

GEOLOGICAL OUTLINE AND SAMPLE DESCRIPTION

The Sorachi-Yezo belt is the Cretaceous tectonic complex forming a large antiform structure in central Hokkaido (Fig. DR1). In the Sorachi-Yezo belt, large massive ultramafic bodies develop in some areas, and have often been regarded as ophiolite (e.g. Horokanai; Ishizuka 1986) together with mafic volcanic and plutonic rocks. This belt can be divided into two geologic units, the Kamuikotan complex and the Sorachi-Yezo unit (Kimura et al., 1994). The Kamuikotan complex consists mainly of high P/T-type crystalline schists and low-grade metamorphosed mafic and sedimentary rocks associated with serpentinite mélange, which are tectonically overlain by the Sorachi-Yezo unit by thrust faults. The radiometric age for the crystalline schists ranges from 145 to 50 Ma (Sakakibara and Ota, 1994). The Late Callovian radiolarians are reported from the chert xenolith included in basalts (Sakakibara et al., 1997). Maekawa (1983) reports various sizes of the low-grade metamorphosed picrite blocks in the mafic and pelitic to psammitic sedimentary matrices in the Biei area (the Oichanunpe Formation).

The Sorachi-Yezo unit consists of a conformable sequence of the Sorachi and Yezo Groups. The lower Sorachi Group consists of the non-metamorphosed thick massive and pillow lavas and volcaniclastics covered by the pelagic sediments containing the Tithonian radiolarians (Kito, 1987; Takashima et al., 2001). The upper Yezo Group consists mainly of the terrigenous sandstone and mudstone deposited in a Cretaceous forearc basin. Niida and Kito (1999) first reported the petrographic characteristics of the picrites in the Furano area, and then Takashima et al. (2001, 2002) performed the detailed geological survey of this area, and revealed that the volcanic rocks consisted mostly of picritic pillow lavas and hyaloclastites (the Gokurakudaira Formation).

In this study, we collected picrite boulders in the two rivers cross-cutting the Oichanunpe and Gokurakudaira Formations (Ino River, 4 km to the west of Asahikawa, and Shirikishimanai River, 8km to the west of Furano, respectively) to study fresher olivine-bearing samples. In the following, we call the picrites from the Kamuikotan complex as “Kamuikotan picrites”, those from the Sorachi-Yezo unit as “Sorachi picrites” and the two are collectively called as “Sorachi-Yezo picrites”. In this paper, we use the term “picrite” for highly olivine-phyric ultramafic volcanic rock without obvious spinifex texture regardless of its whole rock chemistry, according to the notation of Kerr and Arndt (2001).

Under the microscope, there are no petrographic differences between the picrites from the two areas. The picrites show olivine-phyric texture, and the olivine phenocrysts (up to 60 vol.%) in the picrites are partly replaced by secondary minerals such as serpentine and actinolite along cracks and outer rims. The olivine

phenocrysts are commonly euhedral to subhedral, and are 0.1 to 3 mm in size (average 1.0mm). The elongated olivines showing a parallel orientation are often observed. The deformed textures such as kink band are very rare. Chromian spinels occur as discrete microphenocrysts and as inclusions in the olivine phenocrysts. Plagioclases and pyroxenes are completely absent as phenocryst phases. The groundmass consists of fresh clinopyroxene and altered olivine, plagioclase and glass. The groundmass minerals sometimes show feathered or dendritic shapes by quenching.

ANALYTICAL METHODS

Mineral chemistry

The analysis instrument is the wavelength-dispersive electron microprobe (JEOL JXA-8800) at JAMSTEC. For olivine, the counting time was set to 100 s for Mn, Ca, and Ni, and 20 s for other elements at 20 kV and 25 nA. For spinel, the counting time was set to 20 s for peaks and 10 s for background at 15 kV and 15 nA. The natural and synthetic minerals were used for the standard materials. FeO and Fe₂O₃ of spinel were estimated by spinel stoichiometry.

Whole rock chemistry

Major and trace elements analyses were performed by X-ray fluorescence spectrometry (XRF) using the Rigaku Simultix 12 and Rigaku RIX3000 at JAMSTEC. Analysis of V and Cr was performed by XRF using the Rigaku RIX 2100 at Department of Earth Sciences, Graduate School of Science, Tohoku University. Rare earth element and trace element were analyzed by inductively coupled plasma mass spectrometry (ICP-MS) using an Agilent 7500ce system at JAMSTEC. The detail analytical procedures are described in Kawabata et al. (2011).

CALCULATION METHODS

The primary magma MgO was estimated from the modification of the analyzed whole rock composition by addition or subtraction of olivine until the composition are in equilibrium with the most forsterite-rich olivine in the sample. The calculation was performed by the 100% normalized whole rock composition and the assumptions of $\text{Fe}^{3+} / \Sigma\text{Fe} = 0.1$ and $K_d = (\text{Fe/Mg})_{\text{olivine}} / (\text{Fe/Mg})_{\text{liquid}} = 0.3$ (Roeder and Emslie, 1970). The other Mg-rich rocks were from the published whole rock analysis data (Late Archean komatiite (Lahaye and Arndt, 1996), Gorgona komatiite and picrite (Rèvillon et al., 2000), picritic MORB (Perfit et al., 1996)) and olivine data (Sobolev et al. 2007). The number of the calculated samples is shown as "n", and the parenthetic numbers indicate the average values. For the picritic MORB, one olivine composition was applied to calculation for six whole rock compositions, because it was not able to identify its host rock. The mantle potential temperatures T_p is calculated by the equation T_p (°C) = 1463 + 12.74 * MgO -2924 / MgO (Herzberg et al., 2007).

The calculation by PRIMELT2 (Herzberg and Asimow, 2008) were performed by accumulated fractional melting and depleted mantle composition ($\text{MgO}=41.8$ wt.% and FeO (total)=8.07) using 100% normalized major element compositions. The number of the successful calculations without any error is shown as "n", and the parenthetic numbers indicate the average values.

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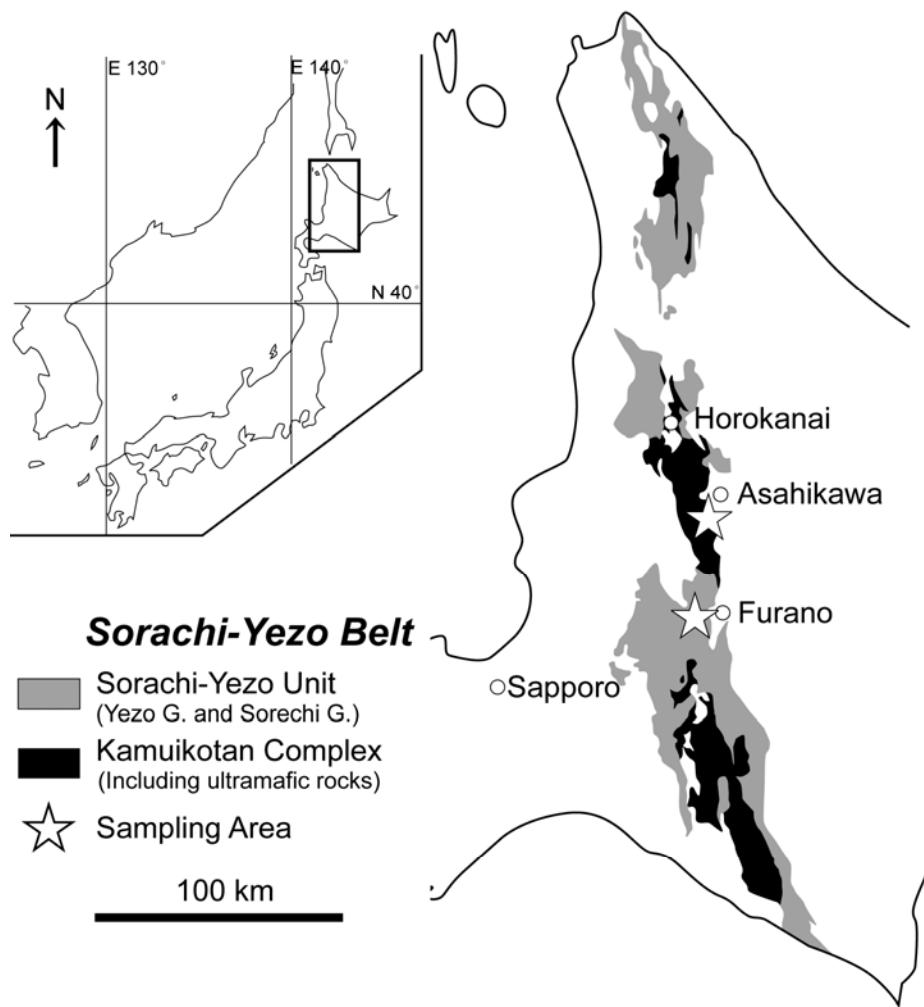


Figure DR1. Distribution of the Sorachi-Yezo belt, central Hokkaido, Japan (after Nagahashi and Miyashita, 2000), and the sample localities in this study.

