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Tethyan suturing in Southeast Asia: Zircon U-Pb and Hf-O isotopic constraints from Myanmar ophiolites

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Supplementary text: Analytical methods

Fig. DR1: Sketch geological map of Myanmar.

Fig. DR2: Sketch geological maps of the Kalaymyo and Myitkyina ophiolites.

Fig. DR3: Total alkali-silica (TAS) diagram (a), rare earth element (b) and trace element patterns (c) of the dating samples. Primitive mantle (PM) and normal mid-ocean ridge basalt (N-MORB) normalized values are from Sun and McDonough (1989).

Fig. DR4: Catholuminscence images of zircons from Myanmar samples. White digits are U-Pb ages, yellow digits are $\varepsilon_{Hf}(t)$ values and red digits in brackets are $\delta^{18}O$ values.

Fig. DR5: Zircon Th/U *vs* U (a) and Th (b).

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Table DR1: Whole rock major and trace elements.

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Supplementary text: Analytical methods

Samples were sawn from the altered and weathered rims, and then crushed to small blocks. Fresh blocks were picked and powdered to 200 meshes in an agate mill. Zircons were separated from the crushed samples using standard density and magnetic separation techniques. They were handpicked carefully under a binocular microscope and mounted in epoxy resin, which were then polished until the grain centers were exposed. A zircon standard 91500, together with an in-house standard Qinghu, was mounted with zircon separates. Zircons were documented with transmitted and reflected light micrographs as well as cathodoluminescence (CL) images to reveal their internal structures, and the mount was vacuum-coated with high-purity gold prior to secondary ion mass spectrometry (SIMS) analysis. All analyses in this study were conducted at the Institute of Geology and Geophysics, Chinese Academy of Sciences (IGGCAS).

1. Whole rock major and trace elements

Whole rock major elements were measured by the X-Ray Fluorescence spectroscopy (XRF) method. About 0.5 g of sample powders were mixed with 5 g $Li_2B_4O_7$ to make glass beads, which were analyzed on an AXIOS Mineral Spectrometer. The uncertainty for major elements varies from 1% to 3%.

Whole rock trace elements were measured by the Inductively Coupled Plasma Mass Spectrometry (ICP-MS) method on an Agilent 7500a. The detailed procedure has been described previously by Yang et al. (2012). About 50 mg powders were digested by a mixed acid of HNO_3 and HF in a Teflon vessel, which were heated within an oven at a temperature higher than 150^{o}C for at least 5 days. After driving the rest acid out of the vessels, the residues were changed to solutions, into which rhodium (Rh) was added as an internal standard. Two standards, i.e., BCR-1 and BHVO-2, were analyzed along with samples, of which the accuracies were better than 5%.

2. Zircon U-Pb ages and Hf-O isotopes

Measurements of U, Th and Pb were conducted using the Cameca IMS-1280 SIMS. U-Th-Pb ratios and absolute abundances were determined relative to the standard zircon 91500 (Wiedenbeck et al., 1995), analyses of which were interspersed with those of unknown grains, using operating and data processing procedures similar to those described by Li et al. (2009). A long-term uncertainty of 1.5% (1 RSD) for $^{206}Pb/^{238}U$ measurements of the standard zircons was propagated to the unknowns (Li et al., 2010a), despite that the measured $^{206}Pb/^{238}U$ error in a specific session is generally around 1% (1 RSD) or less. Measured compositions were corrected for common Pb using non-radiogenic ^{204}Pb. Corrections are sufficiently small to be insensitive to the choice of common Pb composition, and an average of present-day crustal composition (Stacey and Kramers, 1975) is used for the common Pb assuming that the common Pb is largely surface contamination introduced during sample preparation. Uncertainties on individual analyses in data tables are reported at a 1□ level; mean ages for pooled U/Pb (and Pb/Pb) analyses are quoted with 95% confidence interval. Data reduction was carried out using the Isoplot/Ex v. 2.49 program (Ludwig, 2001). During the period of measurement, the in-house standard Qinghu was analyzed as an unknown to monitor the accuracy of data and gave a concordia age of 159.5±1.6 Ma, which is identical within uncertainty to the recommended value (159.5±0.7 Ma, Li et al., 2009).

Zircon oxygen isotopes were measured using CASIMS, with an analytical procedure given by Li et al. (2010b). Oxygen isotopes were obtained on the same spots of zircon grains that were previously analyzed for U-Pb age determinations. The Cs^+ primary ion beam was accelerated at 10 kV, with an intensity of *ca* 2 nA. The spot size was about 20 μm in diameter. The normal incidence electron flood gun was used to compensate for sample charging. Negative secondary ions were extracted with a -10 kV potential. Oxygen isotopes were measured using a multi-collection mode and the mass resolution used to measure oxygen isotopes was *ca* 2500. Measured $^{18}O/^{16}O$ ratios were normalized to Vienna Standard Mean Ocean Water compositions (VSMOW; $^{18}O/^{16}O$=0.0020052), and then corrected for instrumental mass fractionation (IMF) using the Penglai zircon standard. Measurement of the in-house standard Qinghu during the session yielded a value of 5.45‰±0.34‰ (2SD, n=34), which is identical to the recommended value of 5.4‰±0.2‰ (2SD; Li et al., 2013).

In situ zircon Lu-Hf isotopes were measured on a Neptune Multi-Collector ICP-MS (MC-ICPMS) equipped with a Geolas-193 laser-ablation system. Lu-Hf isotopic analyses were obtained on the same zircon grains that were previously analyzed for U-Pb and O isotopes, with ablation pits of 63 μm in diameter, ablation time of 26 seconds, repetition rate of 10 Hz, and laser beam energy density of 10J/cm^2. The isobaric interference of ^{176}Yb on ^{176}Hf is not considered because of the extremely low $^{176}Lu/^{177}Hf$ ratios in zircons (normally <0.002). Interference of ^{176}Yb on ^{176}Hf is corrected by measuring $^{173}Yb/^{171}Yb$ ratio, calculatingthe fractionation coefficient ($ß_{Yb}$), and then extracting the contribution of ^{176}Yb to ^{176}Hf by applying ratios of $^{176}Yb/^{172}Yb$=0.5887 (Wu et al., 2006). Measured $^{176}Hf/^{177}Hf$ ratios were normalized to $^{179}Hf/^{177}Hf$=0.7325. The determined $^{176}Hf/^{177}Hf$ value of 0.282496±0.000008 (2SD; n=46) for zircon standard Mud Tank during the course of this work is in agreement within errors with the recommended value of 0.282507± 0.000006 by solution MC-ICP-MS measurements after chemical separation (Woodhead and Hergt, 2005). The reported $^{176}Hf/^{177}Hf$ value is adjusted relative to the Mud Tank standard value of 0.282507. During this analytical session, standard GJ-1 was used as an unknown sample and yielded a $^{176}Hf/^{177}Hf$ value of 0.282019±12 (2SD; n=44), which is within error of values obtained by solution method (Morel and others, 2008).

