minerals

MDPI

Supplementary Materials File 1

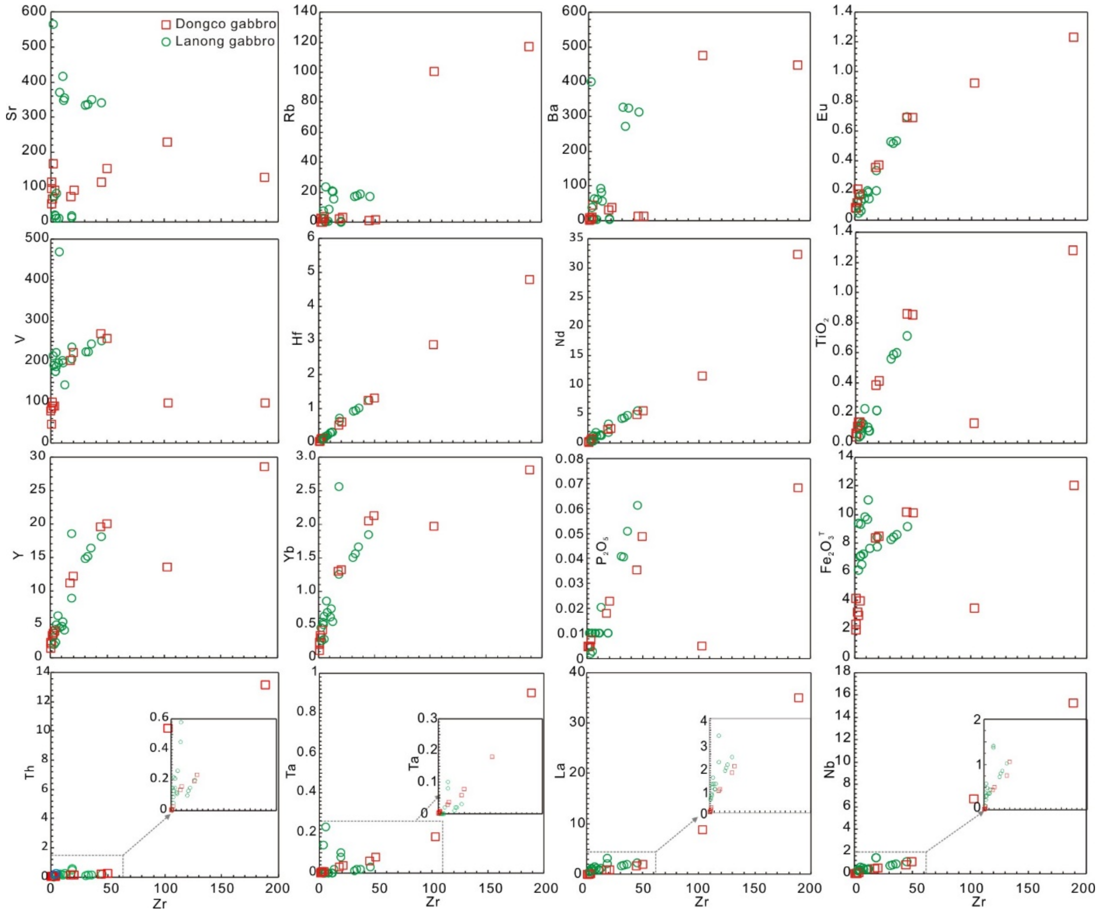

Figure S1. Selected trace elements (ppm) versus Zr (ppm) diagrams of the Dongco and Lanong ophiolites for evaluating element mobility during low-medium temperature hydrothermal alteration.

Our petrographic observations indicate that the investigated mafic rocks from the Lanong and Dongco ophiolites were affected to some extent by post-solidification alteration processes. This observation is consistent with their low to moderate LOI values (1.52–6.39 wt % and 0.94–5.01 wt %, respectively). Zirconium is widely used as an alteration-independent index of geochemical compositions because it is one of the least mobile elements during low-temperature alteration [1,2]. Rb, Sr, and Ba in gabbros do not correlate with Zr, indicating that they were probably affected by alteration. However, some major-element oxides such as P_2O_5, MnO, and TiO_2, some incompatible trace elements such as Hf, Th, Y, Ta, Nb, as well as the rare earth element (REE) of these samples show good correlation with the relatively immobile Zr imply that their concentrations were not disturbed by any metamorphic or hydrothermal alteration processes (Figure S1) [1]. Consequently, only those elements that were not significantly affected by post-magmatic processes were used in the geochemical analysis.

Table S1. Ages of ophiolitic fragments from Bangong-Nujiang Suture Zone (BNSZ), central Tibetan Plateau.

Location	Age (Ma)	Lithology	Dating Method	Tectonic Setting	References
			Western ophiolites		
Zhabu Village	184.4 ± 4.4	dolerite	Zircon LA–ICP–MS U–Pb	mid-oceanic ridge	[3]
Zhabu Village	181.9 ± 2.6	gabbro	Zircon LA–ICP–MS U–Pb	mid-oceanic ridge	[3]
West Bangong Lake	167.0 ± 1.4	gabbro	Zircon SHRIMP U–Pb	supra-subduction zone	[4]
West Bangong Lake	254.0 ± 28.0	peridotite	Whole-rock Re–Os	mid-oceanic ridge	[5]
Bangong Lake	129.2 ± 0.4	gabbro	Zircon LA–ICP–MS U–Pb	fore-arc basin	[6]
Bangong Lake	231.5 ± 2.6	gabbro	Zircon LA–ICP–MS U–Pb	mid-oceanic ridge	[7]
Rebang Co	161.5 ± 1.5	gabbro	Zircon LA–ICP–MS U–Pb	back-arc spreading associated with intra-oceanic subduction zone	[8]
Cuomuqu	164.3 ± 1.9	diabase	Zircon LA–ICP–MS U–Pb	back-arc spreading associated with intra-oceanic subduction zone	[9]
Cuomuqu	156.4 ± 1.4	plagiogranite	Zircon LA–ICP–MS U–Pb	back-arc spreading associated with intra-oceanic subduction zone	[9]
Majiari	170.5 ± 1.7	gabbro	Zircon LA–ICP–MS U–Pb	back-arc spreading associated with intra-oceanic subduction zone	[10]
Majiari	108.4 ± 2.6	gabbro	Plagioclase $^{40}Ar/^{39}Ar$ (plateau age)	intra-oceanic subduction zone	[10]
Majiari	112.0 ± 2.0	gabbro	Plagioclase $^{40}Ar/^{39}Ar$ (isochron age)	supra-subduction zone	[10]
Rutog	165.5 ± 1.9	Gabbro	Zircon LA–ICP–MS U–Pb	supra-subduction zone	[11]
Rutog	169.0 ± 2.0	gabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
			Middle–western ophiolites		
Gerze	177.6 ± 3.4	amphibolite	Hornblendes $^{40}Ar/^{39}Ar$	back-arc basin	[13]
Gerze	176.0 ± 3.9	amphibolite	Hornblendes $^{40}Ar/^{39}Ar$	back-arc basin	[13]
Gerze	176.2 ± 9.0	olivine diabase	Zircon LA–ICP–MS U–Pb	oceanic island	[3]
Gerze	191.0 ± 22.0	gabbro	Whole-rock Sm–Nd	spreading oceanic basin	[14]
Gerze	140.0 ± 4.1	gabbro	Hornblendes K–Ar	supra-subduction zone	[14]
Gerze	152.3 ± 3.6	gabbro	whole–rock K–Ar	supra-subduction zone	[14]
Dongco	222.5 ± 3.6	gabbro	Zircon LA–ICP–MS U–Pb	intra-oceanic subduction zone	[15]
Dongco	177.6 ± 3.3	amphibolite	Hornblendes $^{40}Ar/^{39}Ar$	back-arc basin	[13]
Dongco	167.0±7.2	amphibolite	Hornblendes $^{40}Ar/^{39}Ar$	back-arc basin	[13]
Dongco	166.0 ± 4.0	amphibole-gabbro	Zircon SHRIMP U–Pb	oceanic island	[16]
Dongco	148.2 ± 1.5	Am-schist	Hornblendes $^{40}Ar/^{39}Ar$	oceanic island	[16]
Dongco	167.0 ± 2.0	gabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[11]
Dongco	132.0 ± 3.0	cumulate troctolite	Zircon SHRIMP U–Pb	oceanic island	[17]
Dongco	137.4 ± 2.7	basalt	Whole-rock $^{40}Ar/^{39}Ar$	oceanic island	[17]
Dongco	140.9 ± 2.8	basalt	Whole-rock $^{40}Ar/^{39}Ar$	oceanic island	[17]
Dongco	169.0 ± 3.7	anorthosite	Zircon SIMS U–Pb	back-arc basin associated with intra-oceanic subduction zone	This study
Dongco	184.5 ± 1.9	amphibolite-gabbro	Hornblendes $^{40}Ar/^{39}Ar$ (plateau age)	oceanic plateau magmatism	[18]
Dongco	123.0 ± 1.3	basalt	Whole-rock $^{40}Ar/^{39}Ar$ (plateau ag)	oceanic plateau magmatism	[18]

