0.93
As	5.96	6.27	4.31	4.58	3.15	11.3	3.20	3.18
V	152	142	100	107	109	12.9	77.3	68.7
La	9.87	9.53	9.14	11.3	13.7	13.4	21.7	21.4
Ce	20.7	20.0	17.2	20.4	24.1	26.5	33.4	32.1
Pr	3.07	3.08	2.37	2.78	3.15	3.70	4.11	3.94
Nd	15.3	17.0	10.8	12.1	13.5	15.6	16.1	16.4
Sm	3.30	3.23	2.25	2.47	2.74	3.04	3.56	3.23
Eu	1.30	1.20	0.75	0.83	0.91	0.94	1.04	1.00
Gd	3.36	3.18	2.25	2.35	2.84	2.64	3.03	2.83
Tb	0.47	0.47	0.33	0.37	0.44	0.37	0.44	0.41
Dy	2.82	2.71	2.02	2.22	2.57	2.08	2.53	2.40
Ho	0.56	0.53	0.40	0.45	0.50	0.41	0.49	0.47
Er	1.61	1.54	1.30	1.45	1.62	1.34	1.53	1.43
Tm	0.23	0.21	0.18	0.21	0.23	0.20	0.21	0.22
Yb	1.50	1.47	1.36	1.48	1.63	1.51	1.59	1.54
Lu	0.24	0.23	0.22	0.25	0.27	0.25	0.28	0.27
Sc	14.1	13.9	10.4	10.3	10.9	3.69	5.99	5.97
Y	15.6	15.0	10.6	13.3	15.0	12.7	14.8	14.1

Note: Major elements were analysed by wet chemistry and XRF, trace elements and REE were analysed by ICP-MS. The routine analytical precision and accuracy for most elements measured are estimated to be <5%.

Table S3. LA-ICP-MS zircon U–Pb data of the Xietongmen intrusive rocks.