TABLE DR1 Compositions of the olivine phenocrysts in the Sorachi-Yezo picrites.

Sample	Grain No.		Size (mm)	SiO ₂	TiO ₂	Al ₂ O ₃	FeO*	MnO	MgO	CaO	NiO	Total	Fo
INO-R02	3-OI1	Core	1.6	40.70	0.01	0.08	12.69	0.19	46.96	0.34	0.33	101.29	86.84
		Rim		41.16	0.03	0.09	12.62	0.20	46.84	0.35	0.34	101.61	86.87
4-OI1	Core	0.4	41.46	0.01	0.09	9.05	0.13	49.57	0.33	0.34	100.98	90.71	
		Rim		40.88	0.01	0.03	9.48	0.15	48.04	0.34	0.34	99.27	90.03
4-OI2	Core	0.3	41.81		0.09	8.95	0.15	49.64	0.34	0.35	101.33	90.81	
		Rim		41.32	0.01	0.11	9.45	0.14	47.71	0.32	0.34	99.40	90.00
5-OI1	Core	1.4	41.41	0.01	0.12	9.15	0.15	49.32	0.30	0.41	100.85	90.57	
		Rim		41.41		0.12	8.93	0.15	49.86	0.30	0.41	101.18	90.87
5-OI2	Core	0.2	40.39	0.01	0.05	15.92	0.31	44.36	0.29	0.25	101.59	83.24	
		Rim		40.62	0.00	0.03	13.46	0.24	46.00	0.33	0.29	100.97	85.90
5-OI3	Core	0.3	41.24		0.06	11.51	0.17	48.17	0.32	0.32	101.80	88.18	
		Rim		41.63	0.01	0.06	11.40	0.17	48.03	0.34	0.33	101.97	88.25
5-OI4	Core	0.5	41.66	0.01	0.10	7.35	0.12	51.11	0.31	0.37	101.02	92.54	
		Rim		41.85	0.00	0.07	8.10	0.12	50.48	0.31	0.36	101.30	91.74
5-OI5	Core	1.7	41.36	0.00	0.06	9.59	0.15	48.74	0.30	0.41	100.62	90.06	
		Rim		41.52	0.01	0.12	10.07	0.16	49.36	0.34	0.39	101.97	89.73
6-OI1	Core	0.7	41.24	0.01	0.07	11.03	0.18	47.84	0.32	0.36	101.05	88.55	
		Rim		41.59	0.01	0.06	10.83	0.16	48.50	0.34	0.36	101.86	88.86
6-OI2	Core	1.3	41.14	0.01	0.10	11.01	0.17	48.08	0.31	0.37	101.18	88.62	
		Rim		41.03	0.00	0.07	11.09	0.17	47.95	0.33	0.35	101.00	88.51
6-OI3	Core	0.9	42.05		0.12	7.17	0.12	51.22	0.29	0.43	101.39	92.72	
		Rim		42.29	0.00	0.12	7.41	0.12	51.21	0.30	0.43	101.88	92.50
6-OI4	Core	0.4	41.30	0.01	0.07	11.28	0.18	47.68	0.35	0.32	101.17	88.28	
		Rim		41.98	0.01	0.09	9.59	0.15	49.29	0.32	0.38	101.80	90.16
7-OI1	Core	1.5	41.96	0.02	0.11	9.25	0.14	49.65	0.29	0.42	101.83	90.54	
		Rim		41.92		0.11	9.84	0.16	48.97	0.32	0.39	101.71	89.87
8-OI1	Core	2.2	42.40	0.01	0.12	6.77	0.11	51.35	0.31	0.42	101.49	93.11	
		Rim		42.17		0.14	6.79	0.11	51.12	0.32	0.40	101.04	93.07
9-OI1	Core	2.1	40.68	0.01	0.08	11.59	0.18	46.57	0.34	0.34	99.80	87.75	
		Rim		41.12	0.01	0.06	12.43	0.20	47.28	0.36	0.36	101.80	87.14

11-OI1	Core	0.6	41.51	0.08	10.97	0.17	48.13	0.34	0.35	101.55	88.66		
	Rim		41.49	0.00	0.07	10.85	0.17	48.31	0.34	0.36	101.59	88.81	
11-OI2	Core	0.3	41.47		0.09	10.91	0.18	47.19	0.34	0.35	100.53	88.52	
	Rim		41.31		0.10	11.04	0.17	47.72	0.35	0.37	101.04	88.52	
11-OI3	Core	1.2	41.04	0.01	0.10	11.74	0.19	47.54	0.30	0.36	101.28	87.83	
	Rim		41.11	0.00	0.09	10.93	0.17	48.08	0.34	0.35	101.07	88.69	
11-OI4	Core	0.3	41.85	0.01	0.11	10.87	0.18	47.97	0.35	0.36	101.69	88.72	
	Rim		41.91	0.02	0.12	10.20	0.18	47.27	0.59	0.35	100.62	89.20	
11-OI5	Core	0.5	41.45	0.04	0.10	10.98	0.18	48.30	0.35	0.35	101.74	88.69	
	Rim		41.53	0.01	0.09	10.83	0.17	47.42	0.35	0.35	100.74	88.64	
12-OI1	Core	2.2	41.64		0.11	10.60	0.17	48.38	0.32	0.35	101.58	89.05	
	Rim		41.18	0.01	0.10	10.60	0.17	47.70	0.34	0.36	100.46	88.91	
12-OI2	Core	1.2	41.86		0.11	10.74	0.17	48.22	0.30	0.38	101.76	88.89	
	Rim		41.49		0.08	10.57	0.17	48.00	0.33	0.38	101.03	89.00	
13-OI1	Core	0.1	40.90	0.01	0.07	13.92	0.22	45.55	0.38	0.31	101.35	85.37	
	Rim		41.38	0.01	0.07	14.02	0.22	46.15	0.39	0.30	102.53	85.44	
13-OI2	Core	0.1	41.24	0.02	0.06	11.95	0.18	46.80	0.38	0.32	100.94	87.47	
14-OI1	Core	2.1	41.62		0.09	10.73	0.16	48.01	0.32	0.36	101.27	88.86	
	Rim		41.51	0.01	0.12	11.54	0.18	47.88	0.32	0.35	101.90	88.09	
15-OI1	Core	3.0	42.29		0.13	7.70	0.13	50.82	0.32	0.43	101.82	92.17	
	Rim		41.86	0.01	0.10	7.75	0.13	50.36	0.32	0.43	100.97	92.05	
16-OI1	Core	0.4	41.48	0.02	0.05	11.52	0.18	47.15	0.36	0.31	101.06	87.95	
16-OI2	Core	0.1	41.65	0.02	0.07	11.32	0.18	47.49	0.36	0.27	101.38	88.20	
16-OI3	Core	0.2	41.94	0.01	0.11	8.39	0.14	49.52	0.32	0.39	100.82	91.32	
Sample	Grain No.	Size (mm)	SiO ₂	TiO ₂	Al ₂ O ₃	FeO*	MnO	MgO	CaO	NiO	Total	Fo	
INO-R03	1-OI1	Core	2.3	41.32	0.01	0.10	12.50	0.20	47.16	0.35	0.32	101.95	87.06
		Rim		41.28	0.01	0.06	12.47	0.19	47.21	0.35	0.31	101.89	87.09
	1-OI2	Core	1.2	41.34	0.04	0.05	12.33	0.20	46.69	0.35	0.28	101.26	87.10
		Rim		41.67	0.00	0.05	11.61	0.19	46.97	0.35	0.29	101.13	87.82
	1-OI3	Core	0.5	42.61	0.00	0.07	5.91	0.10	52.35	0.32	0.35	101.72	94.05
		Rim		42.68	0.01	0.06	7.04	0.11	51.16	0.32	0.35	101.72	92.84
	1-OI4	Core	0.4	41.82	0.01	0.07	10.24	0.16	48.59	0.33	0.34	101.56	89.43
		Rim		42.06		0.06	10.22	0.15	49.10	0.33	0.34	102.25	89.54
	1-OI5	Core	0.1	41.25	0.01	0.06	12.25	0.18	47.18	0.34	0.33	101.58	87.29
	2-OI1	Core	0.1	41.35		0.06	12.44	0.19	47.29	0.36	0.31	102.00	87.14