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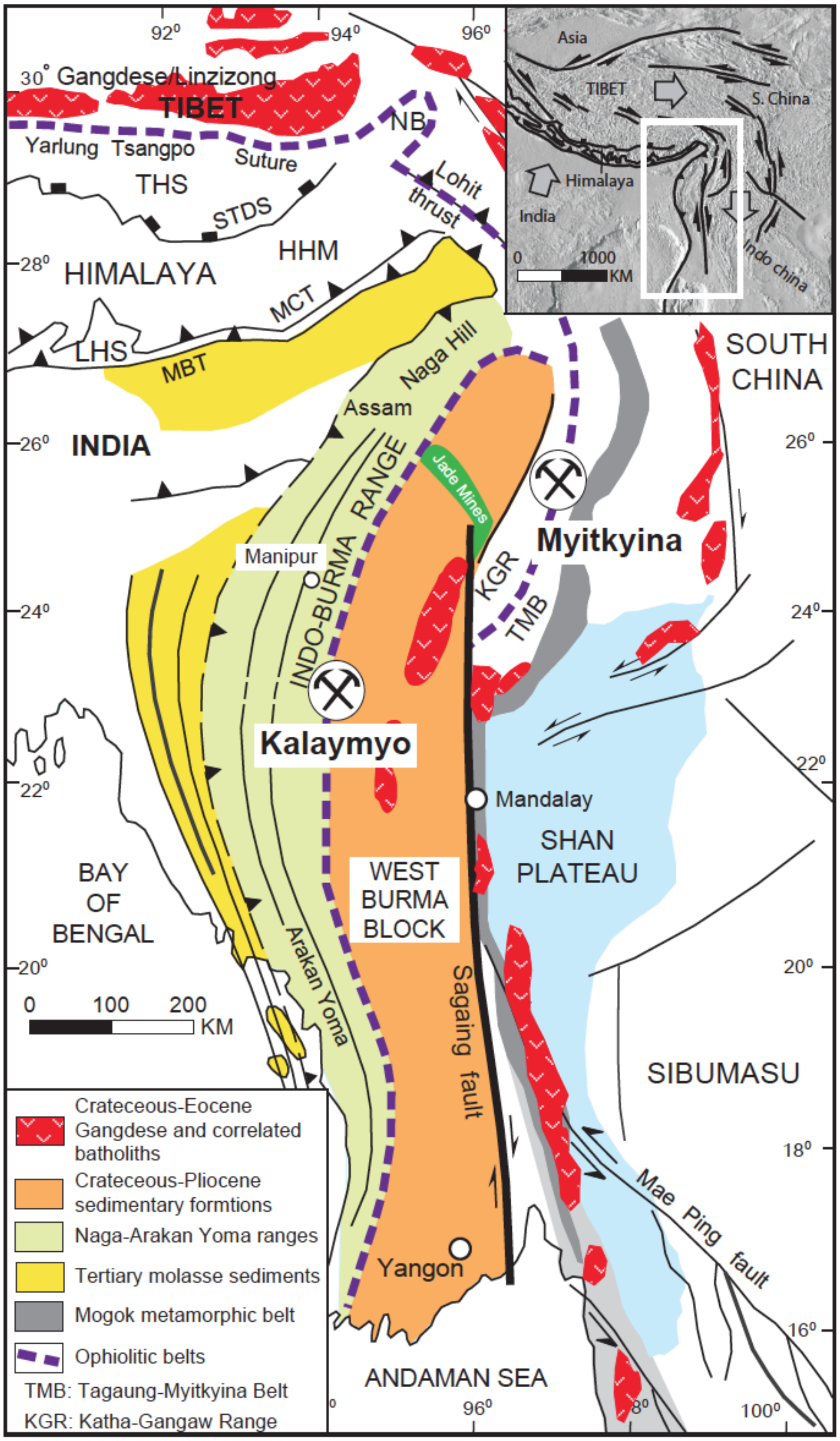
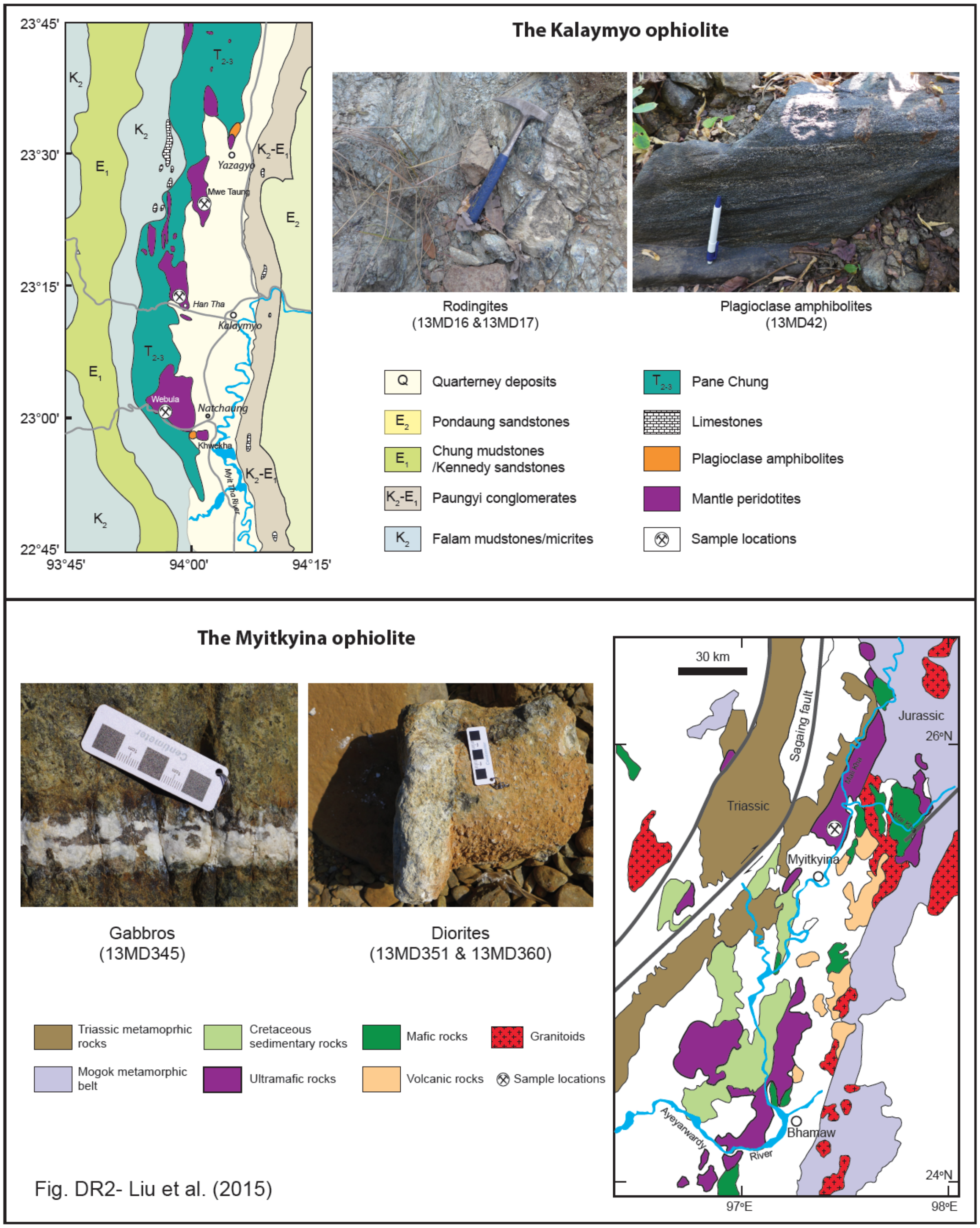


Fig. DR1- Liu et al. (2015)



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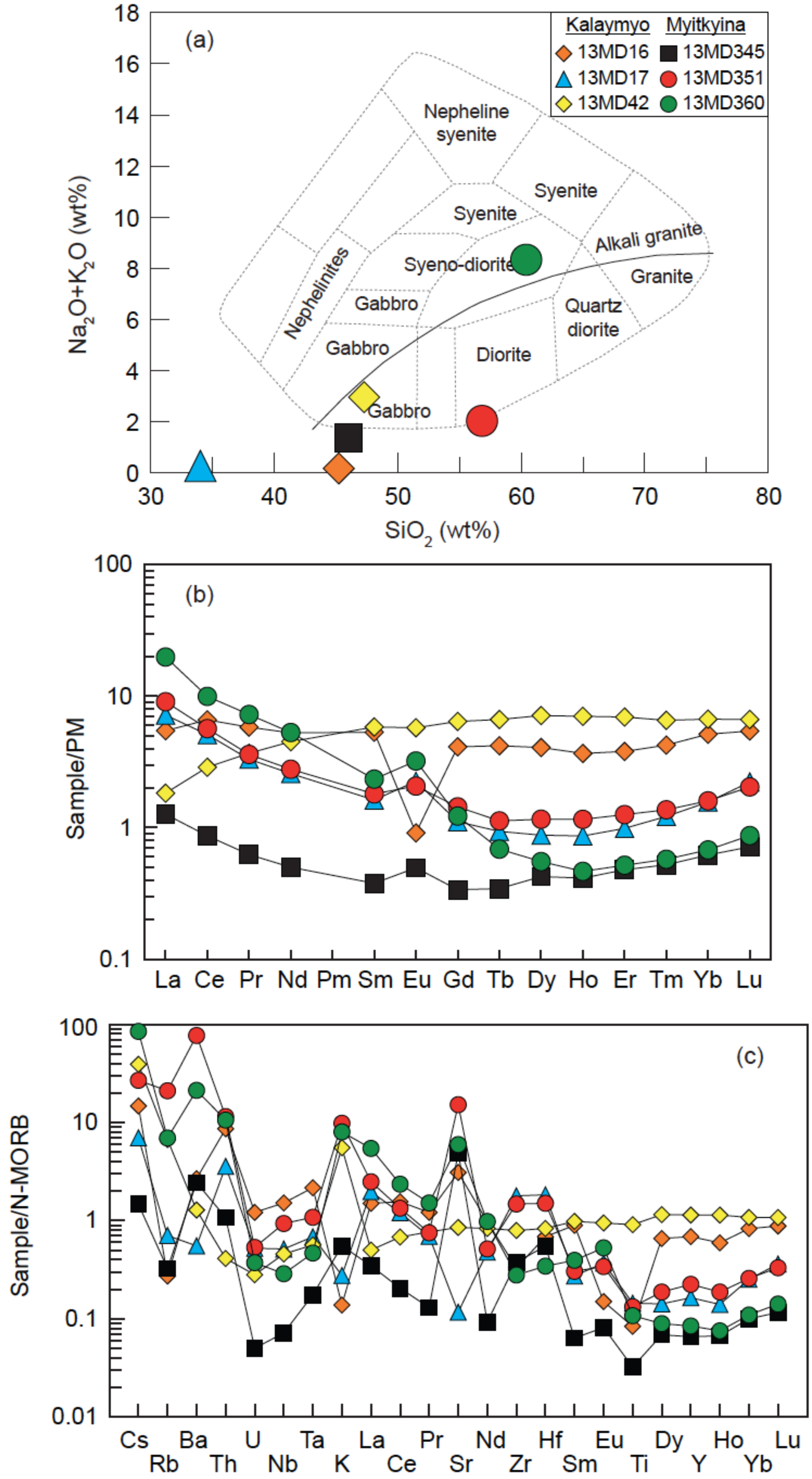