Zhonggang	116.2±4.1	gabbro dike	Zircon LA–ICP–MS U–Pb	oceanic island	[19]
Zhonggang	117–120	gabbro	Zircon LA–ICP–MS U–Pb	oceanic island	[20,21]
Zhonggang	162–168	basalt	Zircon LA–ICP–MS U–Pb	oceanic island	[20,21]
Zhonggang	248–255	basalt	Zircon LA–ICP–MS U–Pb	oceanic island	[20,21]
Kangqiong	114.6 ± 3.7	boninitic dikes	Zircon LA–ICP–MS U–Pb	fore-arc spreading associated with intra-oceanic subduction zone	[22]
Kangqiong	165.0 ± 2.5	boninitic dikes	Zircon LA–ICP–MS U–Pb	fore-arc spreading associated with intra-oceanic subduction zone	[22]
			Middle ophiolites		
Daguo–Yunzhug	150.6 ± 2.4	gabbroic dikes	Zircon LA–ICP–MS U–Pb	slow spreading oceanic setting	[23]
Duoma	115.4	pillow basalt	Clinopyroxene $^{40}Ar/^{39}Ar$ (plateau ag)	oceanic island	[24]
Tarenben	107.7 ± 8.1	basalt	Zircon SHRIMP U–Pb	oceanic island	[24]
Dongqiao	187 ± 2	gabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
Dongqiao	187.8 ± 3.7	cumulate gabbro	Zircon SHRIMP U–Pb	oceanic basin	[25]
Dongqiao	188.4 ± 1.2	layered gabbro	Zircon SIMS U–Pb	initial fore-arc oceanic basin	[26]
Dongqiao	181.4 ± 1.3	amphibole gabbro	Zircon LA–ICP–MS U–Pb	initial fore-arc oceanic basin	[26]
Dongqiao	251.0 ± 65.0	cumulate rocks	Whole-rock Re–Os	supra-subduction zone	[27]
Amdo	188.0 ± 2.0	plagiogranite	Zircon SHRIMP U–Pb	spreading oceanic basin	[28]
Amdo	184.0 ± 2.0	gabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
Amdo	177.0 ± 2.0	plagiogranite	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
Jiang Tso	188.1 ± 4.1	gabbro	Zircon SHRIMP U–Pb	back-arc basin associated with supra-subduction zone	[29,30]
Jiang Tso	189.8 ± 3.3	gabbro	Zircon SHRIMP U–Pb	back-arc basin associated with supra-subduction zone	[29,30]
Lanong	167.3 ± 1.1	gabbro	Zircon LA–ICP–MS U–Pb	fore-arc basin	This study
Lanong	166.8 ± 0.9	anorthosite	Zircon LA–ICP–MS U–Pb	fore-arc basin	This study
Lanong	244.1 ± 3.0	doleritic	Zircon LA–ICP–MS U–Pb	oceanic island	[31]
Lanong	147.6 ± 2.3	basalt	Zircon LA–ICP–MS U–Pb	continental fore-arc basin	[31]
Lanong	149.1 ± 1.2	gabbro-doleritic	Zircon LA–ICP–MS U–Pb	continental fore-arc basin	[31]
Nagqu	183.7 ± 1	gabbro	Zircon LA–ICP–MS U–Pb	mature back-arc basin	[32]
Nagqu	128	cumulate gabbro	Zircon TIMS U–Pb	supra-subduction zone	[33]
Nagqu	120 ± 1.4	basalt	Whole-rock K–Ar	supra-subduction zone	[33]
			Eastern ophiolites		
Dingqing	178.0 ± 3.0	gabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
Dingqing	164.0 ± 2.0	leucogabbro	Zircon LA–ICP–MS U–Pb	back-arc basin associated with intra-oceanic subduction zone	[12]
Dingqing	217.8 ± 1.6	cumulate gabbro	Zircon SIMS U–Pb	mid-oceanic ridge	[34]

Table S2. Whole-rock major (wt %), and trace elements (ppm; including REEs) data of Dongco and Lanong ophiolitic anorthosites and gabbros (including standards rocks) in the middle segments of Bangon-Nujiang Suture Zone (BNSZ), central Tibetan Plateau.

Location	Lanong Ophiolitic Fragments											
Data Sources	This Study											
Rock Type	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro
Sample Name	16XLN02-1	16XLN02-2	16XLN02-3	16XLN02-4	16XLN02-5	16XLN07-1	16XLN07-4	16XLN07-5	16XLN09-3	16XLN09-4	16XLN09-5	16XBLN02-1
Al_2O_3	14.88	15.96	17.28	15.98	17.61	16.92	18.78	20.23	18.68	13.96	14.48	15.62
BaO	0.01	0.01	0.01	0.01	0.05	0.01	0.02	0.01	0.01	0.01	0.01	0.04
CaO	19.35	17.4	17.9	17.45	12.1	8.45	9.16	9.92	10.5	16.8	18.15	9.73
Cr_2O_3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.06	0.02
Fe_2O_3T	6.3	6.86	6.7	6.78	9	10.62	9.31	7.33	9.44	8.12	7.44	8.4
K_2O	0.02	0.02	0.03	0.02	0.24	1.39	1.46	1.05	0.76	0.03	0.02	0.91
MgO	9.53	11.2	9.88	10.65	10.75	10.45	9.07	7.93	5.72	11.15	10	7.74
MnO	0.14	0.13	0.14	0.14	0.15	0.2	0.19	0.14	0.12	0.19	0.17	0.16
Na_2O	0.13	0.11	0.12	0.14	1.59	1.44	1.54	2.37	2.92	0.16	0.11	3.15
P_2O_5	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.02	0.01	0.01	0.01	0.05
SiO_2	46.15	43.37	42.69	43.84	44.64	46.97	46.76	47.13	47.88	45.78	45.39	51.18
SrO	0.01	<0.01	0.01	0.01	0.06	0.05	0.05	0.05	0.05	0.01	0.01	0.05
TiO_2	0.13	0.12	0.09	0.11	0.1	0.08	0.1	0.08	0.22	0.21	0.21	0.59
LOI 1000	3.83	4.92	5.01	4.72	3.7	3.51	3.64	3.73	3.2	4	4.14	2.17
Total	100.49	100.11	99.87	99.85	100	100.1	100.08	99.99	99.5	100.51	100.2	99.81
Li	2.12	4.27	5.23	5.15	7.72	3.97	5.35	3.21	3.95	5.19	5.64	8.01
Be	0.11	0.11	0.1	0.1	0.07	0.1	0.14	0.09	0.16	0.34	0.41	0.25
Sc	40	42	48	40	51	53	43	34	48	34	41	37
Ti	890	793	605	730	646	586	695	503	1482	1205	1410	4039
V	187	198	177	177	215	197	203	144	470	207	236	243
Mn	1069	1025	1122	1117	1254	1588	1520	1076	930	1411	1283	1319
Co	35	42	40	41	49	59	52	39	49	38	38	36
Ni	227	271	248	251	250	110	101	105	50	181	167	107
Cu	4.46	4.99	5.68	5.36	44	1.09	1	1.62	1.08	1.54	2.08	103
Zn	17.89	20.5	23.8	23.8	47	45	37	25.7	17.43	47	42	60
Ga	9.11	9.21	10.64	9.67	10.29	10.7	11.98	11.62	13.15	8.68	8.38	12.36
As	10.13	9.92	10.02	9.96	9.82	9.58	9.16	9.67	9.6	8.4	9	9.63
Se	0.13	0.1	0.13	0.18	0.07	0.08	0.1	0.14	0.01	0.19	0.14	0.37
Rb	0.56	0.32	0.58	0.37	2.82	20.3	20.6	15.28	8.31	0.3	0.27	18.5
Sr	12.35	12.59	22.7	19.1	566	350	419	356	371	18.33	15.08	351

