

## Chemistry of rock-forming minerals in epidote amphibolites and eclogites in the Tonaru epidote-amphibolite mass in the Sambagawa metamorphic belt, Besshi district, central Shikoku, southwest Japan

Yasuo Miyagi<sup>1)</sup>

### Abstract

The Tonaru epidote amphibolite mass is one of several tectonic blocks occurring in the Sambagawa metamorphic belt, central Shikoku, Japan. It consists mainly of various types of epidote-amphibolites with diverse lithology, and minor eclogites surviving after amphibolitization. There are two types of amphibolite: T-I and T-II type amphibolites. T-I type amphibolite is composed of clinopyroxene-amphibolite and serpentinite, and T-II type amphibolite is composed of epidote-amphibolite and eclogite.

EPMA analyses of the constituent minerals in the Tonaru mass show that garnets in T-II type amphibolite are of almandine-rich type, and that omphacites in T-II eclogites have maximum Jd contents of 45 mol. %. Amphiboles from the epidote amphibolites in both T-I and T-II type amphibolites are classified mostly as Ca-amphiboles. Amphibole inclusions in the garnets in T-II eclogites are Na- and Na-Ca amphiboles, whereas symplectitic amphiboles in the matrix of the eclogites are Ca-amphiboles. White micas in T-II type amphibolites include both paragonite and phengite.

**Keywords:** eclogite, tectonic blocks, chemical composition, garnet, omphacite, amphibole, phengite, paragonite, Tonaru mass, Sambagawa.

### Introduction

The Sambagawa metamorphic belt is a typical high-pressure intermediate group metamorphic belt. In central Shikoku, high-grade portions of the Sambagawa metamorphic belt are widely exposed, and several tectonic blocks that have experienced eclogite facies metamorphism occur (Takasu, 1984, 1989; Kunugiza, 1984; Kunugiza et al., 1986). The Tonaru epidote-amphibolite mass is one of the tectonic blocks, and consists mainly of epidote amphibolites with minor eclogites. The eclogitic metamorphism predated the epidote amphibolite metamorphism, and eclogitic mineral assemblages scarcely survived (Moriyama, 1990).

This paper briefly describes the geology and the petrography of the Tonaru mass, and provides the chemical compositions of constituent minerals contained in the Tonaru mass.

### Outline of geology and petrography

The Tonaru mass (6.5 km × 1 km) is exposed in the Besshi district in the Sambagawa metamorphic belt, central Shikoku (Fig. 1). Higashino (1990) performed metamorphic zone mapping in the Besshi district, and subdivided the area into four mineral zones, i.e. chlorite, garnet, albite-biotite, and oligoclase-biotite zones, in ascending order of metamorphic grade, based on the mineral paragenesis of the metapelites. The Tonaru mass occurs in the oligoclase- or albite-biotite zones (Fig. 1). Enami (1983) estimated P-T

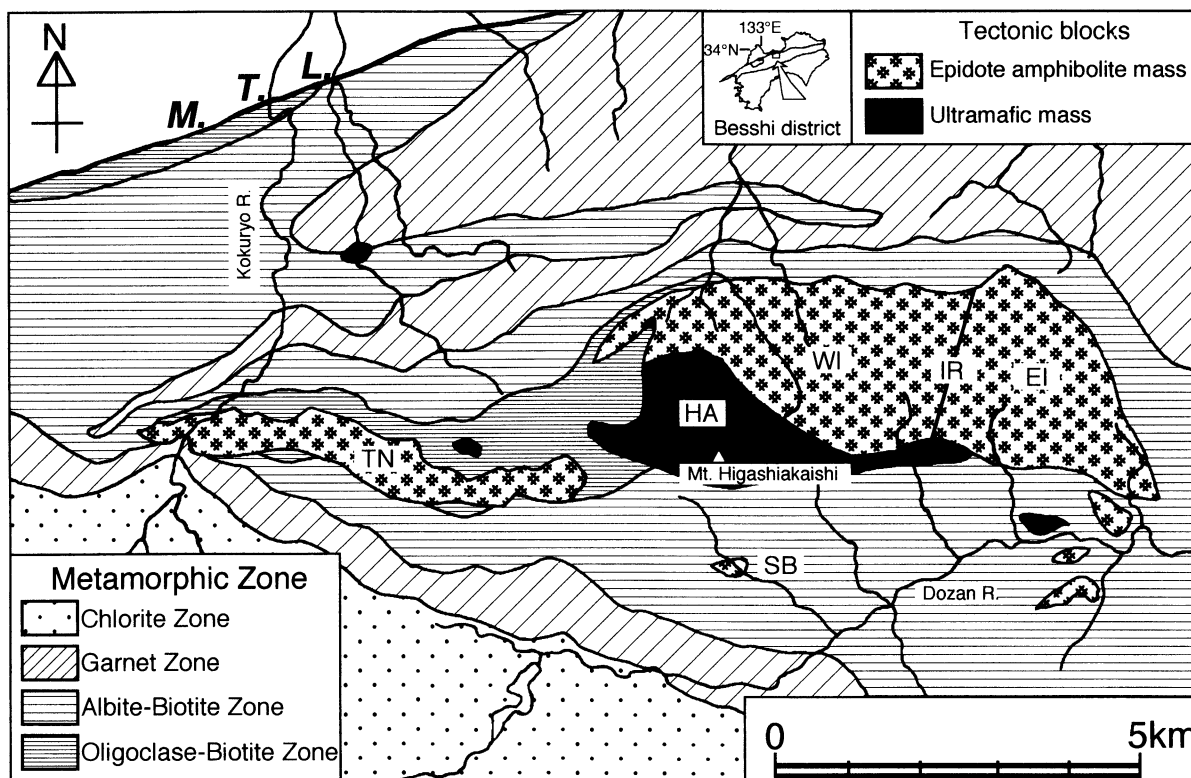
conditions of the oligoclase-biotite zone to be 600°C and 1.0 GPa.