	Rim		41.57	0.01	0.06	11.92	0.19	47.79	0.39	0.31	102.24	87.72
2-OI2	Core	0.2	41.34	0.00	0.06	10.67	0.17	48.27	0.34	0.33	101.17	88.97
	Rim		41.60		0.07	10.89	0.17	48.12	0.35	0.33	101.53	88.73
2-OI3	Core	1.5	41.77	0.00	0.10	9.69	0.15	49.50	0.29	0.41	101.90	90.11
	Rim		41.91	0.01	0.11	10.55	0.16	48.77	0.34	0.38	102.22	89.18
2-OI4	Core	1.4	41.64	0.01	0.09	10.18	0.16	48.75	0.28	0.39	101.50	89.51
	Rim		41.86	0.02	0.10	10.52	0.17	48.66	0.34	0.37	102.03	89.19
2-OI5	Core	0.4	40.85	0.01	0.08	15.99	0.25	43.90	0.36	0.18	101.63	83.03
	Rim		41.12	0.01	0.05	13.28	0.21	45.89	0.38	0.26	101.20	86.03
3-OI1	Core	1.5	41.85		0.08	9.74	0.15	49.34	0.31	0.37	101.84	90.03
	Rim		41.70	0.01	0.07	10.34	0.16	48.96	0.33	0.38	101.94	89.40
4-OI1	Core	2.4	41.00	0.01	0.04	12.33	0.20	47.02	0.30	0.37	101.27	87.18
	Rim		40.74	0.02	0.10	12.22	0.20	46.73	0.36	0.33	100.70	87.20
4-OI2	Core	2.1	41.33	0.01	0.07	11.74	0.18	47.72	0.29	0.39	101.72	87.87
	Rim		41.21		0.07	12.38	0.20	47.13	0.33	0.34	101.65	87.16
4-OI3	Core	0.1	40.77	0.01	0.03	17.02	0.28	43.75	0.28	0.25	102.40	82.09
	Rim		40.84	0.00	0.03	14.07	0.23	46.21	0.29	0.30	101.97	85.41
4-OI4	Core	1.8	41.73		0.06	9.51	0.14	49.62	0.28	0.42	101.76	90.29
	Rim		41.38	0.02	0.07	11.77	0.19	47.01	0.36	0.33	101.12	87.69
5-OI1	Core	0.3	41.12		0.11	12.82	0.20	46.66	0.35	0.37	101.63	86.64
	Rim		41.42		0.08	11.64	0.18	47.57	0.37	0.35	101.61	87.93
5-OI2	Core	0.3	41.25	0.01	0.09	11.34	0.18	48.06	0.34	0.36	101.63	88.32
	Rim		41.80	0.02	0.08	11.33	0.18	47.86	0.40	0.33	102.00	88.28
5-OI3	Core	0.3	41.50	0.01	0.05	10.91	0.17	48.46	0.35	0.26	101.72	88.78
	Rim		40.64		0.02	10.99	0.16	47.34	0.34	0.26	99.76	88.47
5-OI4	Core	0.1	41.04	0.00	0.05	13.90	0.22	45.69	0.39	0.30	101.58	85.42
5-OI5	Core	0.4	40.94	0.01	0.21	12.46	0.19	47.13	0.34	0.31	101.58	87.09
	Rim		41.02	0.01	0.08	11.78	0.18	46.92	0.35	0.31	100.64	87.66
5-OI6	Core	0.2	41.69	0.02	0.05	10.53	0.16	48.48	0.35	0.36	101.64	89.14
	Rim		41.60	0.01	0.07	10.38	0.16	48.09	0.36	0.36	101.02	89.20
6-OI1	Core	2.3	41.34		0.06	12.64	0.19	46.96	0.34	0.33	101.86	86.88
	Rim		40.79	0.01	0.05	12.51	0.20	46.19	0.33	0.33	100.41	86.81
6-OI2	Core	1.7	41.71	0.02	0.09	10.42	0.16	48.61	0.31	0.34	101.67	89.27
	Rim		41.74	0.00	0.09	10.60	0.17	48.46	0.33	0.35	101.72	89.07
6-OI3	Core	0.8	41.68	0.00	0.07	10.09	0.16	48.61	0.32	0.36	101.29	89.57
	Rim		41.47	0.00	0.07	10.08	0.15	48.88	0.31	0.36	101.31	89.63

7-OI1	Core	2.0	42.26	0.01	0.09	7.20	0.12	51.48	0.30	0.40	101.85	92.72	
	Rim		41.66	0.01	0.11	8.53	0.14	49.83	0.30	0.40	100.98	91.24	
8-OI1	Core	1.0	41.26	0.01	0.10	13.70	0.22	45.79	0.31	0.32	101.71	85.63	
	Rim		40.93	0.00	0.11	13.78	0.21	45.71	0.33	0.31	101.38	85.53	
9-OI1	Core	3.1	41.81	0.00	0.09	6.66	0.11	51.01	0.29	0.41	100.38	93.18	
	Rim		41.75	0.01	0.12	7.67	0.12	50.87	0.30	0.40	101.23	92.20	
10-OI1	Core	1.6	42.07	0.01	0.11	7.31	0.12	51.01	0.29	0.40	101.30	92.56	
	Rim		42.28		0.06	7.34	0.13	50.89	0.28	0.39	101.37	92.51	
11-OI1	Core	3.5	41.64		0.06	10.56	0.16	48.62	0.35	0.34	101.74	89.13	
	Rim		41.59	0.02	0.12	10.63	0.17	48.35	0.36	0.37	101.60	89.02	
11-OI2	Core	1.5	41.01	0.02	0.08	14.33	0.22	45.61	0.37	0.29	101.92	85.02	
	Rim		40.95	0.00	0.07	13.54	0.21	45.75	0.38	0.29	101.21	85.76	
11-OI3	Core	1.7	41.60	0.01	0.10	10.36	0.16	48.42	0.30	0.38	101.32	89.28	
	Rim		41.34		0.11	11.24	0.18	47.51	0.31	0.37	101.05	88.28	
12-OI1	Core	3.5	41.50	0.01	0.05	12.27	0.21	47.01	0.36	0.31	101.71	87.23	
	Rim		41.36	0.02	0.05	12.32	0.20	46.66	0.35	0.31	101.26	87.10	
13-OI1	Core	0.9	42.42	0.01	0.09	6.91	0.11	51.25	0.29	0.43	101.52	92.97	
	Rim		42.02		0.11	8.59	0.14	50.09	0.30	0.40	101.64	91.23	
13-OI2	Core	1.1	42.25	0.00	0.05	7.38	0.12	50.62	0.29	0.39	101.10	92.44	
	Rim		42.02	0.00	0.09	7.68	0.12	50.92	0.29	0.39	101.51	92.20	
13-OI3	Core	0.5	41.99	0.00	0.04	9.76	0.15	49.28	0.31	0.39	101.91	90.00	
	Rim		41.35	0.01	0.07	10.10	0.16	48.81	0.32	0.38	101.19	89.60	
13-OI4	Core	0.6	42.47	0.01	0.05	6.75	0.10	51.78	0.31	0.38	101.86	93.18	
13-OI5	Core	0.7	41.91		0.09	9.47	0.14	49.25	0.33	0.40	101.60	90.26	
	Rim		41.85	0.03	0.09	9.69	0.16	48.39	0.34	0.39	100.95	89.90	
14-OI1	Core	3.5	41.43	0.02	0.08	12.36	0.19	47.42	0.31	0.35	102.15	87.24	
	Rim		41.49	0.01	0.04	12.65	0.20	46.44	0.36	0.32	101.51	86.75	
Sample	Grain No.	Size (mm)	SiO ₂	TiO ₂	Al ₂ O ₃	FeO*	MnO	MgO	CaO	NiO	Total	Fo	
SHIR-R01	1-OI1	Core	2.0	42.34	0.01	0.11	8.56	0.14	49.96	0.31	0.34	101.77	91.23
	Rim		42.18	0.01	0.07	11.01	0.18	48.53	0.33	0.33	102.64	88.71	
2-OI1	Core	1.1	42.09	0.02	0.07	11.08	0.17	48.06	0.31	0.32	102.13	88.54	
	Rim		42.51	0.01	0.08	11.49	0.18	48.03	0.33	0.34	102.97	88.16	
4-OI1	Core	1.6	42.27		0.09	10.21	0.18	48.92	0.33	0.37	102.36	89.52	
	Rim		41.92	0.01	0.10	10.88	0.19	47.99	0.33	0.36	101.76	88.71	
5-OI1	Core	0.2	41.80		0.07	11.69	0.19	47.62	0.34	0.34	102.04	87.89	