Y	4.86	6.25	3.57	4.13	3.08	5.28	4.65	4.01	4.4	18.54	8.85	16.32
Zr	5.27	7.02	4.1	4.58	2.37	11.41	10.57	12.49	8.15	18.63	18.61	36
Nb	0.3	0.49	0.22	0.31	0.1	0.37	0.37	0.45	0.37	1.38	1.42	0.86
Cs	0.05	0.05	0.05	0.05	1.7	0.19	0.12	0.12	0.14	0.08	0.04	0.19
Ba	4.19	4.46	6.15	7.77	402	82	95	58	62	5.66	5.96	327
La	1.1	1.51	0.81	1.23	0.57	1.02	1.02	1.25	1.25	3.27	2.16	2.05
Ce	2.38	3.45	1.58	2.51	0.95	2.22	2.18	2.44	2.29	6.59	4.14	5.16
Pr	0.28	0.43	0.18	0.28	0.13	0.3	0.29	0.29	0.26	0.77	0.43	0.85
Nd	1.31	1.86	0.83	1.22	0.63	1.45	1.37	1.28	1.17	3.34	1.78	4.71
Sm	0.36	0.45	0.22	0.31	0.2	0.4	0.37	0.3	0.28	0.95	0.47	1.48
Eu	0.13	0.18	0.09	0.17	0.13	0.19	0.2	0.15	0.15	0.34	0.2	0.54
Gd	0.52	0.63	0.35	0.45	0.29	0.54	0.49	0.39	0.41	1.62	0.78	2.15
Tb	0.1	0.12	0.07	0.08	0.06	0.1	0.09	0.07	0.08	0.34	0.16	0.37
Dy	0.77	0.95	0.55	0.64	0.49	0.81	0.67	0.58	0.63	2.79	1.3	2.61
Ho	0.18	0.23	0.13	0.15	0.12	0.18	0.16	0.14	0.16	0.68	0.32	0.57
Er	0.53	0.71	0.41	0.46	0.37	0.6	0.51	0.44	0.52	2.13	1.02	1.62
Tm	0.09	0.12	0.07	0.08	0.06	0.11	0.09	0.08	0.09	0.36	0.17	0.26
Yb	0.62	0.85	0.49	0.53	0.45	0.73	0.61	0.54	0.68	2.55	1.24	1.66
Lu	0.1	0.13	0.08	0.08	0.07	0.12	0.1	0.09	0.12	0.4	0.2	0.25
Hf	0.17	0.21	0.13	0.14	0.08	0.31	0.3	0.31	0.23	0.73	0.63	1.02
Ta	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	0.02	<0.000	0.08	0.1	0.02
Pb	0.42	0.3	0.55	0.83	0.27	0.71	0.78	0.6	0.97	0.43	0.27	0.86
Th	0.13	0.15	0.09	0.05	<0.000	0.11	0.12	0.26	0.21	0.58	0.45	0.15
U	0.05	0.07	0.07	0.07	0.04	0.08	0.06	0.14	0.1	0.21	0.17	0.1
Mg#	77.90	79.19	77.46	78.54	73.57	69.63	69.42	71.60	58.54	76.19	75.80	68.23
δEu	0.92	1.03	0.99	1.39	1.65	1.25	1.44	1.34	1.35	0.83	1.00	0.92

Table S2. *Cont.*

Location	Lanong Ophiolitic Fragments					Dongco Ophiolitic Fragments							
Data Sources	This Study												References [12]
Rock Type	Gabbro	Gabbro	Gabbro	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Anorthosite	Gabbro
Sample Name	16XBLN02-2	16XBLN02-3	16XBLN02-4	16XLN03-1	16XLN03-6	XDC01	XDC03	XDC04	XDC05	XDC06	XDC07	XDC08	11DC-1
Al_2O_3	15.94	15.44	15.8	24.4	23.74	30.71	30.56	30.8	30.29	30.77	31.32	30.01	17.56
BaO	0.04	0.04	0.04	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	
CaO	8.98	10.2	10.1	24	20.8	15.7	15.8	16.25	16.9	16.35	16.3	16.3	16.42
Cr_2O_3	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Fe_2O_3T	8.95	8.07	8.21	1.8	2.86	1.02	1.08	1.14	0.8	0.99	0.73	1.32	3.87
K_2O	0.87	0.86	0.81	0.16	0.01	0.12	0.08	0.13	0.14	0.14	0.11	0.11	0.21
MgO	7.18	8.07	7.75	2.53	6.2	0.64	0.95	0.44	0.39	0.35	0.3	0.74	10.36
MnO	0.17	0.15	0.18	0.06	0.07	0.03	0.04	0.05	0.04	0.04	0.04	0.04	0.07
Na_2O	3.38	3.08	3.12	0.07	0.01	2.33	2.36	2.23	2.29	2.37	2.34	2.27	0.98
P_2O_5	0.06	0.04	0.04	<0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
SiO_2	51.46	51.2	51.2	42.2	40.4	47.09	47.4	47.05	47.43	47.71	47.79	47.4	48.4
SrO	0.05	0.05	0.05	0.01	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
TiO_2	0.7	0.55	0.58	0.01	0.01	0.02	0.04	0.02	0.02	0.02	0.02	0.03	0.14
LOI 1000	2.34	2.32	2.37	5.05	6.39	2.03	1.74	1.96	2.06	1.92	1.64	1.84	1.95
Total	100.14	100.1	100.28	100.31	100.52	99.74	100.11	100.12	100.42	100.72	100.64	100.1	99.97
Li	7.12	6.93	8.21	3.92	14.76	6.07	0.86	2.73	0.1	0.04	0.1	0.21	
Be	0.27	0.22	0.22	0.03	0.05	0.14	0.13	0.15	0.13	0.15	0.11	0.15	
Sc	34	37	35	5.63	6.44	0.24	0.96	0.39	0.29	0.25	0.19	0.79	49.1
Ti	4576	3619	3747	74	103	161	313	166	161	154	156	231	
V	251	225	224	25.1	27	3.4	10.21	4.25	3.89	3.68	3.1	7.12	91
Mn	1366	1237	1370	487	518	213	301	329	271	270	262	259	
Co	34	35	35	7.4	17.18	2.66	4.26	2.27	1.64	1.52	1.46	3.44	28
Ni	101	109	105	84	142	8.37	18.25	8.22	5.77	4.18	8	12.25	107.1
Cu	63	93	101	2.84	3.43	3.31	3.41	5.45	3.55	3.41	2.44	2.98	4.6
Zn	64	55	57	7.44	14.91	5.61	4.48	3.64	4.78	3.17	2.56	3.7	19.5
Ga	12.96	11.7	11.86	8.12	8.73	11.24	11.37	10.9	10.49	10.5	10.59	10.76	8.9
As	9.35	9.53	9.86	9.81	10.14	10.58	10.2	10.72	10.75	10.73	10.29	9.84	
Se	0.53	0.4	0.56	0.04	0.06	0.09	0.07	0.04	0.07	0.02	0.04	0.11	
Rb	17.01	17.19	17.79	2	0.26	3.59	2.07	2.1	2.34	2.31	1.62	1.89	3.88
Sr	342	335	337	96	24.6	205	198	204	186	204	184	174	92
Y	18.01	14.7	15.05	0.65	0.65	0.77	1.58	0.74	0.64	0.66	0.61	1.09	3.97
Zr	45	31	33	0.71	0.51	8.74	7.47	6.06	7.88	9.63	7.75	8.51	3.8
Nb	1.03	0.73	0.81	0.05	0.04	0.1	0.14	0.12	0.1	0.11	0.08	0.11	0.08
Cs	0.24	0.19	0.21	0.21	0.08	0.14	0.08	0.15	0.12	0.13	0.07	0.08	3.78
Ba	314	328	273	43	17.86	32	25.2	19.91	14.03	14.01	13.28	15.64	45.1