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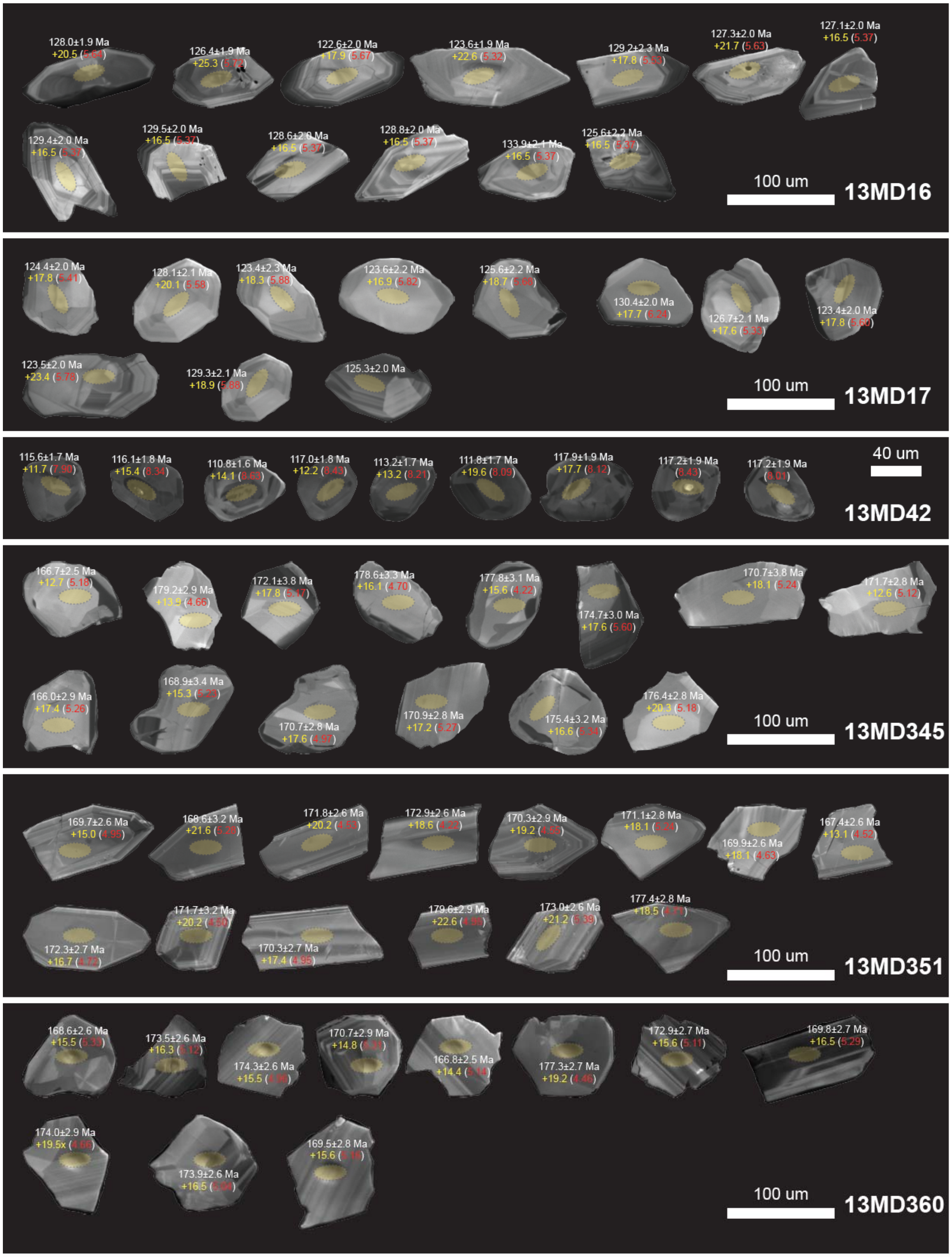

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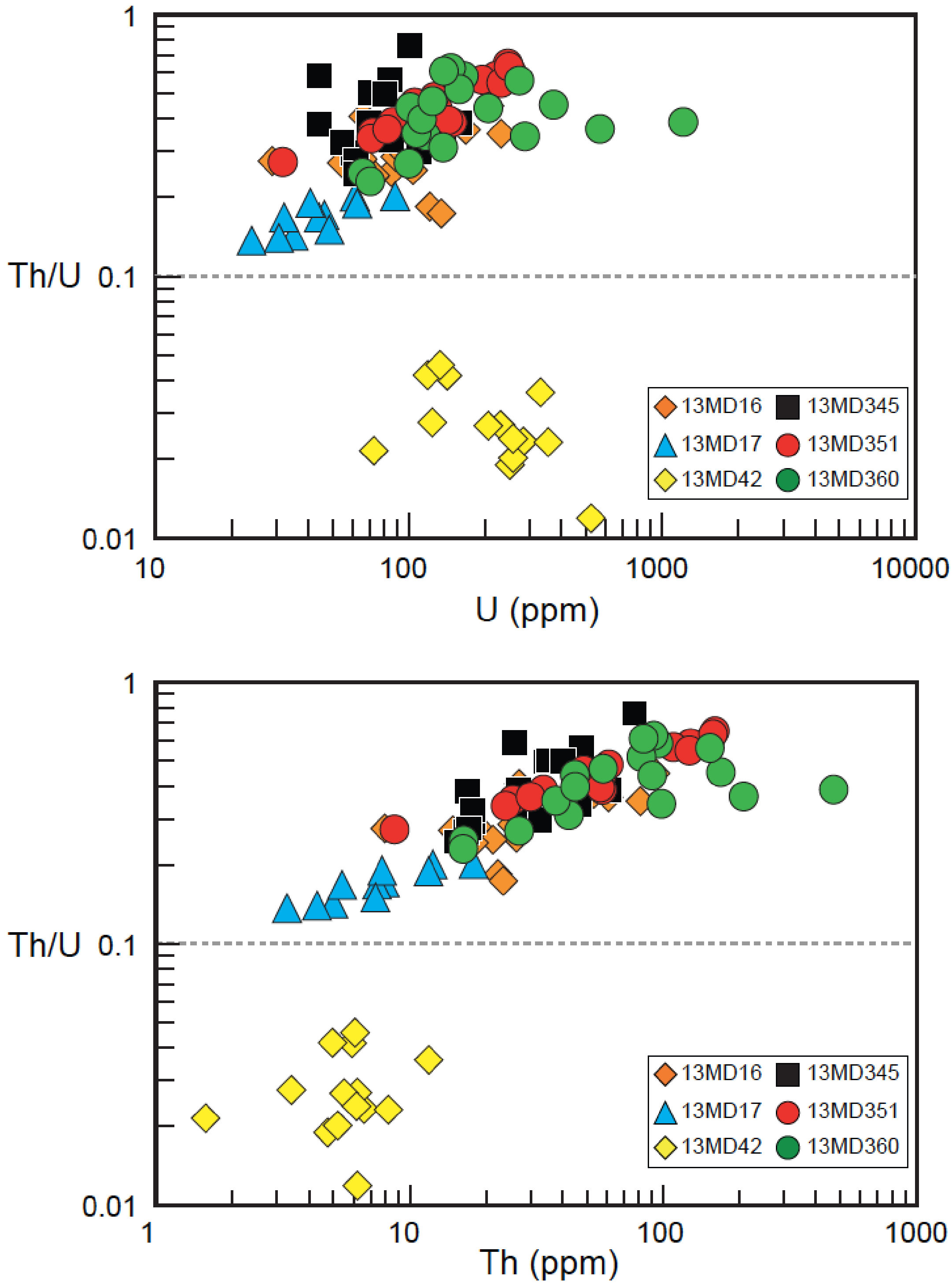