Analysis	Th (ppm)	U (ppm)	Th/U	Isotopic ratios						Isotopic ages (Ma)					
				<sup>207</sup> Pb/ <sup>206</sup> Pb	1σ	<sup>207</sup> Pb/ <sup>235</sup> U	1σ	<sup>206</sup> Pb/ <sup>238</sup> U	1σ	<sup>207</sup> Pb/ <sup>206</sup> Pb	1σ	<sup>207</sup> Pb/ <sup>235</sup> U	1σ	<sup>206</sup> Pb/ <sup>238</sup> U	1σ
TD135-1	69.6	162	0.43	0.0505	0.0044	0.1792	0.0140	0.0263	0.0006	217	4.6	167	12.0	167	3.8
TD135-2	117	123	0.42	0.0488	0.0077	0.1675	0.0247	0.0248	0.0007	200	272	157	21.5	158	4.5
TD135-3	53.4	78.5	0.50	0.0551	0.0074	0.1886	0.0191	0.0277	0.0008	413	308	175	16.3	176	5.1
TD135-4	41.6	64.6	0.86	0.0558	0.0079	0.1845	0.0206	0.0271	0.0009	456	318	172	17.7	173	5.8
TD135-5	19.4	39.4	0.42	0.0912	0.0275	0.1721	0.0387	0.0255	0.0013	1451	596	161	33.5	162	8.2
TD135-6	200	293	1.40	0.0501	0.0041	0.1749	0.0127	0.0254	0.0006	198	191	164	11.0	162	3.5
TD135-7	84.8	178	0.70	0.0527	0.0060	0.1741	0.0166	0.0253	0.0007	322	268	163	14.4	161	4.5
TD135-8	292	288	0.61	0.0524	0.0044	0.2012	0.0135	0.0285	0.0006	306	191	186	11.4	181	4.0
TD135-9	52.4	67.1	0.32	0.0514	0.0073	0.1925	0.0244	0.0284	0.0009	257	309	179	20.8	180	5.4
TD135-10	262	247	0.65	0.0537	0.0035	0.2082	0.0123	0.0286	0.0006	367	145	192	10.4	182	3.8
TD135-11	71.1	76.8	0.51	0.0537	0.0072	0.1780	0.0171	0.0262	0.0008	367	301	166	14.7	167	5.0
TD135-12	68.1	90.7	0.62	0.0486	0.0079	0.1920	0.0428	0.0272	0.0008	128	344	178	36.5	173	5.1
TD137-1	76.4	180	0.42	0.0486	0.0043	0.1908	0.0153	0.0282	0.0007	132	196	177	13.1	179	4.3
TD137-2	74.8	181	0.41	0.0511	0.0049	0.1911	0.0175	0.0275	0.0007	256	220	178	14.9	175	4.5
TD137-3	78.4	187	0.42	0.0494	0.0049	0.1849	0.0166	0.0277	0.0006	165	218	172	14.2	176	3.6
TD137-4	124	245	0.50	0.0488	0.0046	0.1850	0.0150	0.0274	0.0006	139	207	172	12.8	174	3.6
TD137-5	397	464	0.86	0.0470	0.0027	0.1801	0.0096	0.0277	0.0005	55.7	133	168	8.3	176	3.1
TD137-6	88.4	203	0.44	0.0466	0.0048	0.1810	0.0174	0.0278	0.0006	27.9	230	169	15.0	177	3.6
TD137-7	69.9	168	0.42	0.0482	0.0051	0.1797	0.0163	0.0277	0.0007	109	233	168	14.0	176	4.1
TD137-8	1521	1090	1.40	0.0470	0.0020	0.1777	0.0074	0.0273	0.0005	50.1	96.3	166	6.4	173	2.9
TD137-9	363	517	0.70	0.0510	0.0034	0.1876	0.0119	0.0268	0.0005	239	154	175	10.2	171	2.8
TD137-10	113	219	0.52	0.0476	0.0037	0.1775	0.0134	0.0270	0.0006	79.7	174	166	11.6	172	3.7
TD137-11	94.8	188	0.51	0.0508	0.0043	0.1869	0.0124	0.0273	0.0006	232	190	174	10.6	173	3.7
TD137-12	172	283	0.61	0.0509	0.0037	0.1879	0.0133	0.0263	0.0005	235	170	175	11.4	167	3.1
TD137-14	90.6	184	0.49	0.0497	0.0058	0.1825	0.0213	0.0271	0.0006	183	248	170	18.3	172	3.6
TD137-15	145	233	0.62	0.0504	0.0037	0.1879	0.0124	0.0275	0.0005	213	170	175	10.6	175	3.4
TD137-16	127	217	0.59	0.0543	0.0051	0.1977	0.0160	0.0274	0.0007	383	211	183	13.6	174	4.3
TD137-17	196	320	0.61	0.0496	0.0040	0.1820	0.0135	0.0271	0.0005	176	178	170	11.6	172	3.0
TD137-18	108	217	0.50	0.0523	0.0043	0.1836	0.0130	0.0260	0.0005	298	187	171	11.1	165	3.0
TD137-19	95.8	215	0.44	0.0538	0.0051	0.1866	0.0156	0.0260	0.0005	361	215	174	13.4	165	3.4
TD137-20	207	278	0.74	0.0470	0.0038	0.1790	0.0134	0.0276	0.0006	55.7	172	167	11.5	175	4.0
TD137-21	162	511	0.32	0.0519	0.0042	0.1981	0.0129	0.0281	0.0005	280	185	184	10.9	179	3.1
TD137-22	188	290	0.65	0.0489	0.0038	0.1825	0.0131	0.0273	0.0005	143	174	170	11.3	173	2.9
TD137-23	107	209	0.51	0.0516	0.0045	0.1918	0.0151	0.0276	0.0006	333	204	178	12.8	175	3.6
TD137-24	184	299	0.62	0.0493	0.0037	0.1836	0.0133	0.0271	0.0005	161	167	171	11.4	173	3.1
TD137-25	230	417	0.55	0.0518	0.0033	0.1873	0.0111	0.0263	0.0005	280	146	174	9.5	167	3.0

Table S4. Zircon Hf isotope data for the Xietongmen intrusive rocks.