La	2.38	1.79	1.92	0.23	0.3	0.74	0.78	0.62	0.56	0.61	0.56	0.65	0.25
Ce	6.23	4.75	4.93	0.4	0.51	1.38	1.54	1.28	1.12	1.23	1.13	1.35	0.76
Pr	1	0.76	0.8	0.05	0.06	0.17	0.19	0.15	0.14	0.15	0.14	0.17	0.14
Nd	5.51	4.28	4.39	0.24	0.26	0.77	0.91	0.67	0.61	0.63	0.64	0.78	0.78
Sm	1.76	1.38	1.45	0.05	0.06	0.14	0.21	0.13	0.12	0.12	0.11	0.16	0.34
Eu	0.7	0.53	0.52	0.09	0.07	0.25	0.27	0.25	0.23	0.25	0.24	0.25	0.18
Gd	2.46	1.95	1.94	0.07	0.07	0.13	0.24	0.13	0.11	0.12	0.11	0.19	0.5
Tb	0.43	0.34	0.36	0.01	0.01	0.02	0.04	0.02	0.01	0.02	0.02	0.03	0.1
Dy	3	2.42	2.52	0.1	0.08	0.11	0.25	0.11	0.1	0.11	0.1	0.18	0.72
Ho	0.65	0.52	0.53	0.02	0.02	0.02	0.05	0.02	0.02	0.02	0.02	0.04	0.16
Er	1.85	1.52	1.53	0.07	0.07	0.07	0.16	0.06	0.06	0.06	0.05	0.11	0.44
Tm	0.29	0.24	0.24	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.02	0.06
Yb	1.84	1.5	1.55	0.07	0.08	0.07	0.16	0.07	0.06	0.07	0.06	0.11	0.42
Lu	0.28	0.22	0.24	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.02	0.06
Hf	1.25	0.93	0.96	0.02	0.02	0.19	0.2	0.14	0.19	0.23	0.18	0.2	0.14
Ta	0.03	0.01	0.02	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	0.01
Pb	0.64	0.3	0.79	0.6	0.67	1.02	0.8	0.98	0.54	0.45	0.37	0.31	0.93
Th	0.2	0.1	0.13	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	0.03
U	0.12	0.04	0.06	0.02	0.03	0.05	0.05	0.03	0.04	0.01	0.02	0.01	0.01
Mg#	65.15	69.97	68.75	76.61	83.48	59.39	67.21	47.35	53.19	45.17	48.92	56.64	86.19
δEu	1.03	0.99	0.95	4.65	3.29	5.57	3.66	5.82	6.01	6.3	6.6	4.38	1.34

Table 2. *Cont.*

Location	Dong												
Data Sources	References [12]									Standards Rocks			
Rock Type	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro	Gabbro				
Sample Name	11DC-3	11DC-4	11DC-6	11DC-7	11DC-8	11DC-16	11DC-37	11DC-38	11DC-39	GBW07105	Reference Values	NCSDC47009	Reference Values
Al_2O_3	15.43	26.71	16.12	18.69	18.99	16.36	15.66	15.65	22.23	13.76	13.83	2.51	2.49
BaO										0.07	0.06	0.15	0.15
CaO	19.55	17.56	12.28	15.3	18.92	11.43	11.29	11.27	17.44	8.75	8.81	19.75	19.80
Cr_2O_3										0.02	0.02	<0.01	0.00
Fe_2O_3T	3.15	1.93	8.2	4.02	2.29	8.33	9.94	10	2.89	13.17	13.40	2.88	2.96
K_2O	0.02	0.02	0.18	0.11	0.3	0.23	0.11	0.12	0.07	2.30	2.32	0.70	0.70
MgO	10.42	5.3	8.63	11.71	8.72	8.44	7.75	8.59	6.36	7.69	7.77	3.75	3.82
MnO	0.07	0.03	0.14	0.07	0.05	0.14	0.15	0.14	0.06	0.18	0.17	20.40	20.30
Na_2O	0.64	0.91	1.8	0.73	0.85	2.31	2.21	2.05	1.33	3.37	3.38	0.03	0.04
P_2O_5	0.01	0.01	0.02	0.01	0.01	0.02	0.05	0.04	0.01	0.99	0.95	0.14	0.14
SiO_2	49.44	46.14	50.37	46.43	48.09	50.99	50.21	49.75	48.03	44.22	44.64	15.84	15.82
SrO										0.14	0.13	0.04	0.00
TiO_2	0.11	0.04	0.38	0.06	0.07	0.41	0.84	0.85	0.14	2.34	2.37	0.15	0.15
LOI 1000	1.16	1.33	0.94	2.87	1.71	1.32	1.76	1.52	1.43				
Total	100	99.98	99.06	100	99.99	99.98	99.97	99.98	99.98				
Li													
Be													
Sc	60	21	37.6	30.5	49.2	38.8	39.3	40.6	43.1				
Ti													
V	100	47	203	80	85	223	258	269	90				
Mn													
Co	23	14.1	36.4	33.4	19	36.9	38.1	40.1	16.1				
Ni	92.8	90	90.4	213	95	89	84.4	94.2	59.7				
Cu	3.62	17	12.5	43.1	10.7	20	15.8	35.7	93.2				
Zn	16.9	13.3	45.1	23.1	13.8	47.1	47.3	47.3	19.8				
Ga	7.41	10.7	12	8.25	8.26	12.11	14.31	14.01	10.31				
As													
Se													
Rb	0.26	0.18	2.12	2.36	2.67	3.33	1.47	1.29	1.96				
Sr	67.2	96.7	75.5	52.7	116	91.5	155	117	169				
Y	3.29	1.27	11.1	2.21	2.05	12.1	20	19.5	3.6				
Zr	1.96	0.7	17.7	0.65	0.89	20.5	49.7	44.5	2.7				

Nb	0.02	0.02	0.45	0.02	0.02	0.5	1.07	0.76	0.03
Cs	0.25	0.19	1.97	2.45	0.52	2.58	0.17	1.12	0.31
Ba	4.43	3.49	32.8	9.8	5.5	40.2	14.9	14	10.8
La	0.12	0.06	0.95	0.06	0.07	1.02	2	1.71	0.16
Ce	0.36	0.2	2.6	0.19	0.22	2.74	5.85	5	0.55
Pr	0.07	0.04	0.45	0.04	0.04	0.44	1.01	0.92	0.11
Nd	0.39	0.17	2.38	0.2	0.22	2.49	5.53	4.95	0.69
Sm	0.21	0.08	0.93	0.13	0.13	0.89	1.9	1.8	0.29
Eu	0.12	0.09	0.36	0.09	0.08	0.37	0.7	0.7	0.22
Gd	0.37	0.14	1.32	0.24	0.25	1.35	2.62	2.53	0.49
Tb	0.08	0.03	0.25	0.05	0.05	0.27	0.48	0.47	0.09
Dy	0.57	0.22	1.81	0.36	0.38	1.97	3.35	3.23	0.64
Ho	0.14	0.05	0.43	0.09	0.08	0.48	0.75	0.75	0.14
Er	0.37	0.14	1.24	0.26	0.24	1.34	2.13	2.14	0.36
Tm	0.05	0.02	0.19	0.03	0.03	0.19	0.32	0.32	0.05
Yb	0.34	0.11	1.29	0.23	0.2	1.32	2.12	2.04	0.3
Lu	0.05	0.02	0.19	0.04	0.03	0.21	0.32	0.31	0.05
Hf	0.11	0.03	0.53	0.04	0.05	0.62	1.31	1.25	0.13
Ta	0.01	0	0.03	0	0	0.04	0.08	0.06	0.01
Pb	0.21	0.2	0.23	0.64	0.66	1.09	0.36	1.45	0.84
Th	0.01	0.01	0.14	0.01	0.01	0.16	0.24	0.19	0.01
U	0.01	0	0.06	0	0	0.07	0.09	0.1	0
Mg#	88.52	86.49	71.04	87.16	89.87	70.25	64.5	66.69	83.68
δEu	1.3	2.53	1	1.55	1.43	1.04	0.95	1	1.74