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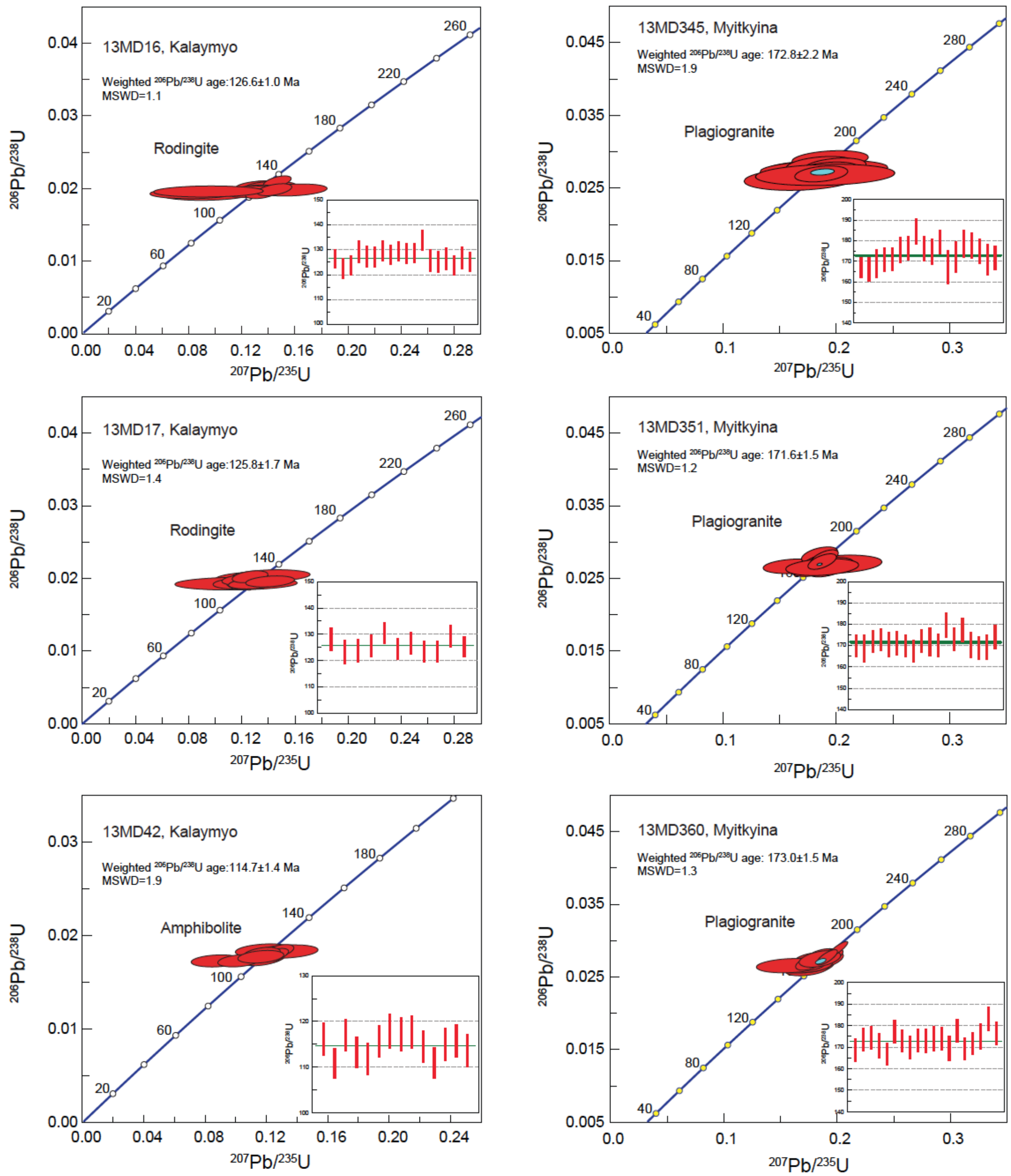

Fig. DR6-Liu et al. (2015)

Table DR1-Major and trace elements of dated samples from Myanmar ophiolites

	13MD16	13MD17	13MD42	13MD345	13MD351	13MD360
	Rodingite	Rodingite	Amphibolite	Gabbro	Diorite	Diorite
	Kalaymyo	Kalaymyo	Kalaymyo	Myitkyina	Myitkyina	Myitkyina
SiO2	45.23	34.13	47.29	46.05	56.93	60.26
TiO2	0.11	0.18	1.15	0.04	0.17	0.14
Al2O3	17.76	18.17	15.49	26.26	15.07	22.60
TFe2O3	0.30	4.64	12.81	1.84	1.70	0.94
MnO	0.45	0.22	0.20	0.03	0.06	0.02
MgO	8.12	11.05	8.47	6.72	9.24	1.29
CaO	22.30	24.39	10.32	15.19	3.95	5.00
K2O	0.01	0.02	0.40	0.04	0.71	0.58
Na2O	0.20	0.04	2.45	1.33	1.27	7.68
P2O5	0.12	0.02	0.08	0.01	0.02	0.02
Cr2O3	0.00	0.01	0.02	0.02	0.00	0.00
NiO	0.02	0.06	0.01	0.05	0.02	0.00
LOI	4.94	6.12	0.80	2.47	12.27	1.90
Total	99.56	99.05	99.50	100.04	101.41	100.44
Mg#	0.98	0.83	0.57	0.88	0.92	0.73
(in ppm)						
Li	2.01	18.33	9.61	0.50	5.45	11.67
Sc	2.66	4.55	46.61	5.45	1.20	0.82
V	1.52	14.0	364	72.6	5.64	3.63
Cr	4.65	94	159	150	18.36	7.41
Co	2.07	21.72	48.45	15.41	9.11	3.76
Ni	180	450	91	357	119	35
Cu	1.32	1.53	29.47	1.89	1.70	1.33
Zn	4.05	54.05	287	6.19	13.74	13.04
Ga	2.86	3.68	16.51	10.68	5.06	13.80
Rb	0.15	0.40	3.75	0.18	11.79	3.89
Sr	279	11	77	444	1367	536
Y	19.3	4.59	32.0	1.84	6.29	2.37
Zr	24	132	59	28	109	21
Nb	3.53	1.20	1.07	0.17	2.18	0.67
Cs	0.10	0.05	0.27	0.01	0.19	0.59
Ba	16.9	3.49	8.09	15.4	485	134
La	3.75	4.93	1.26	0.87	6.22	13.61
Ce	11.70	9.04	5.11	1.54	10.04	17.66
Pr	1.60	0.91	1.01	0.17	0.99	2.00
Nd	7.11	3.49	6.09	0.68	3.76	7.16
Sm	2.36	0.72	2.59	0.17	0.80	1.04
Eu	0.15	0.38	0.96	0.08	0.35	0.54
Gd	2.45	0.66	3.82	0.20	0.86	0.73
Tb	0.45	0.10	0.72	0.04	0.12	0.07
Dy	2.99	0.65	5.24	0.31	0.85	0.41
Ho	0.60	0.14	1.15	0.07	0.19	0.08
Er	1.82	0.47	3.33	0.23	0.60	0.25
Tm	0.31	0.09	0.48	0.04	0.10	0.04
Yb	2.53	0.77	3.29	0.31	0.79	0.33
Lu	0.40	0.16	0.49	0.05	0.15	0.06
Hf	1.41	3.76	1.71	1.13	3.08	0.71
Ta	0.29	0.09	0.07	0.02	0.14	0.06
Pb	0.23	0.12	0.77	0.12	2.15	0.74
Th	1.04	0.43	0.05	0.13	1.38	1.27
U	0.57	0.25	0.13	0.02	0.25	0.18

Table DR2-Summary of zircon U-Pb and Hf-O isotopes

	Location	GPS location	Lithology	U (ppm)	Th (ppm)	Th/U	U-Pb ages (Ma)	εHf(t)	$\delta^{18}O$ (‰)
13MD16	Kalaymyo	23°31'46"N, 94°05'13"E	Rodingite	29-232	8-93	0.29±0.07	126.6±1.0	18.9±1.9	5.66±0.27
13MD17	Kalaymyo	23°31'46"N, 94°05'13"E	Rodingite	24-88	3-18	0.17±0.02	125.8±1.7	18.4±0.9	5.72±0.26
13MD42	Kalaymyo	22°57'47"N, 94°01'09"E	Amphibolite	73-523	2-12	0.03±0.01	114.7±1.4	14.2±2.4	8.11±0.27
13MD345	Myitkyina	25°38'24"N, 97°28'53"E	Gabbro	44-159	17-77	0.41±0.14	172.8±2.2	16.4±1.0	5.10±0.32
13MD351	Myitkyina	25°38'24"N, 97°28'53"E	Diorite	32-254	9-160	0.46±0.11	171.6±1.5	17.9±0.9	4.80±0.36
13MD360	Myitkyina	25°38'24"N, 97°28'53"E	Diorite	66-1210	16-470	0.42±0.12	173.0±1.5	16.5±1.0	5.02±0.25