The Tonaru mass is composed of two types of amphibolites, the T-I type amphibolite and the T-II type amphibolite (Moriyama, 1990).

The T-I type amphibolites (T-I) are mainly exposed close to Tonaru (1.75 km × 0.2 km) and Suryo (0.2 km × 0.07 km), and they are enclosed by the T-II type amphibolites (Fig. 2). The T-I type amphibolites are composed mainly of clinopyroxene amphibolite associated with minor serpentinite lenses and layers. Clinopyroxene amphibolite has a foliation defined by preferred orientation of clinopyroxene and hornblende. Gabbro-pegmatitic structure, which consists coarse-grained hornblende and plagioclase, cuts the foliation of clinopyroxene amphibolite, is rarely preserved. Clinopyroxene amphibolite shows granoblastic to nematoblastic textures, and its mineral assemblages are hornblende and clinopyroxene with minor epidote, biotite, and chlorite. Titanite, apatite, calcite, albite, zircon and ore minerals are occasionally found. The serpentinite consists mainly of serpentine with minor chlorite, brucite, chromite, calcite, dolomite and Fe-Cr-oxides. It occasionally contains olivine, which includes tiny brucite, serpentine and Fe-oxides. Kunugiza (1984) suggested that these olivines were crystallized from serpentinite during the Sambagawa progressive metamorphism.

The T-II type amphibolite (T-II) is widely exposed in the Tonaru mass (Fig. 2). The mineral assemblage of the T-II type amphibolite usually shows typical epidote-amphibolite facies. However, the eclogite facies

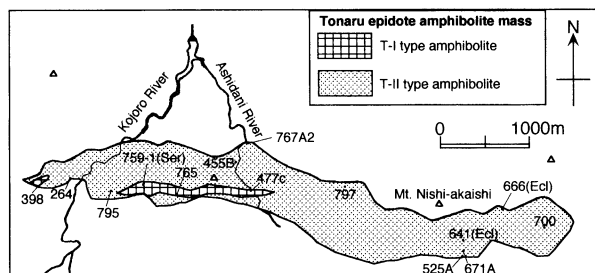
<sup>1)</sup> Department of Geoscience, Shimane University, Matsue 690-8504, Japan



**Fig. 1.** Metamorphic zone map of the Sambagawa metamorphic belt, Besshi district, central Shikoku, Japan. (After Higashino, 1990). TN: Tonaru, SB: Sebadani, and IR: Iratsu epidote-amphibolite masses. IR was subdivided into WI (western Iratsu) and EI (eastern Iratsu) epidote-amphibolite masses. The boundary between WI and EI is based on Takasu and Kohsaka (1987). HA: Higashiakaishi peridotite mass. M.T.L. = Median Tectonic Line.

assemblages are rarely preserved in eastern parts of the Tonaru mass. Moriyama (1990) revealed that the epidote-amphibolite facies rocks commonly have hornblende + plagioclase ± Na-augite symplectite, and the symplectite was formed by breakdown of omphacite. Moriyama concluded that the T-II type amphibolite had once experienced the eclogite facies metamorphism, and then suffered the epidote-amphibolitization. Most of the epidote amphibolites show nematoblastic texture, and their mineral assemblages are mainly hornblende and epidote, and minor sodic plagioclase, quartz, white mica and chlorite with occasional rutile, titanite, apatite, zircon, hematite, and ore

minerals. Garnets, calcites, biotites and trace kyanites occasionally occur. Eclogites in the T-II type amphibolites consist mainly of garnet, omphacite, epidote, hornblende and phengite with minor aegerine-augite, biotite, quartz, sodic plagioclase, rutile, titanite, apatite, and ore minerals. Some garnets include sodic- and sodic-calcic amphiboles such as glaucophane, taramite, barroisite and katophorite (Fig. 5 a). Garnets also include omphacite, paragonite, albite, phengite, ilmenite, rutile, titanite, quartz, and biotite. Garnet rims are sometimes replaced by hornblende + epidote symplectite. In the matrix, omphacites are often decomposed to form sodic plagioclase + hornblende ± aegerine-augite symplectite.