Table 2. *Cont.*

Data Sources	standards rocks											
Sample Name	**SARM-4**	**Reference Values**	**SARM-5**	**Reference Values**	**AGV-2**	**Reference Values**	**BCR-2**	**Reference Values**	**BHVO-2**	**Reference Values**	**GSP-2**	**Reference Values**
Al_2O_3	16.52	16.50	4.12	4.18								
BaO	0.01	0.01	0.01	0.01								
CaO	11.40	11.50	2.62	2.66								
Cr_2O_3	0.01	0.00	3.49	3.58								
Fe_2O_3T	8.98	8.97	12.74	12.70								
K_2O	0.24	0.25	0.08	0.09								
MgO	7.54	7.50	25.60	25.30								
MnO	0.19	0.18	0.23	0.22								
Na_2O	2.46	2.46	0.41	0.37								
P_2O_5	0.01	0.01	0.01	0.02								
SiO_2	52.61	52.64	51.14	51.10								
SrO	0.04	0.03	0.01	0.00								
TiO_2	0.18	0.20	0.18	0.20								
LOI 1000												
Total												
Li					10.94	11.00	9.22	9.00	4.47	4.80	36.02	36.00
Be					2.50	2.30	2.95		1.14	1.00	1.58	1.50
Sc					13.41	13.00	32.35	33.00	31.11	32.00	9.65	7.00
Ti					6640.62	6294.00	14,571.41	13,845.00	17,775.60	16,602.00	4204.98	4076.00
V					112.97	122.00	403.68	416.00	308.57	317.00	48.63	50.00
Mn					808.53	775.00	1611.43	1626.00	1386.54	1356.00	328.96	264.00
Co					15.87	16.00	38.08	37.00	45.55	45.00	7.17	7.30
Ni					20.24	20.00	14.29	18.00	127.98	119.00	18.42	17.00
Cu					53.13	53.00	18.55	21.00	134.23	127.00	45.95	46.00
Zn					94.36	86.00	139.91	127.00	105.19	103.00	118.07	120.00
Ga					21.15	21.00	22.20	23.00	20.79	22.00	42.45	24.00
As					11.01		10.93		10.58		18.64	
Se					0.78		1.05		0.99		1.72	
Rb					67.10	66.80	47.58	46.90	9.59	9.11	238.50	247.00
Sr					654.98	661.00	332.43	340.00	386.32	396.00	229.53	240.00
Y					19.92	20.00	35.49	37.00	25.85	26.00	26.54	28.00
Zr					225.36	230.00	178.07	184.00	165.15	172.00	568.09	550.00
Nb					13.81	14.50	11.88	12.60	17.92	18.10	25.73	27.00
Cs					1.18	1.20	1.13	1.10	0.10	0.10	1.19	1.20
Ba					1132.76	1130.00	667.39	677.00	129.29	131.00	1333.71	1340.00
La					37.80	37.90	24.76	24.90	15.00	15.20	179.51	180.00
Ce					69.57	68.60	52.62	52.90	37.43	37.50	433.63	440.00
Pr					8.27	8.15	6.78	6.70	5.25	5.35	55.54	56.00
Nd					32.14	30.50	30.02	28.70	25.97	24.50	220.78	212.00

Sm	5.43	5.49	6.50	6.58	6.08	6.07	25.51	27.00
Eu	1.53	1.53	1.95	1.96	2.09	2.07	2.26	2.30
Gd	4.58	4.52	6.62	6.75	6.16	6.24	12.76	13.00
Tb	0.64	0.64	1.01	1.07	0.92	0.92	1.46	1.25
Dy	3.50	3.47	6.27	6.41	5.36	5.31	5.89	6.10
Ho	0.66	0.68	1.27	1.28	0.99	0.98	0.96	1.00
Er	1.79	1.81	3.47	3.66	2.45	2.54	2.53	2.53
Tm	0.26	0.26	0.52	0.54	0.34	0.33	0.29	0.30
Yb	1.60	1.62	3.29	3.38	1.97	2.00	1.67	1.70
Lu	0.24	0.25	0.49	0.50	0.27	0.27	0.23	0.23
Hf	4.99	5.00	4.65	4.90	4.21	4.36	14.43	14.00
Ta	0.79	0.87	0.72	0.74	1.10	1.14	0.82	0.79
Pb	13.38	13.20	10.18	11.00	1.60	1.60	42.45	42.00
Th	5.90	6.10	5.61	5.70	1.07	1.22	107.66	105.00
U	1.87	1.86	1.63	1.69	0.41	0.40	2.41	2.40

Table S3. Zircon U–Pb ages data of Dongco ophiolitic anorthosite (XDC08) and Lanong ophiolitic anorthosite (16XLN03-1) and gabbro (16XLN07-1).

Sample Spot	Concentrations (ppm)			Isotopic Ratios				Isotopic Ages (Ma)			
	Th	U	Th/U	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ	$^{207}Pb/^{235}U$	1σ	$^{206}Pb/^{238}U$	1σ
XDC08, Dongco anorthosite (SIMS zircon U–Pb dating)											
XDC08-01	181.42	219.59	0.83	0.177250	2.253151	0.025814	1.500001	165.7	3.45	164.3	2.43
XDC08-03	116.70	145.59	0.80	0.177656	2.808144	0.025532	1.528053	166.0	4.31	162.5	2.45
XDC08-05	34.14	82.49	0.41	0.183139	3.952626	0.025795	1.611948	170.8	6.23	164.2	2.61
XDC08-06	258.97	299.09	0.87	0.179040	2.028895	0.026219	1.504742	167.2	3.13	166.8	2.48
XDC08-07	129.21	204.81	0.63	0.179046	2.265463	0.026238	1.500356	167.2	3.50	167.0	2.47
XDC08-08	174.53	278.59	0.63	0.188846	3.348404	0.026523	1.557463	175.6	5.42	168.8	2.59
XDC08-09	80.65	130.28	0.62	0.175706	2.287407	0.026042	1.505824	164.4	3.48	165.7	2.46
XDC08-10	153.89	274.67	0.56	0.182966	2.092499	0.026285	1.505298	170.6	3.29	167.3	2.49
XDC08-11	246.90	178.79	1.38	0.181863	3.381810	0.025639	1.566439	169.7	5.30	163.2	2.52
XDC08-13	400.85	337.42	1.19	0.177402	2.463571	0.025663	1.689691	165.8	3.78	163.3	2.73
XDC08-15	333.59	359.28	0.93	0.182208	1.944637	0.026795	1.525522	170.0	3.05	170.5	2.57
XDC08-16	209.03	387.13	0.54	0.183144	1.808625	0.026802	1.500202	170.8	2.85	170.5	2.52
XDC08-17	722.10	563.04	1.28	0.179628	1.762587	0.026423	1.562794	167.7	2.73	168.1	2.59
XDC08-18	89.07	170.06	0.52	0.180850	2.119253	0.026836	1.524270	168.8	3.30	170.7	2.57
XDC08-20	179.84	234.67	0.77	0.180659	2.391929	0.026735	1.502971	168.6	3.72	170.1	2.52
XDC08-21	711.55	565.92	1.26	0.182846	1.715703	0.026562	1.500279	170.5	2.70	169.0	2.50
XDC08-23	127.23	188.13	0.68	0.182094	2.061459	0.026678	1.501355	169.9	3.23	169.7	2.52
XDC08-25	47.44	73.04	0.65	0.177068	3.267216	0.026106	1.507985	165.5	5.00	166.1	2.47
XDC08-26	102.45	166.00	0.62	0.179493	2.409826	0.025911	1.500066	167.6	3.73	164.9	2.44
XDC08-27	379.85	475.15	0.80	0.178719	1.746747	0.026383	1.503917	167.0	2.69	167.9	2.49
XDC08-28	109.90	159.37	0.69	0.179796	2.365112	0.026539	1.509843	167.9	3.67	168.8	2.52
XDC08-29	69.34	137.19	0.51	0.179813	2.247548	0.026737	1.512460	167.9	3.48	170.1	2.54
XDC08-30	203.60	321.47	0.63	0.176127	1.975883	0.025782	1.507403	164.7	3.01	164.1	2.44
XDC08-31	148.76	298.10	0.50	0.180659	2.167737	0.026090	1.624153	168.6	3.37	166.0	2.66
XDC08-32	348.59	341.73	1.02	0.178570	2.102591	0.026174	1.561735	166.8	3.24	166.6	2.57
16XLN03-1, Lanong anorthosite (LA–ICP–MS zircon U–Pb dating)											
16XLN03-1-01	179.26	384.00	0.47	0.167922	0.011749	0.026552	0.000322	157.6	10.21	168.9	2.02
16XLN03-1-03	322.19	568.61	0.57	0.180799	0.005388	0.026704	0.000321	168.7	4.63	169.9	2.02
16XLN03-1-04	50.03	149.73	0.33	0.189580	0.008868	0.026716	0.000432	176.3	7.57	170.0	2.71
16XLN03-1-05	1493.61	1174.98	1.27	0.178889	0.007839	0.026321	0.000241	167.1	6.75	167.5	1.51
16XLN03-1-06	1346.46	1390.54	0.97	0.192252	0.006123	0.026011	0.000244	178.5	5.22	165.5	1.54
16XLN03-1-10	261.96	453.82	0.58	0.168017	0.006708	0.026114	0.000240	157.7	5.83	166.2	1.51
16XLN03-1-11	2572.46	2344.83	1.10	0.197838	0.005301	0.026166	0.000178	183.3	4.50	166.5	1.12