	Rim		41.96	0.01	0.08	12.03	0.19	47.93	0.33	0.32	102.85	87.66
5-OI2	Core	0.5	42.57		0.06	10.78	0.17	48.89	0.31	0.38	103.15	88.99
	Rim		42.05	0.02	0.09	11.75	0.19	47.85	0.35	0.34	102.63	87.89
5-OI3	Core	0.4	41.92		0.04	11.88	0.18	48.02	0.36	0.32	102.73	87.81
	Rim		41.93		0.03	12.01	0.20	47.00	0.36	0.32	101.85	87.46
5-OI4	Core	0.8	42.43	0.01	0.10	9.61	0.15	49.15	0.30	0.40	102.13	90.12
	Rim		42.02	0.00	0.07	11.70	0.18	47.47	0.34	0.33	102.12	87.85
5-OI5	Core	0.8	42.17	0.01	0.07	9.76	0.16	49.37	0.31	0.39	102.22	90.02
	Rim		42.51		0.09	10.24	0.16	48.71	0.31	0.38	102.41	89.45
7-OI1	Core	0.5	42.55	0.00	0.10	9.04	0.13	49.87	0.30	0.39	102.39	90.77
	Rim		41.94	0.02	0.07	11.03	0.18	48.15	0.31	0.36	102.07	88.61
7-OI2	Core	0.3	41.91	0.01	0.06	11.73	0.19	47.60	0.38	0.33	102.20	87.86
	Rim		42.14		0.04	11.85	0.18	47.18	0.35	0.33	102.08	87.65
7-OI3	Core	0.9	42.38	0.02	0.06	9.06	0.14	49.98	0.29	0.40	102.32	90.77
	Rim		42.23	0.01	0.09	11.68	0.18	48.07	0.32	0.33	102.91	88.01
7-OI4	Core	0.4	41.89		0.09	11.15	0.18	47.46	0.31	0.31	101.39	88.36
	Rim		42.45	0.01	0.05	11.44	0.18	47.57	0.33	0.33	102.35	88.11
7-OI5	Core	1.9	42.40		0.07	9.55	0.16	49.68	0.32	0.37	102.54	90.26
	Rim		41.88	0.01	0.08	11.35	0.19	47.30	0.34	0.33	101.46	88.14
8-OI1	Core	2.7	41.76		0.04	13.05	0.21	46.70	0.38	0.29	102.42	86.45
	Rim		42.07		0.05	11.96	0.20	47.28	0.37	0.31	102.24	87.57
9-OI1	Core	1.1	42.62		0.06	8.51	0.14	50.12	0.32	0.39	102.16	91.30
	Rim		42.87	0.00	0.07	10.77	0.16	48.43	0.31	0.34	102.96	88.91
9-OI2	Core	1.2	42.63	0.01	0.06	8.45	0.14	50.23	0.30	0.39	102.21	91.38
	Rim		42.61		0.09	11.26	0.18	48.01	0.33	0.33	102.81	88.37
9-OI3	Core	0.6	42.19		0.07	9.49	0.15	49.34	0.30	0.38	101.93	90.26
	Rim		42.61		0.10	10.47	0.17	48.43	0.31	0.34	102.44	89.18
9-OI4	Core	2.0	42.41		0.08	8.49	0.13	50.41	0.31	0.39	102.21	91.37
	Rim		42.50		0.08	10.16	0.16	48.76	0.30	0.38	102.31	89.54
11-OI6	Core	0.1	41.90	0.01	0.07	11.71	0.19	47.34	0.35	0.32	101.90	87.81
12-OI1	Core	0.5	42.51	0.01	0.07	9.28	0.14	49.85	0.30	0.38	102.53	90.54
	Rim		42.60	0.01	0.07	11.30	0.18	47.97	0.31	0.33	102.76	88.33
12-OI2	Core	0.3	41.83	0.02	0.05	11.69	0.19	47.81	0.34	0.31	102.24	87.94
	Rim		42.28	0.01	0.07	11.83	0.19	47.94	0.36	0.32	103.00	87.84
12-OI3	Core	1.3	42.33	0.03	0.10	10.52	0.17	48.15	0.31	0.36	101.96	89.08
	Rim		42.01	0.00	0.04	11.30	0.18	47.30	0.31	0.33	101.48	88.18