Sample	$^{176}\text{Hf}/^{177}\text{Hf}$	$2\sigma$	$^{176}\text{Lu}/^{177}\text{Hf}$	$^{176}\text{Yb}/^{177}\text{Hf}$	Age (Ma)	$\epsilon_{\text{Hf}}(0)$	$\epsilon_{\text{Hf}}(t)$	$T_{\text{DM1}}$ (Ma)	$2\sigma$	$f_{\text{Lu/Hf}}$	$T_{\text{DM2-1}}$ (Ma)	$2\sigma$	$T_{\text{DM2-2}}$ (Ma)	$2\sigma$
TD135-1	0.283081	0.000014	0.000753	0.020205	170	10.9	14.6	240	40	-0.98	282	65	328	92
TD135-2	0.283045	0.000013	0.001038	0.019691	170	9.7	13.3	293	36	-0.97	365	57	448	81
TD135-3	0.283182	0.000015	0.001232	0.029633	170	14.5	18.1	97	44	-0.96	55	69	6	98
TD135-4	0.283122	0.000012	0.000844	0.017456	170	12.4	16.0	182	34	-0.97	189	55	198	78
TD135-5	0.283067	0.000015	0.000737	0.018114	170	10.4	14.1	259	43	-0.98	313	68	373	97
TD135-6	0.283091	0.000012	0.001537	0.030717	170	11.3	14.8	231	35	-0.95	266	55	306	79
TD135-7	0.283158	0.000012	0.000931	0.017420	170	13.7	17.3	131	34	-0.97	108	54	82	77
TD135-8	0.283129	0.000010	0.000506	0.013505	170	12.6	16.3	171	29	-0.98	172	46	173	65
TD135-10	0.283122	0.000012	0.000604	0.013901	170	12.4	16.1	181	33	-0.98	187	52	195	74
TD135-12	0.283202	0.000016	0.002296	0.057790	170	15.2	18.7	71	46	-0.93	18	71	-46	101
TD135-13	0.283149	0.000010	0.000478	0.012410	170	13.3	17.0	142	29	-0.99	125	48	106	67
TD135-14	0.283174	0.000015	0.000736	0.019622	170	14.2	17.9	108	42	-0.98	71	67	30	96
TD137-1	0.283105	0.000012	0.001178	0.022598	172.8	11.8	15.4	208	36	-0.96	229	57	252	80
TD137-2	0.283154	0.000013	0.001291	0.025232	172.8	13.5	17.2	138	37	-0.96	118	59	95	84
TD137-3	0.283138	0.000013	0.000897	0.017024	172.8	13.0	16.6	159	38	-0.97	151	61	142	87
TD137-4	0.283166	0.000014	0.001384	0.026220	172.8	13.9	17.6	122	41	-0.96	93	64	59	91
TD137-5	0.283097	0.000012	0.001259	0.023620	172.8	11.5	15.2	219	35	-0.96	246	55	277	78
TD137-7	0.283067	0.000010	0.000810	0.015176	172.8	10.4	14.2	260	28	-0.98	312	44	370	63
TD137-8	0.283119	0.000014	0.001206	0.023209	172.8	12.3	16.0	188	41	-0.96	196	65	206	92
TD137-9	0.283133	0.000013	0.000932	0.017575	172.8	12.8	16.5	167	37	-0.97	163	59	159	83
TD137-10	0.283103	0.000014	0.001121	0.021307	172.8	11.7	15.4	211	41	-0.97	234	66	259	93
TD137-11	0.283121	0.000009	0.000983	0.018957	172.8	12.4	16.0	184	27	-0.97	190	43	198	61
TD137-12	0.283130	0.000010	0.000905	0.017210	172.8	12.7	16.4	171	28	-0.97	170	44	168	63
TD137-13	0.283141	0.000012	0.001020	0.019314	172.8	13.1	16.7	155	34	-0.97	145	54	133	77
TD137-14	0.283154	0.000011	0.001169	0.022978	172.8	13.5	17.2	138	32	-0.96	118	50	95	72
TD137-15	0.283113	0.000011	0.001170	0.022964	172.8	12.1	15.7	196	32	-0.96	210	51	226	72