

## Oxygen Isotopic Data and Description of Rocks of the Yanai District in the Ryoke Belt, Japan

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Table 1 Oxygen Isotopic Data and Description of Rocks of the Yanai District in the Ryoke Belt, Japan

Description of samples		$\delta^{18}\text{O}$ (‰)		
<i>Pelitic metamorphic rocks from marginal zone</i>				
YN 16	Low-grade, garnet-mica hornfels, thin pelitic layers finely alternating with psammitic layers.	Quartz	$18.2 \pm 0.1$	(2)
		Biotite	11.1	(1)
		Whole-rock	$15.9 \pm 0.0$	(2)
YN 35	Fine-grained two-mica hornfels, derived from argillaceous sediment.	Quartz	18.1	(1)
		Whole-rock	$15.8 \pm 0.1$	(2)
YN 36	Andalusite-spotted schistose hornfels, intercalated in siliceous banded hornfels.	Quartz	$19.7 \pm 0.0$	(2)
YN 38	Pelitic gneiss with ptigmatic K-feldspar-plagioclase-quartz veins. Cordierite-muscovite- K-feldspar-plagioclase-quartz.	Quartz	$16.4 \pm 0.1$	(2)
		Muscovite	14.0	(1)
		Biotite	$11.5 \pm 0.0$	(2)
YN 28	Coarse-grained pelitic gneiss with ptigmatic K-feldspar veins. Sillimanite-cordierite-K-feldspar-quartz.	Quartz	$15.7 \pm 0.1$	(1)
		K-feldspar	$14.5 \pm 0.0$	(2)
		Muscovite	13.8	(1)
		Biotite	$11.5 \pm 0.0$	(2)
<i>Siliceous metamorphic rocks and associated pelitic and layered granitic rocks (OKI granite)</i>				
YN 34	Low-grade, siliceous, garnet-mica hornfels, derived from banded chert.	Quartz	23.9	(1)
		Whole-rock	22.4	(1)
YN 1-1	Coarse-grained, siliceous banded gneiss, derived from banded chert.	Quartz	18.0	(1)
		Muscovite	$15.2 \pm 0.2$	(2)
		Biotite	12.5	(1)
YN 1-2	Migmatitic, two-mica leucogranite in lens in YN1-1.	Quartz	$16.8 \pm 0.1$	(2)
YN 1-3	Muscovite pegmatite in vein and in lens less than 7 cm in thickness in YN1-1.	Quartz	$17.0 \pm 0.1$	(2)
YN 2-1	Coarse-grained, siliceous banded gneiss, derived from banded chert, much the same as YN 1-1.	Quartz	$17.6 \pm 0.1$	(2)
		Muscovite	14.7	(1)
YN 2-2	Migmatitic, garnet-bearing, two-mica leucogranite intercalated in YN 2-1 with loose boundary.	Quartz	17.4	(1)
		Garnet	12.7	(1)
YN 2-3	Garnet-bearing, two-mica pegmatite in lens in YN 2-1.	Quartz	$18.0 \pm 0.0$	(2)
		Garnet	12.8	(1)
OS 2-4	Rather massive, siliceous banded gneiss derived from banded chert. A large xenolith-like body surrounded by migmatitic biotite granite (OS 2-5).	Quartz	$17.7 \pm 0.1$	(2)
		Muscovite	14.7	(1)
		Biotite	$11.4 \pm 0.0$	(2)