12-OI4	Core	0.6	42.14		0.10	10.69	0.17	48.42	0.33	0.34	102.19	88.98	
	Rim		41.86		0.07	11.07	0.18	48.21	0.33	0.32	102.04	88.59	
13-OI1	Core	1.2	42.33		0.08	10.23	0.15	48.78	0.30	0.39	102.27	89.47	
	Rim		42.08	0.02	0.10	11.43	0.19	47.74	0.35	0.36	102.26	88.16	
15-OI1	Core	3.2	41.95	0.01	0.08	11.91	0.20	47.29	0.33	0.31	102.06	87.62	
	Rim		41.88		0.07	11.89	0.19	47.66	0.33	0.32	102.35	87.72	
17-OI1	Core	2.3	42.13	0.01	0.04	12.42	0.20	47.06	0.34	0.32	102.51	87.10	
	Rim		42.15	0.00	0.07	12.12	0.19	47.24	0.35	0.32	102.44	87.42	
17-OI2	Core	0.9	41.88	0.00	0.07	12.52	0.20	47.21	0.33	0.33	102.54	87.05	
	Rim		41.74	0.01	0.08	12.12	0.19	47.48	0.33	0.32	102.25	87.48	
19-OI1	Core	0.3	42.40	0.02	0.11	10.99	0.18	46.69	0.81	0.32	101.53	88.33	
	Rim		42.35	0.00	0.07	11.80	0.19	47.82	0.34	0.33	102.90	87.84	
19-OI2	Core	0.5	41.80		0.05	10.95	0.19	47.79	0.33	0.36	101.46	88.61	
	Rim		42.24		0.09	11.80	0.19	47.00	0.33	0.33	101.97	87.65	
19-OI3	Core	1.4	42.05		0.09	10.08	0.16	48.59	0.31	0.38	101.66	89.57	
	Rim		42.09	0.00	0.11	11.38	0.18	47.81	0.32	0.35	102.25	88.22	
19-OI4	Core	1.6	42.77	0.01	0.10	9.65	0.16	49.78	0.31	0.38	103.16	90.19	
	Rim		42.12		0.08	11.05	0.18	47.97	0.33	0.35	102.07	88.56	
19-OI5	Core	0.2	42.14	0.02	0.07	11.69	0.20	47.43	0.34	0.32	102.22	87.85	
	Rim		42.26	0.02	0.11	11.61	0.19	47.29	0.35	0.31	102.13	87.90	
20-OI1	Core	0.8	42.49	0.01	0.09	10.27	0.16	48.90	0.32	0.36	102.59	89.46	
	Rim		41.98		0.08	10.71	0.18	47.92	0.32	0.37	101.54	88.86	
20-OI2	Core	0.7	42.11	0.02	0.12	9.79	0.16	49.36	0.32	0.37	102.24	89.99	
	Rim		42.07	0.02	0.10	11.13	0.17	47.78	0.33	0.35	101.93	88.45	
20-OI3	Core	0.3	41.79	0.03	0.09	11.36	0.19	47.69	0.33	0.35	101.82	88.21	
	Rim		41.98	0.01	0.09	11.64	0.19	47.42	0.34	0.34	102.02	87.90	
20-OI4	Core	0.6	42.14	0.01	0.08	9.71	0.16	49.39	0.33	0.40	102.21	90.07	
	Rim		42.45	0.02	0.11	11.41	0.18	47.74	0.32	0.36	102.59	88.17	
20-OI5	Core	0.6	42.07	0.01	0.06	9.08	0.15	49.64	0.31	0.41	101.72	90.69	
	Rim		42.31	0.01	0.08	10.92	0.18	48.41	0.34	0.38	102.61	88.77	
Sample	Grain No.	Size (mm)	SiO ₂	TiO ₂	Al ₂ O ₃	FeO*	MnO	MgO	CaO	NiO	Total	Fo	
SHIR-R05	1-OI1	Core	1.9	42.16	0.01	0.09	10.45	0.16	48.61	0.31	0.36	102.15	89.24
	Rim		41.72	0.01	0.07	11.05	0.18	48.36	0.35	0.33	102.07	88.64	
2-OI1	Core	1.1	41.98	0.02	0.08	10.30	0.17	48.81	0.32	0.36	102.04	89.41	
	Rim		42.02	0.01	0.07	11.02	0.17	48.36	0.35	0.34	102.34	88.67	

3-OI1	Core	1.8	41.89	0.01	0.05	11.02	0.18	48.29	0.31	0.36	102.10	88.65		
	Rim		41.38		0.05	10.88	0.18	48.24	0.35	0.36	101.43	88.77		
3-OI2	Core	0.1	41.66	0.02	0.05	11.94	0.20	47.49	0.36	0.30	102.02	87.64		
3-OI3	Core	0.1	41.97	0.00	0.06	9.63	0.15	49.36	0.34	0.36	101.89	90.13		
3-OI4	Core	0.1	41.72	0.00	0.10	11.04	0.18	47.84	0.34	0.33	101.55	88.53		
	Rim		41.71	0.00	0.08	11.42	0.18	47.73	0.34	0.34	101.80	88.16		
3-OI5	Core	0.2	41.82	0.00	0.05	11.15	0.18	47.88	0.36	0.32	101.76	88.44		
	Rim		41.86	0.02	0.10	11.63	0.18	47.70	0.39	0.32	102.20	87.97		
3-OI6	Core	0.2	41.69	0.00	0.05	11.18	0.18	48.33	0.33	0.35	102.11	88.51		
	Rim		41.78	0.01	0.05	11.07	0.17	48.58	0.35	0.35	102.35	88.67		
3-OI7	Core	0.2	41.77	0.02	0.10	11.51	0.19	48.01	0.34	0.33	102.27	88.15		
	Rim		41.62	0.01	0.10	11.10	0.18	48.13	0.35	0.34	101.82	88.54		
5-OI1	Core	1.5	42.02	0.02	0.06	10.25	0.17	49.16	0.33	0.36	102.36	89.53		
	Rim		41.53	0.01	0.07	10.53	0.17	48.01	0.33	0.35	101.01	89.04		
7-OI1	Core	0.4	41.96	0.01	0.05	10.80	0.17	48.60	0.34	0.31	102.23	88.92		
7-OI2	Core	0.7	41.78	0.00	0.10	10.18	0.16	48.37	0.30	0.38	101.27	89.44		
	Rim		41.62	0.00	0.12	10.55	0.16	47.49	0.31	0.33	100.58	88.92		
7-OI3	Core	0.4	42.01	0.02	0.08	8.49	0.15	50.09	0.31	0.39	101.53	91.32		
	Rim		42.03		0.06	9.28	0.16	49.82	0.33	0.38	102.06	90.54		
7-OI4	Core	0.3	42.44	0.01	0.06	8.62	0.14	50.31	0.30	0.39	102.27	91.23		
	Rim		41.65		0.08	10.64	0.16	48.87	0.32	0.38	102.09	89.11		
7-OI5	Core	0.5	42.02	0.02	0.06	10.62	0.17	48.22	0.33	0.33	101.77	89.01		
	Rim		41.65	0.00	0.07	10.98	0.18	47.90	0.34	0.33	101.44	88.61		
8-OI1	Core	3.5	42.44	0.01	0.07	7.85	0.13	51.08	0.32	0.41	102.31	92.06		
	Rim		42.05	0.01	0.09	9.58	0.15	49.41	0.30	0.37	101.97	90.19		
9-OI4	Core	1.0	41.89	0.01	0.07	9.91	0.16	49.07	0.33	0.36	101.80	89.82		
	Rim		41.67	0.02	0.06	10.28	0.16	48.77	0.33	0.35	101.64	89.42		
9-OI5	Core	0.5	41.87	0.00	0.07	9.84	0.16	48.48	0.34	0.36	101.13	89.78		
	Rim		42.05	0.02	0.08	10.90	0.17	48.37	0.34	0.34	102.27	88.78		
11-OI1	Core	0.6	42.33	0.01	0.10	8.68	0.14	49.91	0.32	0.39	101.87	91.11		
	Rim		42.51		0.08	9.22	0.14	49.66	0.34	0.37	102.33	90.56		
12-OI1	Core	0.4	42.15	0.02	0.07	8.86	0.14	50.07	0.31	0.33	101.95	90.97		
	Rim		41.73	0.02	0.09	9.66	0.16	48.92	0.32	0.34	101.22	90.03		
12-OI2	Core	0.2	41.77	0.01	0.05	10.15	0.16	48.69	0.33	0.36	101.52	89.53		
	Rim		41.76	0.02	0.09	10.62	0.17	48.57	0.33	0.36	101.91	89.07		
12-OI3	Core	0.4	41.98	0.01	0.08	10.51	0.17	48.40	0.32	0.36	101.83	89.14		