Table DR3-U-Pb isotopes of zircons from the Myanmar ophiolites

Sample spot #	U (ppm)	Th (ppm)	Th/U	f_{206} (%)	$^{207}Pb/^{206}Pb$	±1σ (%)	$^{207}Pb/^{235}U$	±1σ (%)	$^{206}Pb/^{238}U$	±1σ (%)	$t_{207/235}$ (Ma)	±1σ	$t_{206/238}$ (Ma)	±1σ
13MD16														
13MD16@1	232	81	0.35	0.79	0.04885	2.38	0.13513	2.83	0.0201	1.53	128.7	3.4	128.0	1.9
13MD16@2	168	61	0.36	0.62	0.04985	2.81	0.13613	3.20	0.0198	1.54	129.6	3.9	126.4	1.9
13MD16@3	66	27	0.41	2.06	0.03530	14.40	0.09342	14.49	0.0192	1.67	90.7	12.7	122.6	2.0
13MD16@4	74	18	0.24	2.19	0.03130	15.91	0.08357	15.99	0.0194	1.56	81.5	12.6	123.6	1.9
13MD16@5	96	28	0.29	1.17	0.04741	4.21	0.13230	4.57	0.0202	1.77	126.2	5.4	129.2	2.3
13MD16@6	100	29	0.29	0.33	0.04836	4.51	0.13295	4.79	0.0199	1.62	126.7	5.7	127.3	2.0
13MD16@7	89	25	0.29	0.41	0.04754	3.94	0.13057	4.24	0.0199	1.57	124.6	5.0	127.1	2.0
13MD16@8	135	23	0.17	1.17	0.05109	3.07	0.14285	3.45	0.0203	1.59	135.6	4.4	129.4	2.0
13MD16@9	73	18	0.24	1.74	0.04699	4.71	0.13147	4.95	0.0203	1.52	125.4	5.9	129.5	2.0
13MD16@10	85	21	0.25	1.43	0.05266	3.95	0.14634	4.25	0.0202	1.58	138.7	5.5	128.6	2.0
13MD16@11	104	26	0.25	1.75	0.04826	3.71	0.13426	4.02	0.0202	1.54	127.9	4.8	128.8	2.0
13MD16@12	208	93	0.45	0.44	0.05090	2.47	0.14729	2.92	0.0210	1.56	139.5	3.8	133.9	2.1
13MD16@13	55	15	0.27	1.35	0.04797	5.08	0.13009	5.39	0.0197	1.80	124.2	6.3	125.6	2.2
13MD16@14	66	18	0.28	1.46	0.04689	5.65	0.12674	5.89	0.0196	1.68	121.2	6.7	125.2	2.1
13MD16@15	29	8	0.28	2.18	0.05825	6.44	0.15908	6.67	0.0198	1.72	149.9	9.3	126.4	2.2
13MD16@16	142	53	0.37	1.35	0.05071	3.36	0.13550	3.70	0.0194	1.55	129.0	4.5	123.7	1.9
13MD16@17	121	22	0.18	1.43	0.05306	3.28	0.14526	3.70	0.0199	1.72	137.7	4.8	126.7	2.2
13MD16@18	57	15	0.27	2.30	0.03522	17.72	0.09530	17.79	0.0196	1.57	92.4	15.8	125.3	1.9
13MD17														
13MD17@1	49	7	0.15	1.67	0.04706	5.33	0.12638	5.57	0.0195	1.62	120.8	6.4	124.4	2.0
13MD17@2	31	4	0.14	0.00	0.04647	8.71	0.12862	8.87	0.0201	1.69	122.9	10.3	128.1	2.1
13MD17@3	32	5	0.17	1.96	0.04360	16.12	0.11620	16.23	0.0193	1.85	111.6	17.3	123.4	2.3
13MD17@4	24	3	0.14	0.22	0.04631	8.03	0.12365	8.22	0.0194	1.76	118.4	9.2	123.6	2.2
13MD17@5	41	8	0.19	1.80	0.05124	5.90	0.13898	6.15	0.0197	1.73	132.1	7.6	125.6	2.2
13MD17@6	35	5	0.14	1.46	0.05065	8.27	0.14268	8.42	0.0204	1.58	135.4	10.7	130.4	2.0
13MD17@7	44	7	0.17	1.39	0.04516	5.87	0.12360	6.09	0.0198	1.64	118.3	6.8	126.7	2.1
13MD17@8	63	12	0.19	1.73	0.04740	4.82	0.12631	5.09	0.0193	1.64	120.8	5.8	123.4	2.0
13MD17@9	47	8	0.17	1.63	0.04835	5.63	0.12899	5.87	0.0193	1.64	123.2	6.8	123.5	2.0
13MD17@10	88	18	0.20	0.00	0.04534	4.06	0.12663	4.40	0.0203	1.68	121.1	5.0	129.3	2.1
13MD17@11	61	12	0.20	1.39	0.05239	5.11	0.14172	5.36	0.0196	1.60	134.6	6.8	125.3	2.0
13MD42														
13MD42@1	258	6	0.02	0.43	0.04719	2.88	0.11775	3.26	0.0181	1.53	113.0	3.5	115.6	1.7
13MD42@2	523	6	0.01	0.18	0.04904	1.75	0.12291	2.36	0.0182	1.58	117.7	2.6	116.1	1.8
13MD42@3	331	12	0.04	2.37	0.03670	7.54	0.08774	7.69	0.0173	1.50	85.4	6.3	110.8	1.6
13MD42@4	355	8	0.02	0.08	0.04880	3.04	0.12325	3.40	0.0183	1.52	118.0	3.8	117.0	1.8
13MD42@5	258	5	0.02	0.37	0.05119	2.42	0.12504	2.86	0.0177	1.53	119.6	3.2	113.2	1.7
13MD42@6	133	6	0.05	0.32	0.04839	4.31	0.11671	4.58	0.0175	1.56	112.1	4.9	111.8	1.7
13MD42@7	119	5	0.04	0.91	0.04669	6.30	0.11877	6.49	0.0184	1.59	114.0	7.0	117.9	1.9
13MD42@8	73	2	0.02	1.27	0.05282	6.15	0.13358	6.36	0.0183	1.60	127.3	7.6	117.2	1.9
13MD42@9	206	6	0.03	0.03	0.05067	2.76	0.12862	3.15	0.0184	1.52	122.9	3.7	117.6	1.8
13MD42@10	230	6	0.03	0.31	0.04941	3.43	0.12197	3.76	0.0179	1.53	116.9	4.2	114.4	1.7
13MD42@11	283	7	0.02	1.22	0.04285	5.26	0.10259	5.49	0.0174	1.55	99.2	5.2	111.0	1.7
13MD42@12	251	5	0.02	0.50	0.05079	2.48	0.12598	2.94	0.0180	1.58	120.5	3.3	114.9	1.8
13MD42@13	142	6	0.04	0.30	0.04708	3.92	0.11759	4.21	0.0181	1.55	112.9	4.5	115.7	1.8
13MD42@14	124	3	0.03	0.34	0.04761	5.09	0.11679	5.33	0.0178	1.59	112.2	5.7	113.7	1.8
13MD345														
13MD345@1	138	47	0.34	0.00	0.04944	4.44	0.17864	4.69	0.0262	1.50	166.9	7.2	166.7	2.5
13MD345@2	110	33	0.30	0.00	0.04941	4.17	0.19201	4.48	0.0282	1.63	178.3	7.3	179.2	2.9
13MD345@3	62	15	0.25	0.91	0.04919	8.42	0.18348	8.70	0.0271	2.21	171.1	13.8	172.1	3.8
13MD345@4	44	26	0.58	0.00	0.04801	6.70	0.18594	6.96	0.0281	1.89	173.2	11.1	178.6	3.3
13MD345@5	62	17	0.28	0.90	0.05129	5.43	0.19775	5.71	0.0280	1.76	183.2	9.6	177.8	3.1
13MD345@6	62	17	0.27	0.00	0.05051	5.66	0.19133	5.92	0.0275	1.72	177.8	9.7	174.7	3.0
13MD345@7	55	18	0.32	1.03	0.05120	13.02	0.18945	13.21	0.0268	2.23	176.2	21.6	170.7	3.8
13MD345@8	81	40	0.50	0.69	0.04991	4.90	0.18574	5.18	0.0270	1.67	173.0	8.3	171.7	2.8
13MD345@9	159	61	0.39	0.36	0.04808	5.51	0.17289	5.79	0.0261	1.75	161.9	8.7	166.0	2.9
13MD345@10	85	28	0.33	0.00	0.05403	4.56	0.19777	5.00	0.0265	2.06	183.2	8.4	168.9	3.4
13MD345@11	84	48	0.56	0.42	0.05129	8.06	0.18975	8.24	0.0268	1.69	176.4	13.4	170.7	2.8
13MD345@12	101	77	0.76	1.86	0.05118	6.01	0.18958	6.23	0.0269	1.67	176.3	10.1	170.9	2.8
13MD345@13	70	35	0.50	0.00	0.04677	5.36	0.17786	5.66	0.0276	1.82	166.2	8.7	175.4	3.2
13MD345@14	69	34	0.50	0.79	0.04898	5.31	0.18730	5.56	0.0277	1.63	174.3	8.9	176.4	2.8
13MD345@15	44	17	0.38	0.00	0.04846	6.88	0.19382	7.09	0.0290	1.70	179.9	11.7	184.4	3.1
13MD345@16	60	18	0.29	0.57	0.04994	11.41	0.19073	11.54	0.0277	1.77	177.2	18.9	176.1	3.1
13MD345@17	70	27	0.39	0.47	0.04766	10.78	0.18060	10.93	0.0275	1.80	168.6	17.1	174.8	3.1
13MD345@18	70	27	0.39	0.85	0.04624	11.98	0.16751	12.22	0.0263	2.41	157.3	18.0	167.2	4.0

Table DR3 (continued)