16XLN03-1-16	1844.17	2040.21	0.90	0.169018	0.005085	0.026226	0.000227	158.6	4.42	166.9	1.43
16XLN03-1-19	1285.89	1711.23	0.75	0.182034	0.004726	0.026156	0.000262	169.8	4.06	166.4	1.65
16XLN03-1-24	5092.74	3689.75	1.38	0.200108	0.004645	0.026431	0.000304	185.2	3.93	168.2	1.91
16XLN03-1-25	958.82	1178.85	0.81	0.180536	0.004877	0.025704	0.000296	168.5	4.20	163.6	1.86
16XLN03-1-27	971.44	1150.90	0.84	0.198014	0.004824	0.026293	0.000256	183.4	4.09	167.3	1.61
16XLN03-1-28	366.57	760.49	0.48	0.198073	0.005486	0.026158	0.000318	183.5	4.65	166.5	2.00
16XLN03-1-31	571.33	890.97	0.64	0.178246	0.004535	0.026093	0.000292	166.5	3.91	166.0	1.84
16XLN03-1-32	515.96	1007.55	0.51	0.180499	0.004449	0.025892	0.000346	168.5	3.83	164.8	2.18
16XLN07-1, Lanong gabbro (LA–ICP–MS zircon U–Pb dating)											
16XLN07-1-03	1346.36	1383.95	0.97	0.175374	0.003893	0.026031	0.000280	164.1	3.36	165.7	1.76
16XLN07-1-06	746.01	1441.77	0.52	0.187355	0.003877	0.027041	0.000251	174.4	3.32	172.0	1.58
16XLN07-1-08	2226.49	2089.92	1.07	0.182595	0.003650	0.026328	0.000261	170.3	3.14	167.5	1.64
16XLN07-1-09	3696.23	2650.87	1.39	0.177246	0.003227	0.026160	0.000233	165.7	2.79	166.5	1.47
16XLN07-1-10	1584.44	1436.05	1.10	0.182336	0.003955	0.026341	0.000225	170.1	3.40	167.6	1.41
16XLN07-1-11	3794.64	1381.72	2.75	0.183516	0.003902	0.026174	0.000261	171.1	3.35	166.6	1.64
16XLN07-1-12	980.12	1204.58	0.81	0.176945	0.003762	0.026294	0.000278	165.4	3.25	167.3	1.75
16XLN07-1-17	2022.03	1920.99	1.05	0.176160	0.004242	0.026375	0.000300	164.8	3.66	167.8	1.89
16XLN07-1-18	1697.92	1864.86	0.91	0.178308	0.004876	0.026072	0.000265	166.6	4.20	165.9	1.67
16XLN07-1-19	3138.16	709.00	4.43	0.177732	0.005082	0.026171	0.000294	166.1	4.38	166.5	1.85
16XLN07-1-22	2007.54	572.33	3.51	0.179664	0.005159	0.025983	0.000283	167.8	4.44	165.4	1.78
16XLN07-1-23	787.69	910.58	0.87	0.171442	0.004197	0.026038	0.000247	160.7	3.64	165.7	1.56
16XLN07-1-25	1213.05	1082.82	1.12	0.175514	0.004307	0.026080	0.000308	164.2	3.72	166.0	1.94
16XLN07-1-27	4053.07	1472.67	2.75	0.178544	0.003769	0.026937	0.000278	166.8	3.25	171.3	1.75
16XLN07-1-28	869.73	971.03	0.90	0.172466	0.004086	0.026259	0.000273	161.6	3.54	167.1	1.72

Table S4. Zircon Hf isotopic data of the anorthosite samples from the Dongco (XDC08) and Lanong (16XLN03-1) ophiolites.

Samples	Age	$^{176}Yb/^{177}Hf$	2σ	$^{176}Lu/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf$	2σ	$(^{176}Hf/^{177}Hf)_i$	εHf(t)	T_{DM1} (Ma)	T_{DM2} (Ma)
XDC08, Dongco ophiolitic anorthosite											
XDC08-02	163.6	0.044118	0.000451	0.001797	0.000016	0.283127	0.000021	0.283121	15.94	180.3	189.7
XDC08-06	166.8	0.086875	0.000050	0.003370	0.000004	0.282954	0.000017	0.282944	9.73	450.5	591.0
XDC08-07	167	0.066985	0.000546	0.002569	0.000013	0.283047	0.000012	0.283039	13.12	302.5	374.3
XDC08-09	165.7	0.069702	0.000899	0.002712	0.000036	0.283114	0.000012	0.283105	15.43	204.0	224.1
XDC08-10	167.3	0.106907	0.000476	0.004267	0.000018	0.282921	0.000014	0.282907	8.46	514.4	672.9
XDC08-11	163.2	0.055883	0.000759	0.002166	0.000030	0.283000	0.000013	0.282994	11.43	367.7	479.5
XDC08-13	163.3	0.091645	0.000176	0.003505	0.000004	0.282902	0.000012	0.282891	7.79	532.3	712.6
XDC08-15	170.5	0.142389	0.001320	0.005206	0.000041	0.282899	0.000016	0.282882	7.63	564.2	728.1
XDC08-20	170.1	0.083933	0.000557	0.003176	0.000011	0.282930	0.000013	0.282919	8.95	485.0	643.4
XDC08-21	169	0.130530	0.000145	0.004943	0.000004	0.282921	0.000014	0.282905	8.42	524.8	676.9
XDC08-23	169.7	0.074350	0.000264	0.003004	0.000014	0.282991	0.000012	0.282982	11.14	390.3	503.1
XDC08-24	159.4	0.080983	0.001070	0.003006	0.000033	0.283015	0.000013	0.283006	11.77	355.1	455.1
XDC08-26	164.9	0.046846	0.000359	0.001958	0.000016	0.283074	0.000013	0.283068	14.08	258.6	310.8
XDC08-28	168.8	0.072299	0.000030	0.002703	0.000004	0.283031	0.000015	0.283023	12.58	327.1	410.2
XDC08-31	166	0.072048	0.000884	0.002996	0.000035	0.283010	0.000015	0.283001	11.75	361.3	461.2
XDC08-32	166.6	0.107650	0.000375	0.004166	0.000017	0.282840	0.000013	0.282827	5.62	637.0	853.5
16XLN03, Lanong anorthosite											
16XLN03-1-01	168.9	0.184966	0.001100	0.006380	0.000035	0.282980	0.000010	0.282960	10.37	449.2	552.1
16XLN03-1-03	169.9	0.182163	0.001090	0.004900	0.000021	0.283105	0.000009	0.283089	14.95	231.8	258.5
16XLN03-1-04	170	0.134067	0.002150	0.003655	0.000048	0.283083	0.000010	0.283071	14.32	257.1	299.2
16XLN03-1-10	166.2	0.172945	0.001730	0.005959	0.000064	0.283005	0.000011	0.282986	11.23	403.6	495.0

Table S5. Whole-rock Sr–Nd isotopic data of the anorthosite and gabbro samples from the Dongco and Lanong ophiolites.