OS 2-1	Partly migmatitic pelitic gneiss in thin layer intercalated in siliceous gneiss (OS 2-4). Sillimanite-cordierite-muscovite-K-feldspar-plagioclase-quartz. Garnet occurs in siliceous bands.	Quartz	18.1 ± 0.2	(2)
		K-feldspar	15.0 ± 0.0	(2)
		Muscovite	15.5	(1)
		Garnet	15.2	(1)
		Biotite	11.8 ± 0.2	(2)
OS 2-2	Medium-grained, migmatitic, two-mica granite, in thin melanocratic band rich in quartz and biotite, enclosed in OS 2-3.	Whole-rock	16.3 ± 0.1	(2)
		Quartz	16.8 ± 0.0	(2)
OS 2-3	Medium-grained, garnet-bearing, two-mica leucogranite, occurring in thin layer, 10 to 30 cm in thickness, in siliceous gneiss (OS 2-4).	Biotite	11.8	(1)
		Quartz	16.5 ± 0.0	(2)
OS 2-6	Very leucocratic band in leucogranite, (OS 2-2).	Biotite	10.8 ± 0.1	(2)
		Quartz	16.8 ± 0.0	(2)
		Muscovite	14.2	(1)
		Garnet	12.6 ± 0.1	(2)
OS 2-5	Foliated, fine-grained, migmatitic biotite granite in rather homogeneous mass. Some thin bands of remnants of siliceous gneiss are included. The main facies of the Okiura layered granite.	Biotite	9.8	(1)
		Quartz	13.2 ± 0.1	(2)
		K-feldspar	12.4	(1)
		Plagioclase	12.1 ± 0.2	(2)
OS 4	Much the same as OS 2-5.	Biotite	7.6 ± 0.0	(2)
		Quartz	13.1 ± 0.0	(2)
YN 7-3	Coarse-grained, siliceous banded gneiss derived from banded chert. Alternates with layered, migmatitic granite.	Biotite	7.0 ± 0.0	(2)
		Quartz	22.3	(1)
		Muscovite	19.9	(1)
YN 8-1	Coarse-grained, siliceous banded gneiss derived from banded chert. Composed mainly of quartz with less amounts of biotite, muscovite and K-feldspar. Alternates with layered migmatitic granite (YN 8-3).	Biotite	17.0 ± 0.1	(2)
		Quartz	15.3	(1)
		Muscovite	12.9	(1)
YN 8-3	Foliated, medium- and iso-grained, rather homogeneous migmatitic granite derived presumably from argillaceous sediments. Garnet-biotite-muscovite (-K-feldspar)-plagioclase-quartz.	Biotite	9.9 ± 0.1	(2)
		Quartz*	14.6	
		Plagioclase*	12.8	
		Muscovite	12.5	(1)
		Garnet	11.8	(1)
YN 14	Thin band of remnants of siliceous banded gneiss, enclosed in YN 12.	Biotite*	9.8	
		Quartz	12.7	(1)
YN 12	Foliated, fine-grained, migmatitic biotite granite. Many thin siliceous and biotite-rich bands are included.	Quartz	12.8	(1)
		Biotite	8.3 ± 0.0	(2)
YN 15	Weakly foliated, medium-grained, garnet-bearing leucogranite in rather homogeneous mass. Similar chemically to other members of OKI granite. Intrusive leucogranites of this type occur widely in the gneiss-granite complex.	Quartz	12.3 ± 0.0	(2)
		K-feldspar	11.3	(1)
		Plagioclase	10.6	(1)
		Garnet	9.4	(1)
		Biotite	7.2	(1)
<i>Amphibolites and associated granitic rocks (minor facies of O-G granodiorite)</i>				
OS 11	Medium-grained, granoblastic amphibolite in agmatitic mass. Hornblende-biotite-K-feldspar-plagioclase-quartz-magnetite-ilmenite.	Quartz	13.9 ± 0.0	(2)
		Plagioclase	11.2 ± 0.0	(2)
		Hornblende	10.6 ± 0.0	(2)
		Biotite	10.3 ± 0.0	(2)
OS 7-1	Medium-grained, granoblastic amphibolite in agmatitic mass, surrounded by porphyroblastic quartz-bearing biotite	Quartz	13.9	(1)
		Plagioclase	11.5	(1)