	Rim		41.74	0.02	0.06	10.73	0.17	48.27	0.34	0.34	101.67	88.91
12-OI4	Core	0.5	41.94	0.02	0.09	8.94	0.14	49.44	0.32	0.38	101.27	90.79
13-OI1	Core	1.8	41.76	0.00	0.09	11.32	0.18	47.78	0.33	0.34	101.80	88.27
	Rim		41.67	0.02	0.07	11.19	0.18	47.87	0.34	0.33	101.66	88.41
14-OI1	Core	0.6	41.71	0.02	0.06	9.09	0.14	49.72	0.31	0.38	101.44	90.70
	Rim		41.78	0.01	0.09	10.99	0.18	48.23	0.31	0.34	101.93	88.67
14-OI2	Core	0.4	41.77	0.02	0.05	10.71	0.17	47.96	0.32	0.36	101.36	88.87
	Rim		41.72	0.01	0.07	10.79	0.18	48.32	0.34	0.35	101.77	88.86
14-OI3	Core	0.7	42.14	0.02	0.07	8.42	0.14	49.53	0.30	0.39	100.99	91.30
	Rim		41.64	0.02	0.10	10.96	0.18	48.25	0.32	0.34	101.80	88.70
14-OI4	Core	0.4	42.44	0.02	0.06	9.19	0.15	49.49	0.30	0.39	102.02	90.57
	Rim		41.75	0.01	0.05	10.55	0.16	48.62	0.32	0.35	101.81	89.15
14-OI5	Core	0.8	42.14	0.02	0.09	8.90	0.15	49.61	0.30	0.39	101.60	90.85
	Rim		41.88	0.02	0.06	11.17	0.18	47.69	0.33	0.34	101.67	88.38
15-OI1	Core	1.5	42.07	0.00	0.07	10.50	0.17	49.02	0.33	0.35	102.50	89.27
	Rim		41.98	0.02	0.06	10.52	0.17	48.52	0.33	0.36	101.95	89.16
16-OI1	Core	1.5	41.99	0.01	0.07	10.13	0.17	49.02	0.31	0.35	102.05	89.62
	Rim		41.99	0.01	0.08	11.25	0.18	48.21	0.34	0.34	102.39	88.43
17-OI1	Core	2.0	41.78	0.00	0.06	10.36	0.16	48.58	0.32	0.34	101.59	89.31
	Rim		42.01	0.00	0.09	10.72	0.17	48.44	0.32	0.34	102.09	88.96
18-OI1	Core	1.8	41.58	0.00	0.04	11.09	0.18	48.27	0.31	0.36	101.83	88.58
	Rim		41.74	0.01	0.04	11.59	0.18	47.77	0.34	0.33	101.99	88.02
19-OI1	Core	2.0	41.71	0.01	0.06	10.24	0.17	48.48	0.32	0.35	101.34	89.41
	Rim		41.92		0.07	10.95	0.18	48.11	0.35	0.33	101.90	88.68
20-OI1	Core	2.0	42.45	0.01	0.09	7.45	0.13	50.61	0.29	0.40	101.42	92.37
	Rim		42.17	0.00	0.11	10.94	0.18	48.29	0.34	0.34	102.36	88.73
21-OI1	Core	1.6	41.82	0.01	0.10	10.37	0.17	48.92	0.32	0.34	102.05	89.37
	Rim		41.95		0.08	11.29	0.18	48.10	0.34	0.33	102.27	88.36
22-OI1	Core	1.2	41.74	0.03	0.07	10.96	0.17	48.42	0.38	0.36	102.12	88.74
	Rim		41.25	0.01	0.03	10.60	0.17	47.83	0.39	0.37	100.65	88.94
23-OI1	Core	2.0	42.09	0.00	0.05	10.22	0.16	48.76	0.33	0.34	101.94	89.48
	Rim		42.29	0.03	0.11	10.45	0.16	48.69	0.35	0.33	102.40	89.25

*: Total iron as FeO.

TABLE DR2 Compositions of the chromian spinel in the Sorachi-Yezo picrites

Sample	Occurrence	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO*	MnO	MgO	Total	FeO	Fe ₂ O ₃	Cr# [†]	Mg# ^{††}	Fe ³⁺ # ^{†††}	Coexisting OI (Fo)	fO ₂ (Δ QFM) [‡]	Equilibrium T (°C) [‡]	
INO-R02	Microphenocryst	0.44	22.95	40.10	17.72	0.21	16.68	98.10	9.89	8.70	0.54	0.75	0.10				
	Microphenocryst	0.61	15.76	46.92	20.92	0.27	14.05	98.52	13.01	8.78	0.67	0.66	0.11				
	Olivine Inclusion	0.75	21.33	32.24	29.25	0.34	13.56	97.46	14.48	16.42	0.50	0.63	0.20	3-OI1	86.84	2.2	
	Microphenocryst	0.36	20.67	43.79	16.48	0.21	17.18	98.69	8.87	8.46	0.59	0.78	0.10			1162	
	Olivine Inclusion	0.36	18.31	45.57	18.31	0.24	15.35	98.15	11.09	8.03	0.63	0.71	0.09	5-OI5	90.06	1.2	
	Olivine Inclusion	0.32	18.62	43.90	20.85	0.29	14.06	98.03	13.01	8.71	0.61	0.66	0.10			1215	
	Olivine Inclusion	0.45	20.03	42.74	19.89	0.24	15.53	98.88	11.43	9.40	0.59	0.71	0.11	7-OI1	90.57	1.3	
	Olivine Inclusion	0.26	21.84	43.63	16.03	0.22	16.42	98.39	10.00	6.70	0.57	0.75	0.08	8-OI1	93.11	1.6	
	Olivine Inclusion	0.69	22.95	35.28	25.68	0.24	14.15	99.00	14.31	12.64	0.51	0.64	0.15	9-OI1	87.75	1.7	
	Olivine Inclusion	0.50	17.77	43.85	21.37	0.26	14.48	98.22	12.51	9.85	0.62	0.67	0.12	11-OI1	88.66	1.9	
	Olivine Inclusion	0.35	18.83	44.09	20.76	0.27	14.96	99.26	12.13	9.59	0.61	0.69	0.11	12-OI1	89.05	1.4	
	Olivine Inclusion	0.41	19.76	42.68	20.90	0.24	14.97	98.96	12.24	9.62	0.59	0.69	0.11	14-OI1	88.86	1.4	
	Olivine Inclusion	0.33	21.15	44.00	15.34	0.19	17.21	98.22	8.73	7.35	0.58	0.78	0.08	15-OI1	92.17	1.4	
INO-R03	Sample	Occurrence	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO*	MnO	MgO	Total	FeO	Fe ₂ O ₃	Cr# [†]	Mg# ^{††}	Fe ³⁺ # ^{†††}	Coexisting OI (Fo)	fO ₂ (Δ QFM) [‡]	Equilibrium T (°C) [‡]
	Olivine Inclusion	0.32	14.47	19.42	52.09	0.49	9.72	96.51	18.79	37.01	0.47	0.48	0.46	1-OI1	87.06	3.9	
	Olivine Inclusion	0.70	21.10	36.73	26.04	0.24	13.96	98.75	14.25	13.10	0.54	0.64	0.15	1-OI2	87.10	1.8	
	Olivine Inclusion	0.44	18.54	44.71	20.21	0.25	14.94	99.09	12.14	8.97	0.62	0.69	0.11	2-OI3	90.11	1.5	
	Olivine Inclusion	0.45	21.70	41.56	19.28	0.22	15.94	99.16	11.17	9.02	0.56	0.72	0.10	3-OI1	90.03	1.4	
	Olivine Inclusion	0.36	17.03	43.04	23.72	0.28	13.82	98.26	13.29	11.59	0.63	0.65	0.14	4-OI1	87.18	1.5	
	Olivine Inclusion	0.41	16.02	43.60	24.79	0.29	13.57	98.67	13.70	12.33	0.65	0.64	0.15	4-OI2	87.87	1.7	
	Microphenocryst	0.49	21.25	41.18	18.92	0.21	15.24	97.29	11.60	8.14	0.57	0.70	0.10				
	Microphenocryst	0.45	16.39	43.12	23.90	0.29	13.62	97.75	13.41	11.65	0.64	0.64	0.14				
	Microphenocryst	0.51	16.56	43.51	23.71	0.29	13.69	98.26	13.54	11.29	0.64	0.64	0.14				
	Microphenocryst	0.34	16.74	44.71	24.13	0.27	13.15	99.34	14.59	10.60	0.64	0.62	0.13				
	Microphenocryst	0.35	17.75	44.55	23.13	0.30	13.12	99.20	14.71	9.36	0.63	0.61	0.11				
	Olivine Inclusion	0.54	23.61	33.78	25.20	0.23	14.72	98.08	13.14	13.41	0.49	0.67	0.16	6-OI1	86.88	1.7	
	Olivine Inclusion	0.37	20.32	45.64	15.27	0.24	17.43	99.26	8.58	7.43	0.60	0.78	0.09	7-OI1	92.72	1.5	
SHIR-R01	Olivine Inclusion	0.30	20.40	45.97	14.02	0.20	17.93	98.82	7.65	7.07	0.60	0.81	0.08	9-OI1	93.18	1.5	
	Olivine Inclusion	0.37	19.13	46.05	17.41	0.24	15.61	98.79	11.03	7.08	0.62	0.72	0.08	10-OI1	92.56	1.7	
	Olivine Inclusion	0.49	23.77	36.50	21.21	0.22	15.80	97.98	11.40	10.90	0.51	0.71	0.13	11-OI1	89.13	1.7	
	Olivine Inclusion	0.41	18.48	32.42	34.66	0.46	11.35	97.78	17.14	19.48	0.54	0.54	0.24	12-OI1	87.23	2.7	
	Olivine Inclusion	0.35	19.18	45.43	16.51	0.21	16.74	98.41	9.22	8.11	0.61	0.76	0.09	13-OI2	92.44	1.7	
	Olivine Inclusion	0.34	21.70	39.32	19.46	0.21	16.12	97.16	10.18	10.32	0.55	0.74	0.12	13-OI5	90.26	1.7	
	Olivine Inclusion	0.60	22.92	36.82	24.03	0.25	14.34	98.96	13.89	11.28	0.52	0.65	0.13	14-OI1	87.24	1.5	
	Sample	Occurrence	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO*	MnO	MgO	Total	FeO	Fe ₂ O ₃	Cr# [†]	Mg# ^{††}	Fe ³⁺ # ^{†††}	Coexisting OI (Fo)	fO ₂ (Δ QFM) [‡]	Equilibrium T (°C) [‡]
	Olivine Inclusion	0.37	20.88	39.50	22.67	0.28	14.18	97.88	13.23	10.49	0.56	0.66	0.12	1-OI1	91.23	2.2	
	Microphenocryst	0.38	19.46	41.74	23.67	0.24	12.63	98.11	15.47	9.11	0.59	0.59	0.11			949	
	Olivine Inclusion	0.42	18.23	41.45	24.70	0.28	13.25	98.33	14.43	11.42	0.60	0.62	0.14	5-OI2	88.99	1.9	
	Olivine Inclusion	0.38	20.95	37.74	24.01	0.25	14.36	97.68	12.96	12.27	0.55	0.66	0.14	5-OI4	90.12	2.2	
	Olivine Inclusion	0.38	19.65	42.34	18.11	0.32	15.27	96.08	10.70	8.24	0.59	0.72	0.10	7-OI3	90.77	1.5	
	Olivine Inclusion	0.38	21.66	40.18	19.46	0.23	15.64	97.54	11.05	9.35	0.55	0.72	0.11	7-OI5	90.26	1.6	
	Olivine Inclusion	0.61	22.30	34.48	27.17	0.22	14.05	98.82	14.28	14.33	0.51	0.64	0.17	8-OI1	86.45	1.8	
	Olivine Inclusion	0.34	20.16	44.06	18.65	0.26	15.57	99.04	11.30	8.17	0.59	0.71	0.09	9-OI1	91.30	1.6	
	Microphenocryst	0.29	17.95	44.89	22.16	0.30	13.24	98.83	14.38	8.64	0.63	0.62	0.10			1164	
	Microphenocryst	0.29	17.83	46.06	21.18	0.27	13.39	99.01	14.21	7.74	0.63	0.63	0.09			1187	
	Microphenocryst	0.32	17.02	44.49	23.36	0.29	12.84	98.31	14.72	9.60	0.64	0.61	0.12			1085	
	Microphenocryst	0.32	17.08	44.86	22.73	0.26	12.94	98.20	14.56	9.07	0.64	0.61	0.11				
	Microphenocryst	0.32	17.25	44.49	23.84	0.31	12.85	99.06	14.97	9.86	0.63	0.60	0.12				
	Olivine Inclusion	0.43	18.39	40.99	22.76	0.29	14.66	97.53	12.03	11.92	0.60	0.68	0.14	12-OI3	89.08	1.8	
	Olivine Inclusion	0.56	20.86	37.00	26.51	0.28	12.96	98.18	15.37	12.38	0.54	0.60	0.15	12-OI4	88.98	2.2	
	Microphenocryst	0.33	22.34	40.23	21.27	0.26	14.16	98.58	13.66	8.45	0.55	0.65	0.10			966	
	Olivine Inclusion	0.56	22.98	33.80	26.41	0.27	13.93	97.95	14.19	13.59	0.50	0.64	0.16	15-OI1	87.62	2.0	
	Sample	Occurrence	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO*	MnO	MgO	Total	FeO	Fe ₂ O ₃	Cr# [†]	Mg# ^{††}	Fe ³⁺ # ^{†††}	Coexisting OI (Fo)	fO ₂ (Δ QFM) [‡]	Equilibrium T (°C) [‡]