Samples	Location	Age	Rb	Sr	$^{87}Sr/^{86}Sr$	Error(1δ)	$^{87}Rb/^{86}Sr$	$(^{87}Sr/^{86}Sr)_i$	Sm	Nd	$^{143}Nd/^{144}Nd$	$^{147}Sm/^{144}Nd$	Error(1δ)	$(^{143}Nd/^{144}Nd)_i$	εNd(t)	T_{1DM} (Ma)	T_{2DM} (Ma)	Data Sources
anorthosite																		
16XLN03-1	Lanong	166.8	2.00	96.00	0.706268	0.000003	0.060259	0.706125	0.05	0.24	0.512481	0.12589	0.000004	0.512343	−1.56	1163.8	1081.8	this study
16XLN03-4	Lanong	166.8	0.24	6.86	0.713192	0.000003	0.101262	0.712952	0.42	1.83	0.512563	0.13868	0.000004	0.512411	−0.24	1196.4	974.3	this study
16XLN03-7	Lanong	166.8	0.26	6.59	0.707136	0.000002	0.114127	0.706865	0.96	4.07	0.512604	0.14253	0.000003	0.512448	0.49	1172.5	915.1	this study
16XLN08-2	Lanong	166.8	0.57	308.00	0.706070	0.000003	0.005353	0.706058	2.85	10.86	0.512700	0.15858	0.000003	0.512527	2.02	1248.1	790.1	this study
DC01	Dongco	169.0	3.59	205.00	0.703736	0.000004	0.050640	0.703614	0.14	0.77	0.512875	0.10986	0.000008	0.512753	6.50	406.4	426.6	this study
DC03	Dongco	169.0	2.07	198.00	0.704187	0.000005	0.030233	0.704114	0.21	0.91	0.512937	0.13944	0.000008	0.512782	7.06	441.5	380.4	this study
DC06	Dongco	169.0	2.31	204.00	0.703556	0.000004	0.032744	0.703477	0.12	0.63	0.512951	0.11510	0.000009	0.512824	7.88	309.6	313.9	this study
DC08	Dongco	169.0	1.89	174.00	0.703670	0.000005	0.031410	0.703595	0.16	0.78	0.512963	0.12395	0.000008	0.512826	7.91	320.2	310.8	this study
gabbro																		
16XLN02-1	Lanong	167.3	0.56	12.35	0.706360	0.000002	0.131156	0.706048	0.36	1.31	0.512712	0.16605	0.000011	0.512530	2.10	1405.0	784.1	this study
16XLN02-3	Lanong	167.3	0.58	22.70	0.706391	0.000003	0.073905	0.706215	0.22	0.83	0.512587	0.16016	0.000013	0.512411	−0.22	1606.8	973.6	this study
16XLN07-1	Lanong	167.3	20.30	350.00	0.706225	0.000005	0.167761	0.705826	0.40	1.45	0.512816	0.16669	0.000004	0.512633	4.11	1089.4	620.4	this study
16XLN07-4	Lanong	167.3	20.60	419.00	0.706240	0.000003	0.142206	0.705902	0.37	1.37	0.512816	0.16319	0.000005	0.512638	4.20	1011.9	613.2	this study
16XLN07-5	Lanong	167.3	15.28	356.00	0.706162	0.000006	0.124146	0.705867	0.30	1.28	0.512656	0.14162	0.000007	0.512500	1.52	1049.0	831.6	this study
16XLN09-3	Lanong	167.3	8.31	371.00	0.706119	0.000005	0.064787	0.705965	0.28	1.17	0.512609	0.14461	0.000006	0.512451	0.55	1196.2	910.5	this study
16XLN09-4	Lanong	167.3	0.30	18.33	0.706726	0.000004	0.047342	0.706613	0.95	3.34	0.512644	0.17187	0.000004	0.512455	0.64	1848.3	903.4	this study
16XLN09-5	Lanong	167.3	0.27	15.08	0.706607	0.000006	0.051790	0.706484	0.47	1.78	0.512557	0.15955	0.000005	0.512382	−0.79	1671.0	1019.3	this study
11 DC-1	Dongco	167.0	3.88	92.01	0.704093	0.000003	0.121978	0.703803	0.34	0.78	0.513095	0.26084	0.000002	0.512810	7.55	−181.4	338.9	[12]
11 DC-3	Dongco	167.0	0.26	67.16	0.703420	0.000002	0.011367	0.703393	0.21	0.39	0.513125	0.33172	0.000007	0.512763	6.62	−33.7	414.6	[12]
11 DC-6	Dongco	167.0	2.12	75.48	0.703488	0.000002	0.081256	0.703295	0.93	2.38	0.513067	0.23540	0.000002	0.512810	7.55	−590.4	339.2	[12]
12 DC-16	Dongco	167.0	3.33	91.53	0.703638	0.000002	0.105109	0.703388	0.89	2.49	0.513074	0.21641	0.000003	0.512838	8.09	−4243.4	294.9	[12]

Table S6. Ages of arc-related rocks from the Northern Lhase terrane and Southern Qiangtang terrane, Tibetan Plateau.

Samples Location	Ages (Ma)	lithology	References
	Southern Qiangtang terrane		
Gerze	87.0 ± 0.8	rhyolites	[35]
Gerze	97.1 ± 0.6	rhyolites	[35]
Gerze	99.3 ± 1.1	rhyolites	[35]
Biluoco area	95.4 ± 0.9	andesite	[35]
Biluoco area	94.4 ± 0.81	andesite	[35]
Duobuzha	113.4 ± 1.5	andesite	[36]
Duobuzha	113.8 ± 1.4	andesite	[36]
Duobuzha	117.6 ± 1.5	rhyolite	[36]
Duolong	117.9 ± 1.5	Basaltic andesites	[37]
Duolong	105.7 ± 1.7	Basaltic andesites	[37]
Duolong	121.5 ± 1.2	Basaltic andesites	[37]
Duolong	111.9 ± 1.9	andesite	[37]
Duolong	118.5 ± 1.4	basaltic andesite	[37]
Duolong	106.4 ± 1.4	basaltic andesite	[37]
Maierze area	122.0 ± 1.0	basalt	[38]
Maierze area	120.0 ± 1.0	dacites	[38]
Along Tso	120.8 ± 1.2	diabasic dyke	[39]
Bizha area	121.3 ± 0.9	gabbroic diorite	[40]
Bizha area	122.9 ± 1.9	pyroxene diorite	[40]
Bizha area	122.2 ± 1.8	pyroxene diorite	[40]
Bizha area	121.8 ± 1.7	pyroxene diorite	[40]
Gerze	153.0 ± 1.9	diorite	[41]
Gerze	152.7 ± 1.4	diorite	[41]
Gerze	148.4 ± 2.5	diorite	[41]
Gerze	151.7 ± 1.3	granodiorite	[41]
Gerze	148.1 ± 1.5	granodiorite	[41]
Gerze	111.7 ± 0.9	granodiorite porphyry	[41]
Gerze	122.4 ± 0.4	andesite	[42]
Gerze	124.4 ± 0.4	andesite	[42]
Gerze	157.5 ± 2.2	diorite	[43]
Gerze	148.4 ± 1.4	granodiorite	[43]
Gerze	156.3 ± 3.3	dioritic enclave	[43]
Gerze	150.6 ± 8.5	andesite	[43]
Gerze	106.6 ± 0.8	andesite	[43]
Gerze	106.6 ± 0.8	andesite	[43]
Gerze	107.0 ± 0.9	andesite	[43]
Gerze	112.3 ± 1.0	granodiorite	[43]
Gerze	109.0 ± 1.8	granodiorite	[43]
Gerze	151.7±1.0	granodiorite	[43]
Gerze	149.6 ± 0.8	granodiorite	[43]
Gerze	122.9 ± 1.7	diorite	[43]
Gerze	155.1 ± 4.5	granodiorite	[44]
Gerze	145.0 ± 1.0	granodiorite	[44]
Gerze	111.0 ± 2.0	volcanic	[44]
Gerze	107.0 ± 1.0	volcanic	[44]
Gerze	116.0 ± 2.0	volcanic	[44]
Gerze	147.3 ± 1.1	granodiorite	[45]
Zhabuyebei	134.1 ± 0.8	granodiorite	[46]
Galale	155.6 ± 1.1	granodiorite	[46]
Gerze	142.2 ± 0.4	granodiorite	[46]
Sena	122.0 ± 1.8	granodiorite	[47]
Gerze	163.6 ± 1.2	Granodiorite	[48]