	granite (OS 7-2). Much the same as OS11, but K-feldspar is absent.	Hornblende	9.8	(1)
		Biotite	11.3	(1)
OS 7-2	Medium-grained, gneissose, migmatitic biotite granite with porphyroblastic large crystals of quartz.	K-feldspar	12.2	(1)
		Plagioclase	11.7	(1)
		Biotite	7.9	(1)
OS 8-2	Remnants of amphibolite in small patch scattered layerly in coarse-grained, migmatitic biotite granodiorite (OS 8-1). Occurring in a marginal part of an agmatitic mass.	Quartz	13.0	(1)
		Plagioclase	11.7	(1)
		Hornblende	10.8	(1)
		Biotite	8.9	(1)
OS 8-1	Foliated, coarse-grained, migmatitic biotite granodiorite. A leucosome associated with amphibolite paleosome (OS 8-2).	Quartz	13.9	(1)
		Plagioclase	12.0	(1)
		Biotite	9.4 ± 0.1	(2)
YN 3-1	Granoblastic amphibolite with poikilitic biotite in nebulitic block enclosed in migmatitic, biotite granodiorite (YN 3-2). The mineral assemblage is the same as OS11.	Quartz	14.5 ± 0.1	(2)
		Plagioclase	10.8	(1)
		Hornblende	10.7	(1)
		Biotite	8.8 ± 0.0	(2)
YN 3-2	Medium- and equi-granular, migmatitic biotite granodiorite with many blocks of basic remnants.	Quartz	14.4 ± 0.0	(2)
		K-feldspar	13.5	(1)
		Plagioclase	12.8	(1)
		Biotite	9.4 ± 0.1	(2)
YN 3-3	A granitic facies developed in the migmatitic, biotite granodiorite (YN 3-2), with large amounts of euhedral porphyroblasts (up to 1.5 × 5 cm) of K-feldspar.	Quartz*	14.4	
		K-feldspar*	12.5	
		Plagioclase*	12.0	
		Biotite*	7.7	
YN 10	Gneissose, fine grained, hornblende-biotite granodiorite characterized by an advanced lineation. The Gokenya granodiorite**.	Quartz	13.0 ± 0.1	(2)
		Plagioclase	11.5	(1)
		Biotite	7.9 ± 0.1	(2)
OS 1	Migmatitic, hornblende-biotite granodiorite with zoned phenoblasts of plagioclase. Enclosing many blocks of basic remnants.	Quartz	13.1 ± 0.0	(2)
		Hornblende	9.6	(1)
		Biotite	7.9 ± 0.1	(2)
<i>Coarse-grained layered granodiorites (main facies of O-G granodiorite)</i>				
YN 30	Foliated, coarse-grained, diopsidic pyroxene-bearing hornblende-biotite granodiorite. Including many basic xenolith-like blocks and nebulites with foliation parallel to that of the host granodiorite.	Quartz	13.4 ± 0.1	(2)
		K-feldspar	12.4	(1)
		Plagioclase	11.5	(1)
		Hornblende	10.7	(1)
		Biotite	8.3 ± 0.1	(2)
YN 9-1	Foliated, coarse-grained, diopsidic pyroxene-bearing hornblende-biotite granodiorite, in large mass. Enclose many basic patches (up to 4 × 10 cm).	Quartz	13.0 ± 0.0	(2)
		K-feldspar	11.7	(1)
		Plagioclase	10.9	(1)
		Hornblende	10.2	(1)
		Pyroxene	9.9	(1)
		Biotite	8.0 ± 0.0	(2)
YN 29	Foliated, coarse-grained, hornblende-biotite granodiorite in large homogeneous mass.	Quartz	12.4 ± 0.0	(1)
		K-feldspar	11.2	(1)
		Plagioclase	11.0	(1)
		Biotite	7.7	(1)
YN 4-2	Biotite-rich schlieren enclosed in coarse-grained biotite granodiorite (YN 4-1).	Quartz	12.4 ± 0.0	(1)
		K-feldspar	11.5	(1)
		Plagioclase	11.2	(1)