13MD351													
13MD351@1	143	57	0.39	0.00	0.04827	4.10	0.17759	4.38	0.0267	1.53	166.0	6.7	169.7	2.6
13MD351@2	149	58	0.39	0.00	0.05271	3.34	0.19253	3.86	0.0265	1.94	178.8	6.4	168.6	3.2
13MD351@3	248	157	0.63	0.15	0.04868	2.74	0.18131	3.14	0.0270	1.54	169.2	4.9	171.8	2.6
13MD351@4	231	127	0.55	0.49	0.05086	2.24	0.19064	2.70	0.0272	1.50	177.2	4.4	172.9	2.6
13MD351@5	105	49	0.46	0.51	0.05045	3.42	0.18627	3.82	0.0268	1.72	173.4	6.1	170.3	2.9
13MD351@6	126	61	0.48	0.60	0.04987	3.07	0.18501	3.48	0.0269	1.63	172.4	5.5	171.1	2.8
13MD351@7	194	110	0.56	1.14	0.04371	6.63	0.16100	6.81	0.0267	1.54	151.6	9.6	169.9	2.6
13MD351@8	82	30	0.36	1.12	0.04893	3.82	0.17753	4.13	0.0263	1.58	165.9	6.3	167.4	2.6
13MD351@9	71	24	0.34	1.07	0.05179	4.03	0.19338	4.33	0.0271	1.58	179.5	7.1	172.3	2.7
13MD351@10	72	26	0.35	0.00	0.05432	7.23	0.20220	7.48	0.0270	1.91	187.0	12.8	171.7	3.2
13MD351@11	110	46	0.41	1.08	0.04940	3.39	0.18231	3.74	0.0268	1.59	170.0	5.9	170.3	2.7
13MD351@12	130	57	0.44	0.28	0.04730	3.14	0.18427	3.54	0.0283	1.64	171.7	5.6	179.6	2.9
13MD351@13	220	128	0.58	0.62	0.04829	2.38	0.18110	2.84	0.0272	1.54	169.0	4.4	173.0	2.6
13MD351@14	254	154	0.61	0.60	0.04907	2.19	0.18878	2.71	0.0279	1.60	175.6	4.4	177.4	2.8
13MD351@15	105	46	0.43	1.10	0.05195	4.42	0.19184	4.78	0.0268	1.81	178.2	7.8	170.4	3.0
13MD351@16	86	34	0.39	0.25	0.05083	5.45	0.18603	5.69	0.0265	1.64	173.2	9.1	168.9	2.7
13MD351@17	32	9	0.27	1.13	0.05085	6.83	0.18652	7.05	0.0266	1.78	173.7	11.3	169.2	3.0
13MD351@18	246	160	0.65	0.44	0.04942	2.21	0.18648	2.73	0.0274	1.61	173.6	4.4	174.1	2.8
13MD360														
13MD360@1	124	58	0.47	0.25	0.04945	3.15	0.18067	3.51	0.0265	1.55	168.6	5.5	168.6	2.6
13MD360@2	137	84	0.61	0.55	0.04806	4.51	0.18076	4.76	0.0273	1.51	168.7	7.4	173.5	2.6
13MD360@3	70	16	0.23	0.78	0.04806	3.49	0.18163	3.81	0.0274	1.54	169.5	6.0	174.3	2.6
13MD360@4	206	90	0.44	0.06	0.04935	2.09	0.18257	2.72	0.0268	1.74	170.3	4.3	170.7	2.9
13MD360@5	113	45	0.40	0.36	0.04781	4.44	0.17277	4.70	0.0262	1.53	161.8	7.1	166.8	2.5
13MD360@6	107	38	0.35	0.37	0.04834	2.89	0.18583	3.27	0.0279	1.53	173.1	5.2	177.3	2.7
13MD360@7	158	82	0.52	0.35	0.04801	3.30	0.17998	3.64	0.0272	1.54	168.0	5.7	172.9	2.6
13MD360@8	101	45	0.44	0.32	0.04792	3.86	0.17632	4.19	0.0267	1.62	164.9	6.4	169.8	2.7
13MD360@9	147	92	0.62	0.44	0.04842	3.46	0.18177	3.78	0.0272	1.53	169.6	5.9	173.2	2.6
13MD360@10	137	42	0.31	0.51	0.04869	3.65	0.18253	3.98	0.0272	1.60	170.2	6.3	172.9	2.7
13MD360@11	165	96	0.58	0.19	0.05043	2.64	0.19026	3.13	0.0274	1.67	176.9	5.1	174.0	2.9
13MD360@12	273	153	0.56	0.80	0.04629	3.17	0.17454	3.52	0.0273	1.54	163.4	5.3	173.9	2.6
13MD360@13	117	40	0.34	0.64	0.04643	5.69	0.17051	5.93	0.0266	1.67	159.9	8.8	169.5	2.8
13MD360@14	287	98	0.34	0.16	0.04996	2.05	0.19241	2.54	0.0279	1.50	178.7	4.2	177.6	2.6
13MD360@15	100	27	0.27	1.42	0.04312	7.60	0.15819	7.75	0.0266	1.51	149.1	10.8	169.3	2.5
13MD360@16	373	169	0.45	0.42	0.04703	2.58	0.17511	3.00	0.0270	1.55	163.8	4.6	171.8	2.6
13MD360@17	66	16	0.25	0.48	0.04849	3.71	0.18400	4.08	0.0275	1.71	171.5	6.5	175.0	2.9
13MD360@18	1210	470	0.39	0.61	0.05024	0.86	0.19980	1.76	0.0288	1.54	185.0	3.0	183.3	2.8
13MD360@19	568	208	0.37	0.34	0.04972	1.31	0.19021	2.04	0.0277	1.56	176.8	3.3	176.4	2.7