Gerze	161.2 ± 1.4	Granodiorite porphyry	[48]
Gerze	168.4 ± 1.7	Diorite	[48]
Gerze	153.1 ± 1.3	Diorite	[48]
Gerze	150.1 ± 1.2	Granodiorite	[48]
Gerze	160.3 ± 1.6	Diorite	[48]
BH-83-1	120.0 ± 1.0	Granodiorite	[48]
BH-83-1	164.0 ± 1.9	Granodiorite	[48]
BH-83-1	165.7 ± 1.6	Granodiorite	[48]
BH-83-1	164.5 ± 1.2	Granodiorite	[48]
SJ-1	123.1 ± 2.1	Diorite	[48]
SJ-1	160.7 ± 1.2	Diorite	[48]
SJ-1	161.0 ± 1.0	Diorite	[48]
Amdo	228.6 ± 1.6	basalts	[49]
Amdo	220.0 ± 2.1	pillow lavas	[49]
Northern Lhasa terrane			
Nagqu	112.7 ± 0.7	Andesite	[50]
Nagqu	109.2 ± 3.5	Rhyolite dacite	[51]
Nagqu	111.9 ± 1. 2	Andesite	[51]
Nagqu	116.3 ± 1.4	Andesite	[52]
Nagqu	111.8 ± 0.7	Andesite	[52]
Bange	122.1 ± 0.9	Andesite	[53]
Baerda	113.6 ± 0.7	Granodiorite-porphyry	[54]
Baerda	114.6 ± 0.8	andesitic porphyrite	[54]
Gerenco	113.6 ± 1.1	Andesite	[55]
Zhalongqiongwa	85.6 ± 0.5	quartz monzonite	[56]
Zhalongqiongwa	85.5 ± 0.8	quartz monzonite	[56]
Rusong	82.0 ± 1.1	granodiorite	[57]
Rusong	82.9 ± 1.3	granodiorite	[57]
Rusong	90.7 ± 1.2	granodiorite	[57]
Rusong	79.6 ± 0.3	granite porphyry	[58]
Rusong	76.9 ± 1.2	dioritic porphyrite	[58]
Nyima	91.0 ± 0.8	dacite	[59]
Minqianri	91.2 ± 0.2	Basaltic, andesite, andesite, dacite	[60]
Balazha	88.0 ± 1.6	Granodiorite-porphyry	[61]
Gaerqiong	87.1 ± 0.4	Quartz diorite	[62]
Sebuta	89.7 ± 1.8	Biotite granite	[63]
Xiongba	90.0 ± 0.5	Miocene ultra-K volcanic rocks	[64]
Gaerqiong	84.6 ± 1.0	dioritic porphyrite	[65]
Gaerqiong	84.6 ± 1.1	dioritic porphyrite	[65]
Bange-Naqu-Sangba	122.1 ± 0.9	Andesite	[66]
Bange-Naqu-Sangba	113.4 ± 1.7	Biotite monzogranite	[66]
Bange-Naqu-Sangba	108.9 ± 2.6	Biotite granite	[66]
Bange-Naqu-Sangba	110.7 ± 0.6	Syenogranite	[66]
Bange-Naqu-Sangba	110.7 ± 0.8	Monzogranite	[66]
Bange-Naqu-Sangba	111.9 ± 0.9	Dacite	[66]
Bange-Naqu-Sangba	110.8 ± 0.6	Andesite	[66]
Bange-Naqu-Sangba	118.4 ± 0.5	Monzogranite	[66]
Bange-Naqu-Sangba	127.0 ± 1.6	Bt granite	[66]
Bange-Naqu-Sangba	130.4 ± 1.0	Dacite	[66]
Bange-Naqu-Sangba	117.4 ± 1.3	Hb granite	[66]
Bange-Naqu-Sangba	117 ± 2.8	Granite	[66]
Bange-Naqu-Sangba	111.7 ± 1.6	Granite	[66]
Bange-Naqu-Sangba	123.3 ± 3.2	Granite	[66]
Bange-Naqu-Sangba	120.8 ± 1.5	Bt granite	[66]
Bange-Naqu-Sangba	103.3 ± 2.0	Granite	[66]
Bange-Naqu-Sangba	108.9 ± 0.8	Bt diorite	[66]
Bange-Naqu-Sangba	114.6 ± 1.8	Granite	[66]
Bange-Naqu-Sangba	119.0 ± 2.3	Granite	[66]

Bange-Naqu-Sangba	111.8 ± 2.4	Granite	[66]
Bange-Naqu-Sangba	124.0 ± 3.6	Granite	[66]
Bange-Naqu-Sangba	117.5 ± 3.9	Granite	[66]
Bange-Naqu-Sangba	111.6 ± 0.5	Granite	[66]
Bange-Naqu-Sangba	123.3 ± 4.2	Granite	[66]
Bange-Naqu-Sangba	115.4 ± 0.6	Diorite porphyry	[66]
Bange-Naqu-Sangba	116.6 ± 0.8	Rhyolite	[66]
Bange-Naqu-Sangba	116.4 ± 1.2	Andesite	[66]
Bange-Naqu-Sangba	111.4 ± 0.7	Andesite	[66]
Bange-Naqu-Sangba	117.2 ± 1.6	granite	[66]
Bange-Naqu-Sangba	121.2 ± 1.7	granite	[66]
Bange-Naqu-Sangba	118.0 ± 0.5	granite	[66]
Bange-Naqu-Sangba	114.0 ± 0.8	granite	[66]
Bange-Naqu-Sangba	110.0 ± 0.7	granite	[66]
Bange-Naqu-Sangba	109.2 ± 3.5	rhyolite	[66]
Bange-Naqu-Sangba	105.0 ± 0.9	dacite	[66]
Gerze-Nyima-Bange	112.2 ± 0.9	Granite	[66]
Gerze-Nyima-Bange	88.0 ± 1.6	Monzogranite porphyry	[66]
Gerze-Nyima-Bange	91.0 ± 0.8	Dacite	[66]
Gerze-Nyima-Bange	115.7 ± 0.6	Rhyolite	[66]
Gerze-Nyima-Bange	103.0 ± 0.8	rhyolite	[66]
Gerze-Nyima-Bange	107.2 ± 1.0	rhyolite	[66]
Gerze-Nyima-Bange	105.0 ± 1.0	dacite	[66]
Gerze-Nyima-Bange	100.0 ± 1.0	dacite	[66]
Yanhu	131.2 ± 1.4	Andesite	[66]
Yanhu	110.1 ± 0.7	Monzogranite	[66]
Yanhu	110.6 ± 0.6	Rhyolite	[66]
Yanhu	116.7 ± 1.2	Andesite	[66]
Yanhu	109.0 ± 1.0	Rhyolite	[66]
Yanhu	109.7 ± 0.8	Quartz diorite porphyrite	[66]
Yanhu	127.8 ± 0.5	Andesite	[66]
Yanhu	122.0 ± 0.6	Andesite	[66]
Yanhu	132.0 ± 2.0	Volcanic rocks	[66]
Yanhu	126.4 ± 1.1	Volcanic rocks	[66]
Yanhu	120.0 ± 1.0	Volcanic rocks	[66]

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