		Biotite	7.6	(1)
YN 4-1	Foliated, coarse-grained, biotite granodiorite in rather large homogeneous mass.	Quartz*	12.1	
		K-feldspar*	11.6	
		Plagioclase*	11.2	
		Biotite*	7.6	
<i>Discordant granites</i>				
YN 6-1	Gneissose, fine-grained, two-mica granite in rather homogeneous mass, intruded into the coarse-grained, biotite granodiorite (YN 4-1).	Quartz	13.2	(1)
		Muscovite	10.9	(1)
		Biotite	8.0	(1)
YN 5-2	Fine-grained, two-mica aplite in vein in fine-grained two-mica granite (YN 6-1).	Quartz	13.3 ± 0.0	(2)
YN 5-3	Garnet-bearing pegmatite in vein in YN 5-2.	Quartz	12.8 ± 0.3	(2)
OS 9-1	Pegmatite in dyke in two-mica granite.	Quartz	12.9 ± 0.0	(2)
YN 24	Biotite granite with large (up to 5 × 12 cm) euhedral phenocrysts of K-feldspar. Muscovite occurs replacing biotite in its margin. The Kibe granite**.	Quartz	13.1 ± 0.1	(2)
		K-feldspar	12.0 ± 0.0	(2)
		Muscovite	11.2	(1)
		Biotite	8.9 ± 0.0	(2)
YN 25	Much the same as YN24, the Kibe granite**.	Quartz	13.1 ± 0.2	(2)
		Biotite	8.9	(1)
YN 11	Massive, medium-grained, muscovite-bearing biotite granite. The Murotsu granite**.	Quartz	13.3 ± 0.1	(2)
		K-feldspar	12.1 ± 0.1	(2)
		Plagioclase	11.9	(1)
		Muscovite	10.7	(1)
		Biotite	7.9 ± 0.0	(2)
OS 15	Weakly foliated, coarse-grained biotite granite. The Towa granite**.	Quartz	12.4 ± 0.0	(2)
		Biotite	7.0	(1)
OS 6	Weakly foliated, coarse-grained hornblende-biotite granodiorite. The basic facies of the Towa granite.	Quartz*	11.6	
		K-feldspar*	11.1	
		Plagioclase	10.5	(1)
		Hornblende	9.3	(2)
		Biotite*	6.0	

Analytical error is the average deviation from the mean. Numbers in parentheses indicate number of separate analyses.

\*data from MATSUHISA *et al.* (1972), Oxygen isotopic study of the Cretaceous granitic rocks of Japan. *Contrib. Mineral. Petrol.*, 37, p. 65-74.

\*\*OKAMURA, Y. (1957), Structure of the Ryoke metamorphic and granodioritic rocks of the Yanai district, Yamaguchi Prefecture. *J. Geol. Soc. Japan*, 63, p. 684-697 (in Japanese).

Table 2 Modal compositions and estimated whole-rock  $\delta^{18}\text{O}$  values

	OS 2-4	OS 2-2	OS 2-3	OS 2-5	YN 8-1	YN 8-3	YN 15	OS 11	OS 7-1	OS 7-2	OS 8-2
quartz	88.5	73.4	67.0	28.9	79.8	32.6	33.6	8.4	3.3	37.3	6.3
K-feldspar	0.5	8.4	0.8	22.5	2.9	3.0	33.3			2.8	0.6
plagioclase	0.9	2.3	21.6	39.7	0.1	46.2	29.0	49.0	45.0	50.1	41.4
biotite	6.2	4.9	8.3	8.8	14.1	14.4	4.1	16.6	12.9	9.7	43.3
muscovite	1.6	9.6	1.5		3.1	2.8					
garnet		0.4	0.2			0.8					
hornblende								24.8	38.4		7.8
others	2.3	1.0	0.6	0.1		0.2		1.1	0.4	0.1	0.6
$\delta$ whole-rock	16.7	16.3	15.9	12.1	14.5	13.0	11.3	11.1	10.9	11.9	10.1
	OS 8-1	YN 3-1	YN 3-2	YN 3-3	YN 30	YN 9-1	YN 4-1	YN 24	YN 11	OS 6	
quartz	31.9	11.9	29.2	27.7	26.7	29.2	37.0	23.8	33.8	23.0	
K-feldspar	0.3	1.2	6.1	23.3	1.3	9.7	6.2	40.8	13.8	9.7	
plagioclase	56.1	51.9	47.4	39.8	49.9	38.5	45.8	28.2	40.3	55.3	
biotite	11.7	20.2	17.3	9.2	21.7	21.4	11.0	6.2	9.3	6.8	
muscovite								1.1	2.8		
garnet											
hornblende		13.0			0.1	0.7				5.2	
others		1.8			0.3	0.5					
$\delta$ whole-rock	12.4	10.9	12.8	12.4	11.4	11.0	11.1	12.4	12.0	10.5	