Table DR4-Lu-Hf isotopes of zircons from the Myanmar ophiolites

Sample spot #	$^{176}Yb/^{177}Hf$	$^{176}Lu/^{177}Hf$	$^{176}Hf/^{177}Hf$	2σ	$^{176}Hf/^{177}Hf_i$	$\varepsilon_{Hf}(t)$	2σ	T_{DM} (Ma)	$f_{Lu/Hf}$
13MD16									
13MD16@2	0.2477	0.0092	0.283294	0.000052	0.283273	20.5	1.84	-81	-0.72
13MD16@3	0.2192	0.0085	0.283429	0.000042	0.283409	25.3	1.50	-322	-0.75
13MD16@4	0.1775	0.0069	0.283216	0.000036	0.283200	17.9	1.26	58	-0.79
13MD16@5	0.2171	0.0080	0.283352	0.000049	0.283333	22.6	1.74	-180	-0.76
13MD16@6	0.1323	0.0049	0.283208	0.000032	0.283196	17.8	1.15	68	-0.85
13MD16@7	0.2250	0.0083	0.283325	0.000053	0.283305	21.7	1.87	-134	-0.75
13MD16@8	0.2126	0.0080	0.283179	0.000037	0.283160	16.5	1.31	126	-0.76
13MD16@9	0.3058	0.0105	0.283274	0.000036	0.283249	19.7	1.28	-46	-0.68
13MD16@10	0.1928	0.0074	0.283231	0.000050	0.283214	18.4	1.78	32	-0.78
13MD16@11	0.1897	0.0067	0.283226	0.000056	0.283210	18.3	1.97	40	-0.80
13MD16@12	0.1983	0.0069	0.283172	0.000049	0.283155	16.3	1.75	133	-0.79
13MD16@13	0.2163	0.0071	0.283095	0.000046	0.283078	13.6	1.64	265	-0.79
13MD17									
13MD17@1	0.0443	0.0021	0.283201	0.000029	0.283196	17.8	1.01	73	-0.94
13MD17@2	0.0618	0.0030	0.283269	0.000028	0.283262	20.1	1.01	-29	-0.91
13MD17@3	0.0703	0.0029	0.283217	0.000034	0.283210	18.3	1.20	50	-0.91
13MD17@4	0.1437	0.0057	0.283185	0.000046	0.283172	16.9	1.61	106	-0.83
13MD17@5	0.0714	0.0027	0.283230	0.000046	0.283223	18.7	1.64	31	-0.92
13MD17@6	0.0611	0.0023	0.283198	0.000027	0.283193	17.7	0.94	76	-0.93
13MD17@7	0.0861	0.0031	0.283198	0.000031	0.283190	17.6	1.11	79	-0.91
13MD17@8	0.0937	0.0036	0.283207	0.000036	0.283198	17.8	1.27	67	-0.89
13MD17@9	0.0950	0.0035	0.283364	0.000068	0.283356	23.4	2.41	-175	-0.89
13MD17@10	0.0623	0.0023	0.283233	0.000027	0.283227	18.9	0.95	26	-0.93
13MD42									
13MD42@1	0.0348	0.0014	0.283035	0.000039	0.283032	11.7	1.40	310	-0.96
13MD42@2	0.0312	0.0012	0.283138	0.000045	0.283136	15.4	1.58	160	-0.96
13MD42@3	0.0232	0.0009	0.283102	0.000035	0.283100	14.1	1.25	211	-0.97
13MD42@4	0.0281	0.0011	0.283049	0.000038	0.283046	12.2	1.36	288	-0.97
13MD42@5	0.0296	0.0012	0.283076	0.000064	0.283074	13.2	2.27	250	-0.96
13MD42@6	0.0237	0.0010	0.283257	0.000054	0.283254	19.6	1.90	-9	-0.97
13MD42@7	0.0305	0.0012	0.283203	0.000063	0.283200	17.7	2.21	68	-0.96
13MD345									
13MD345@1	0.0353	0.0014	0.283029	0.000028	0.283024	12.7	0.98	320	-0.96
13MD345@2	0.0412	0.0015	0.283062	0.000030	0.283057	13.9	1.06	272	-0.96
13MD345@3	0.0359	0.0014	0.283171	0.000041	0.283167	17.8	1.47	114	-0.96
13MD345@4	0.0219	0.0008	0.283122	0.000036	0.283119	16.1	1.28	182	-0.97
13MD345@5	0.0316	0.0012	0.283111	0.000025	0.283107	15.6	0.89	200	-0.96
13MD345@6	0.0268	0.0011	0.283165	0.000041	0.283161	17.6	1.45	122	-0.97
13MD345@7	0.0219	0.0010	0.283180	0.000025	0.283176	18.1	0.88	101	-0.97
13MD345@8	0.0268	0.0010	0.283024	0.000037	0.283020	12.6	1.29	324	-0.97
13MD345@9	0.0386	0.0015	0.283162	0.000035	0.283157	17.4	1.24	127	-0.96
13MD345@10	0.0264	0.0010	0.283101	0.000020	0.283098	15.3	0.73	213	-0.97
13MD345@11	0.0424	0.0017	0.283167	0.000027	0.283161	17.6	0.96	121	-0.95
13MD345@12	0.0438	0.0018	0.283156	0.000030	0.283151	17.2	1.07	137	-0.95
13MD345@13	0.0494	0.0019	0.283139	0.000040	0.283133	16.6	1.43	162	-0.94
13MD345@14	0.0514	0.0020	0.283246	0.000046	0.283240	20.3	1.64	6	-0.94
13MD345@15	0.0848	0.0034	0.283195	0.000041	0.283184	18.4	1.46	84	-0.90
13MD345@16	0.0271	0.0012	0.283154	0.000025	0.283150	17.2	0.87	138	-0.97
13MD345@17	0.0017	0.0001	0.283090	0.000028	0.283090	15.0	1.00	223	-1.00
13MD345@18	0.0323	0.0014	0.283274	0.000032	0.283270	21.4	1.12	-35	-0.96
13MD345@19	0.0293	0.0012	0.283101	0.000027	0.283097	15.3	0.94	214	-0.96
13MD345@20	0.0354	0.0015	0.283131	0.000029	0.283126	16.3	1.02	173	-0.95
13MD351									
13MD351@1	0.1398	0.0052	0.283106	0.000043	0.283089	15.0	1.52	232	-0.84
13MD351@2	0.1928	0.0071	0.283297	0.000047	0.283275	21.6	1.68	-81	-0.79
13MD351@3	0.1514	0.0060	0.283255	0.000036	0.283236	20.2	1.26	-8	-0.82
13MD351@4	0.1623	0.0063	0.283212	0.000039	0.283191	18.6	1.38	64	-0.81
13MD351@5	0.1848	0.0065	0.283229	0.000049	0.283208	19.2	1.74	35	-0.80
13MD351@6	0.1160	0.0042	0.283189	0.000024	0.283176	18.1	0.87	95	-0.87
13MD351@7	0.1777	0.0067	0.283198	0.000054	0.283176	18.1	1.89	88	-0.80
13MD351@8	0.1380	0.0049	0.283052	0.000046	0.283037	13.1	1.61	315	-0.85
13MD351@9	0.1570	0.0059	0.283157	0.000033	0.283138	16.7	1.18	153	-0.82
13MD351@10	0.1648	0.0063	0.283257	0.000031	0.283237	20.2	1.09	-12	-0.81
13MD351@11	0.2498	0.0091	0.283187	0.000062	0.283158	17.4	2.19	115	-0.73
13MD351@12	0.2294	0.0088	0.283332	0.000050	0.283304	22.6	1.77	-149	-0.74
13MD351@13	0.2334	0.0076	0.283288	0.000063	0.283264	21.2	2.23	-66	-0.77
13MD351@14	0.1327	0.0047	0.283203	0.000030	0.283188	18.5	1.05	74	-0.86
13MD351@15	0.1190	0.0047	0.283136	0.000027	0.283121	16.1	0.97	181	-0.86
13MD351@16	0.1248	0.0046	0.283160	0.000026	0.283145	17.0	0.91	142	-0.86
13MD351@17	0.1142	0.0043	0.283153	0.000026	0.283139	16.8	0.91	153	-0.87
13MD351@18	0.1237	0.0047	0.283174	0.000029	0.283159	17.5	1.04	120	-0.86
13MD351@19	0.1352	0.0048	0.283203	0.000038	0.283188	18.5	1.34	74	-0.86
13MD351@20	0.1410	0.0055	0.283171	0.000035	0.283153	17.2	1.23	129	-0.83

Table DR4 (continued)

13MD360									
13MD360@1	0.0607	0.0028	0.283112	0.000029	0.283103	15.5	1.02	208	-0.92
13MD360@2	0.0470	0.0021	0.283133	0.000027	0.283126	16.3	0.94	172	-0.94
13MD360@3	0.0424	0.0021	0.283110	0.000027	0.283103	15.5	0.96	206	-0.94
13MD360@4	0.0982	0.0040	0.283095	0.000037	0.283082	14.8	1.32	241	-0.88
13MD360@5	0.0598	0.0023	0.283079	0.000027	0.283071	14.4	0.95	254	-0.93
13MD360@6	0.0710	0.0030	0.283217	0.000038	0.283207	19.2	1.33	50	-0.91
13MD360@7	0.0687	0.0027	0.283114	0.000042	0.283105	15.6	1.48	204	-0.92
13MD360@8	0.0243	0.0010	0.283134	0.000029	0.283131	16.5	1.03	165	-0.97
13MD360@9	0.0451	0.0018	0.283221	0.000031	0.283215	19.5	1.09	42	-0.95
13MD360@10	0.0849	0.0033	0.283141	0.000026	0.283130	16.5	0.93	166	-0.90
13MD360@11	0.0461	0.0018	0.283110	0.000029	0.283104	15.6	1.01	204	-0.94
13MD360@12	0.1957	0.0076	0.283228	0.000051	0.283204	19.1	1.81	38	-0.77
13MD360@13	0.1202	0.0048	0.283119	0.000030	0.283104	15.5	1.07	208	-0.86
13MD360@14	0.1137	0.0045	0.283188	0.000034	0.283174	18.0	1.20	98	-0.87
13MD360@15	0.1079	0.0042	0.282993	0.000047	0.282980	11.1	1.67	400	-0.87
13MD360@16	0.1262	0.0050	0.283231	0.000038	0.283214	19.4	1.36	31	-0.85
13MD360@17	0.3597	0.0120	0.283314	0.000039	0.283275	21.6	1.37	-130	-0.64
13MD360@18	0.2799	0.0100	0.283138	0.000067	0.283106	15.6	2.37	211	-0.70

Table DR5-Oxygen isotopes of zircons from Myanmar ophiolites

Sample	$\delta^{18}O$	2 SE	Sample	$\delta^{18}O$	2 SE	Sample	$\delta^{18}O$	2 SE
13md16@1	5.64	0.32	13md17@1	5.41	0.44	13md42@1	7.90	0.31
13md16@2	5.72	0.22	13md17@2	5.58	0.28	13md42@2	8.34	0.38
13md16@3	5.67	0.27	13md17@3	5.88	0.28	13md42@3	8.63	0.40
13md16@4	5.32	0.33	13md17@4	5.82	0.39	13md42@5	8.43	0.27
13md16@6	5.53	0.37	13md17@5	5.68	0.25	13md42@6	8.21	0.24
13md16@7	5.63	0.37	13md17@6	6.24	0.45	13md42@7	8.09	0.34
13md16@8	5.37	0.31	13md17@7	5.33	0.34	13md42@8	8.12	0.34
13md16@9	5.42	0.38	13md17@8	5.60	0.32	13md42@9	8.43	0.49
13md16@10	5.98	0.21	13md17@9	5.78	0.32	13md42@10	8.01	0.28
13md16@11	5.86	0.52	13md17@10	5.88	0.48	13md42@11	7.81	0.39
13md16@12	6.34	0.18				13md42@12	7.71	0.36
13md16@13	5.69	0.35				13md42@14	7.65	0.28
13md16@14	5.61	0.31				13md42@15	8.12	0.42
13md16@15	5.45	0.32				13md42@16	8.01	0.46
						13md42@17	8.13	0.34
						13md42@18	8.10	0.39