Sample	Occurrence	TiO ₂	Al ₂ O ₃	Cr ₂ O ₃	FeO*	MnO	MgO	Total	FeO	Fe ₂ O ₃	Cr# [†]	Mg# ^{††}	Fe ³⁺ # ^{†††}	Coexisting Olivine	FoFo ₂ (ΔQFM) [‡]	Equilibrium T (°C) [‡]	
SHIR-R05	Olivine Inclusion	0.34	18.03	40.12	25.55	0.29	14.16	98.50	13.02	13.93	0.60	0.66	0.17	1-OI1	89.24	2.2	1148
	Olivine Inclusion	0.40	19.69	42.61	20.95	0.26	15.26	99.17	11.83	10.14	0.59	0.70	0.12	2-OI1	89.41	1.5	1206
	Olivine Inclusion	0.40	20.29	41.29	21.97	0.27	14.89	99.11	12.47	10.56	0.58	0.68	0.12	3-OI1	88.65	1.5	1195
	Microphenocryst	0.41	19.45	43.70	18.13	0.22	15.77	97.68	10.56	8.41	0.60	0.73	0.10				1208
	Microphenocryst	0.47	23.19	36.25	22.40	0.25	15.13	97.68	12.20	11.33	0.51	0.69	0.13				
	Olivine Inclusion	0.65	24.23	36.54	20.76	0.23	16.11	98.53	11.30	10.51	0.50	0.72	0.12	5-OI1	89.53	1.7	1201
	Olivine Inclusion	0.60	28.89	34.48	16.38	0.18	18.97	99.51	7.95	9.36	0.44	0.81	0.10	8-OI1	92.06	1.7	1306
	Microphenocryst	0.39	20.46	41.97	20.02	0.24	15.48	98.55	11.42	9.56	0.58	0.71	0.11				
	Microphenocryst	0.36	21.04	41.09	20.53	0.26	14.92	98.20	12.19	9.27	0.57	0.69	0.11				
	Olivine Inclusion	0.43	22.85	37.68	20.87	0.26	16.01	98.10	10.87	11.11	0.53	0.72	0.13	9-OI5	89.78	1.8	1227
	Microphenocryst	0.59	23.00	39.64	18.74	0.21	16.40	98.57	10.62	9.02	0.54	0.73	0.10				
	Olivine Inclusion	0.39	21.37	41.49	19.75	0.24	15.38	98.62	11.73	8.92	0.57	0.70	0.10	11-OI1	91.11	1.7	1054
	Microphenocryst	0.50	24.17	32.80	26.56	0.22	14.24	98.48	14.08	13.88	0.48	0.64	0.16				
	Microphenocryst	0.44	20.97	39.23	23.23	0.30	14.21	98.38	13.39	10.93	0.56	0.65	0.13				
	Microphenocryst	0.51	24.40	36.26	21.10	0.23	15.93	98.42	11.44	10.74	0.50	0.71	0.12				
	Olivine Inclusion	0.57	23.79	34.82	24.44	0.23	15.08	98.93	12.90	12.83	0.50	0.68	0.15	13-OI1	88.27	1.9	1163
	Olivine Inclusion	0.50	20.35	43.05	18.41	0.24	16.08	98.63	10.60	8.68	0.59	0.73	0.10	14-OI5	90.85	1.5	1192
	Microphenocryst	0.43	27.14	33.86	20.70	0.23	16.69	99.06	10.86	10.94	0.46	0.73	0.12				
	Olivine Inclusion	0.43	23.80	36.43	21.56	0.25	15.75	98.21	11.49	11.20	0.51	0.71	0.13	15-OI1	89.27	1.7	1195
	Olivine Inclusion	0.36	22.85	39.41	21.12	0.22	15.80	99.76	11.70	10.47	0.54	0.71	0.12	16-OI1	89.62	1.6	1172
	Olivine Inclusion	0.45	23.75	36.91	21.18	0.22	15.93	98.43	11.31	10.96	0.51	0.72	0.13	17-OI1	89.31	1.7	1213
	Olivine Inclusion	0.61	21.30	36.44	24.90	0.28	14.70	98.22	12.86	13.38	0.53	0.67	0.16	18-OI1	88.58	2.0	1173
	Olivine Inclusion	0.38	24.49	36.49	20.61	0.25	15.93	98.15	11.24	10.42	0.50	0.72	0.12	19-OI1	89.41	1.6	1190
	Olivine Inclusion	0.30	18.38	43.31	21.18	0.27	14.00	97.44	12.88	9.22	0.61	0.66	0.11	20-OI1	92.37	2.3	912
	Olivine Inclusion	0.44	24.45	36.02	21.38	0.25	16.03	98.58	11.27	11.23	0.50	0.72	0.13	21-OI1	89.37	1.7	1206
	Olivine Inclusion	0.74	25.68	35.18	20.79	0.25	16.39	99.02	11.31	10.54	0.48	0.72	0.12	22-OI1	88.74	1.5	1255
	Olivine Inclusion	0.42	23.56	36.53	21.29	0.24	15.87	97.90	11.15	11.27	0.51	0.72	0.13	23-OI1	89.48	1.8	1212
	Microphenocryst	0.44	23.42	41.24	17.65	0.23	16.23	99.21	10.97	7.42	0.54	0.72	0.08				