Sample	$\delta^{18}O$	2 SE	Sample	$\delta^{18}O$	2 SE	Sample	$\delta^{18}O$	2 SE
13MD345@1	5.18	0.26	13MD351@1	4.95	0.41	13md360@1	5.33	0.50
13MD345@2	4.66	0.40	13MD351@2	5.28	0.36	13md360@2	5.12	0.32
13MD345@3	5.17	0.38	13MD351@3	4.53	0.45	13md360@3	4.96	0.27
13MD345@4	4.70	0.25	13MD351@4	4.22	0.43	13md360@4	5.31	0.40
13MD345@5	4.22	0.36	13MD351@5	4.55	0.31	13md360@5	5.14	0.32
13MD345@6	5.60	0.33	13MD351@6	5.24	0.32	13md360@6	4.46	0.41
13MD345@7	5.24	0.42	13MD351@7	4.63	0.34	13md360@7	5.11	0.39
13MD345@8	5.12	0.22	13MD351@8	4.52	0.23	13md360@8	5.29	0.18
13MD345@9	5.26	0.39	13MD351@9	4.72	0.37	13md360@9	4.66	0.38
13MD345@10	5.23	0.26	13MD351@10	4.50	0.40	13md360@10	5.04	0.32
13MD345@11	4.97	0.39	13MD351@11	4.95	0.37	13md360@11	5.16	0.35
13MD345@12	5.27	0.33	13MD351@12	4.95	0.38	13md360@12	4.77	0.32
13MD345@13	5.34	0.30	13MD351@13	5.39	0.40	13md360@13	5.12	0.33
13MD345@14	5.18	0.23	13MD351@14	4.71	0.30	13md360@14	4.75	0.24
13MD345@15	5.45	0.34	13MD351@15	5.24	0.37	13md360@15	5.09	0.36
13MD345@16	5.05	0.31	13MD351@16	4.24	0.38			
13MD345@17	4.66	0.43	13MD351@17	5.16	0.20			
13MD345@18	5.24	0.37	13MD351@18	4.94	0.33			
13MD345@19	5.39	0.43	13MD351@19	4.28	0.28			
13MD345@20	5.34	0.35	13MD351@20	5.04	0.29			
13MD345@21	4.82	0.27						

Table DR6-Compilation of age data of Yarlung Tsangpo and Bangong Lake ophiolite, Tibetan Plateau

	Location	Sample	GPS	Lithology	Age (Ma)	2δ	Mineral	Method	Reference
Yarlung-Tsangpo Suture									
1	Dongpo/Koigar	L-178-3		Gabbro	130.0	0.5	Zircon	SHRIMP	Xiong et al. (2011)
		L-190-2		Gabbro	128.0	1.1	Zircon	SHRIMP	Xiong et al. (2011)
		GCT-329		Gabbronorite	159.7	0.5	Zircon	TIMS	Chan et al. (2015)
2	Purang	3X332	30°33'49", 81°09'28"	Diabase	120.2	2.3	Zircon	SHRIMP	Li et al., (2008)
		Y-40	30°33'43", 81°15'09"	Gabbro	130.0	3.0	Zircon	SHRIMP	Liu et al. (2011)
		3X314	30°35'33", 81°30'57"	Diabase	118.8	1.8	Zircon	SHRIMP	Xia et al. (2011)
		GCT-134		Gabbro	123.8	1.1	Zircon	TIMS	Chan et al. (2015)
		GCT-61		Gabbronorite	123.4	1.1	Zircon	TIMS	Chan et al. (2015)
3	Xiugugabu	3X269	30°11'56", 83°03'30"	Diabase	122.3	2.4	Zircon	SHRIMP	Wei et al. (2006)
4	Dangqiong	GCT-185		Gabbro	126.7	0.5	Zircon	TIMS	Chan et al. (2014)
		GCT-163		Gabbro	123.4	0.8	Zircon	TIMS	Chan et al. (2014)
5	Zhongba	ZOES-4-04		Diabase	125.7	0.9	Zircon	SIMS	Dai et al. (2012)
6	Sangsang	3X66	29°20'16", 86°41'32"	Diabase	125.2	3.4	Zircon	SHRIMP	Xia et al. (2008a)
7	Jiding	3X562	29°07'53", 88°03'55"	Gabbro	128.0	2.0	Zircon	SHRIMP	Wang et al. (2006)
		JD07		Gabbro	127.1	3.5	Zircon	LA	Dai et al. (2013)
		RZ-5		Diabase	128.5	1.0	Zircon	LA	Bao et al. (2013)
		GCT-152		Gabbro	131.8	1.3	Zircon	LA	Chan et al. (2015)
		12FW34	29°07'17", 88°21'.27"	Rodingite	124.0	1.6	Zircon	SIMS	Zhang LL, unpublished
8	Xiaru	12FW45	29°07'01", 88°58'14"	Rodingite	125.7	0.8	Zircon	SIMS	Zhang LL, unpublished
9	Qunrang	3X692	29°08'06", 88°59'23"	Gabbro	125.6	0.9	Zircon	SHRIMP	Li et al. (2009)
10	Deji	DJ11-22		Quartz diorite	123.3	1.5	Zircon	LA	Dai et al. (2013)
		DJ11-01		Diabase	124.9	1.1	Zircon	LA	Dai et al. (2013)
		DJ11-14		Diabase	126.5	4.7	Zircon	LA	Dai et al. (2013)
		12FW149	29°08'47", 89°06'18"	Rodingite	125.7	1.3	Zircon	SIMS	Zhang LL et al. (2015)
		12FW152	29°08'48", 89°06'18"	Gabbro	124.6	1.4	Zircon	SIMS	Zhang LL et al. (2015)
		12FW156	29°08'57", 89°06'17"	Quartz diorite	124.7	1.9	Zircon	SIMS	Zhang LL et al. (2015)
		12FW159	29°09.01',89°06.29′	Tonalite	127.1	1.0	Zircon	SIMS	Zhang LL et al. (2015)
11	Pengcang	PC01	29°10'09", 89°10'11"	Rodingite	126.0	3.0	Zircon	SIMS	Zhang LL et al. (2015)
		PC03	29°10'09", 89°10'11"	Rodingite	130.0	1.3	Zircon	SIMS	Zhang LL et al. (2015)
		PC06	29°10'08", 89°10'11"	Quartz diorite	129.1	1.4	Zircon	SIMS	Zhang LL et al. (2015)
12	Dazhuqu	D13		Quartz diorite	126.0	1.5	Zircon	SHRIMP	Malpas et al. (2003)
		DZQ11-03		Diabase	126.1	1.3	Zircon	LA	Dai et al. (2013)
		12FW138	29°17'51", 89°32'55"	Rodingite	124.9	1.4	Zircon	SIMS	Zhang LL, unpublished
		12FW139	29°17'49", 89°32'42"	Gabbro	124.4	1.3	Zircon	SIMS	Zhang LL, unpublished
		12FW143	29°18'23", 89°31'48"	Gabbro	127.5	1.0	Zircon	SIMS	Zhang LL, unpublished
13	Zedong	ZD47	29°13'16", 91°37'58"	Rodingite	131.5	1.1	Zircon	SIMS	Zhang LL, unpublished
		ZD48	29°13'16", 91°37'58"	Rodingite	130.3	1.2	Zircon	SIMS	Zhang LL, unpublished
		13ZD47	29°13'17", 91°37'24"	Gabbro	131.7	0.9	Zircon	SIMS	Zhang LL, unpublished
		ZD69	29°12'08", 91°40'33"	Plagiogranites	137.8	1.0	Zircon	SIMS	Zhang LL, unpublished
14	Luobusa	GCT-405		Diabase	148.4	4.5	Zircon	LA	Chan et al. (2015)
		GCT-406		Diabase	149.9	2.2	Zircon	LA	Chan et al. (2015)
		12FW174	29°14'23", 92°11'43"	Gabbro	130.9	1.3	Zircon	SIMS	Zhang C et al. (2015)
		13LBS08	29°14'10", 92°12'18"	Gabbro	128.3	0.9	Zircon	SIMS	Zhang C et al. (2015)
		12FW170	29°14.39',92°11.71′	Gabbro	131.5	6.9	Titanite	LA	Zhang C et al. (2015)
		12FW171	29°14.39',92°11.71′	Gabbro	131.3	3.3	Titanite	LA	Zhang C et al. (2015)
		12FW174	29°14.39',92°11.71′	Gabbro	133.9	3.1	Titanite	LA	Zhang C et al. (2015)

Bangong-Nujiang Suture									
15	Bangong Lake	BHG41		Gabbro	181.9	2.6	Zircon	LA	Qu et al. (2010)
		01Y-155		Gabbro	168.0	2.0	Zircon	SHIRMP	Shi (2007)
		12RT-20	33°26'24",79°38'25"	Gabbro	169.0	2.0	Zircon	LA	Wang BD et al. (2015)
16	Dong Tso	XDC61	32°17'49",84°43'19"	Hornblende	166.0	4.0	Zircon	SHIRMP	Li et al.(2013)
		11DC-6	32°18'56", 84°44'25"	Gabbro	167.0	2.0	Zircon	LA	Wang BD et al. (2015)
17	Lagkor Tso	GZ-45		Plagiogranite	166.6	2.5	Zircon	SHIRMP	Zhang XZ et al. (2007)
18	Dongqiao	XDQ29		Gabbro	187.8	3.7	Zircon	SHIRMP	Xia et al. (2008b)
		12DQ-1	32°00'54",90°34'14"	Gabbro	187.0	2.0	Zircon	LA	Wang BD et al. (2015)
19	Amdo	P1-6TW1?		Plagiogranite	188.0	2.0	Zircon	SHIRMP	Sun et al. (2011)
		12AD-50	32°15'35",91°41'14"	Gabbro	184.0	2.0	Zircon	LA	Wang BD et al. (2015)
20	Naqu	9038		Gabbro	183.7	1.0	Zircon	LA	Huang et al. (2013)
21	Dingqing	13DQ-19	31°21'52",95°45'59"	Gabbro	178.0	3	Zircon	LA	Wang BD et al. (2015)
		13DQ-25	31°21'52",95°45'59"	Leucogabbro	164.0	2	Zircon	LA	Wang BD et al. (2015)

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