*: Total iron as FeO.

[†]: Cr/(Cr+Al) (atomic ratio)

^{††}: Mg/(Mg+Fe²⁺) (atomic ratio)

^{†††}: Fe³⁺/(Fe³⁺+Cr+Al) (atomic ratio)

[‡]: Calculated by the equation of Ballhaus et al. (1991)

Table DR3 Whole rock chemistry and modal composition of the Sorachi-Yezo picrites.

Sample	Sorachi picrite			Kamuikotan picrite				
	SHIR-R01	SHIR-R05	SHIR-R06	INO-R01	INO-R02	INO-R03	INO-R05	INO-R06
Major element (wt.%) by XRF								
SiO ₂	40.57	40.38	41.05	39.66	40.12	40.02	40.23	40.10
TiO ₂	0.43	0.44	0.54	0.43	0.47	0.44	0.48	0.48
Al ₂ O ₃	5.92	5.92	6.72	5.24	5.89	5.61	6.07	5.95
Fe ₂ O ₃ *	11.33	11.25	11.75	11.57	11.65	11.71	11.52	11.71
MnO	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.16
MgO	28.77	28.54	26.77	29.86	28.41	29.04	27.64	28.08
CaO	5.57	6.19	6.30	5.03	5.75	5.81	6.23	5.50
Na ₂ O	0.27	0.29	0.40	0.04	0.24	0.17	0.17	0.03
K ₂ O	0.13	0.35	0.21	0.04	0.35	0.03	0.19	0.11
P ₂ O ₅	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05
Total	93.20	93.57	93.95	92.06	93.08	93.03	92.74	92.18
Trace element (ppm) by XRF								
V	203	185	-	-	191	183	-	-
Cr	4473	3122	-	-	2622	3259	-	-
Ni	1442	1603	1347	1589	1567	1590	1537	1499
Cu	81.8	72.1	95.0	77.9	92.5	83.2	86.4	87.6
Zn	59.6	69.4	61.8	57.8	72.1	72.8	72.4	65.9
Pb	nd	nd	nd	nd	nd	nd	nd	nd
Th	nd	nd	nd	nd	nd	0.6	nd	nd
Rb	6.8	9.6	9.4	8.5	14.2	5.2	13.4	6.6
Sr	20.4	28.3	63.3	47.6	36.0	26.5	62.5	45.8
Y	7.4	7.5	8.6	7.3	7.0	7.7	8.6	8.4
Zr	17.2	18.6	21.7	17.8	18.4	17.6	19.2	19.6
Nb	0.6	nd	0.6	0.7	0.6	0.5	0.5	0.5
Trace element (ppm) by ICP-MS								
Sc	20.6	20.2	22.0	18.5	20.4	19.5	21.0	20.4
Co	95.6	95.6	91.9	104.5	102.6	101.9	96.6	97.6
Cu	71.9	73.4	83.6	70.3	79.4	75.2	81.6	76.4
Rb	4.88	8.32	7.97	6.88	12.40	3.72	11.50	5.30
Sr	21.4	28.6	64.6	45.9	36.8	27.7	62.8	45.0
Y	7.27	7.24	8.39	6.98	7.68	7.16	7.94	7.74
Zr	16.5	17.9	21.5	16.9	18.4	16.6	19.1	18.7
Nb	0.472	0.403	0.502	0.525	0.562	0.498	0.567	0.558
Cs	0.86	1.16	2.42	0.66	0.84	0.31	1.03	1.54
Ba	3.12	4.41	21.40	3.05	12.20	7.61	10.80	7.06
La	0.52	0.51	0.55	0.57	0.62	0.56	0.64	0.61
Ce	1.50	1.67	1.79	1.73	1.87	1.68	1.93	1.89
Pr	0.27	0.31	0.34	0.31	0.33	0.30	0.35	0.34
Nd	1.70	1.92	2.18	1.82	2.00	1.80	2.05	2.05
Sm	0.75	0.79	0.96	0.74	0.81	0.73	0.83	0.83
Eu	0.31	0.33	0.40	0.30	0.33	0.30	0.34	0.33
Gd	1.18	1.19	1.44	1.08	1.20	1.10	1.25	1.22
Tb	0.22	0.22	0.26	0.20	0.22	0.20	0.23	0.23
Dy	1.43	1.44	1.70	1.33	1.47	1.37	1.54	1.50
Ho	0.30	0.31	0.35	0.29	0.31	0.29	0.33	0.32
Er	0.89	0.88	1.01	0.83	0.92	0.86	0.97	0.94
Tm	0.12	0.12	0.14	0.12	0.13	0.12	0.14	0.13
Yb	0.81	0.81	0.90	0.77	0.86	0.81	0.90	0.88
Lu	0.12	0.12	0.13	0.12	0.13	0.12	0.14	0.13
Hf	0.546	0.583	0.700	0.537	0.595	0.536	0.612	0.604

Ta	0.032	0.029	0.035	0.035	0.038	0.034	0.039	0.038
TI	0.004	0.019	0.007	0.003	0.016	0.007	0.012	0.006
Pb	0.056	0.079	0.076	0.066	0.123	0.109	0.157	0.205
Th	0.041	0.035	0.041	0.040	0.044	0.038	0.045	0.044
U	0.011	0.013	0.012	0.012	0.013	0.014	0.025	0.013
Modal composition (vol.%)								
Olivine [†]	44.8 (8.8)	58.5 (25.7)	-	58.3 (4.0)	52.0 (4.3)	54.4 (8.8)	44.4 (0.0)	45.9 (0.0)
Spinel	0.7	0.6	-	0.5	0.6	0.9	0.4	0.4
Groundmass	54.5	40.9	-	41.2	47.4	44.7	55.2	45.9

*: Total iron as Fe₂O₃.

[†]: Original value including altered minerals. The values in parenthesis are relic olivine modal compositions.

nd: Not detected.