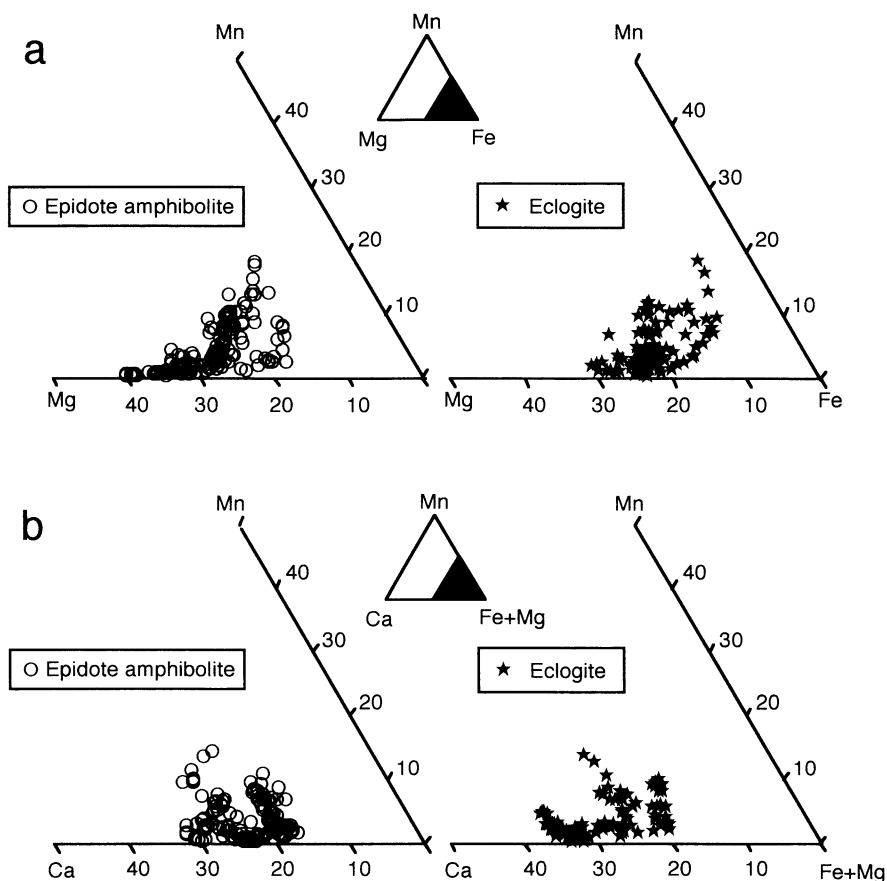


**Fig. 2.** Geological map of the Tonaru epidote amphibolite mass. Numbers indicate the sample localities.

### Chemical compositions of minerals

Determination of the chemical compositions of the constituent minerals is performed using an electron probe microanalyser, JEOL JXA-8800 M of the Research Center of Coastal Lagoon Environments, Shimane University. Analytical conditions are; accelerating voltage = 15 kV, specimen current =  $2 \times 10^{-8}$  A, and beam diameter = 5–10  $\mu$ m. Correction procedure followed the method of Bence and Albee (1968).

Fe<sup>3+</sup> estimation procedure followed the method of Droop



**Fig. 3.** Chemical compositions of garnets in the T-II type amphibolite (Epidote-amphibolite and eclogite) (a) Mg-Mn-Fe and (b) Ca-Mn-(Fe+Mg) diagrams.

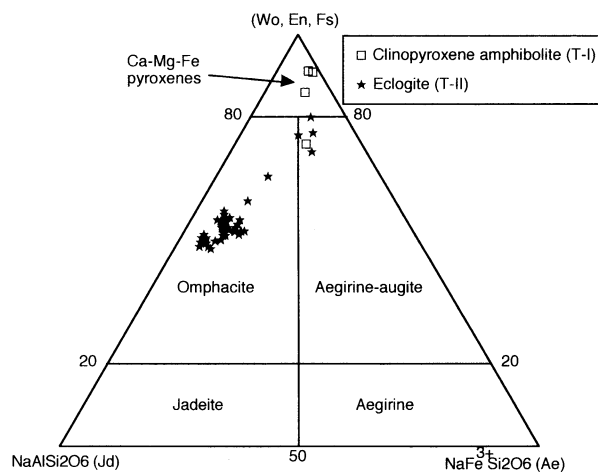
(1987) excepting  $\text{Fe}^{3+}$  of amphiboles. The classification of amphiboles is after Leake et al. (1997) and  $\text{Fe}^{3+}$  was estimated assuming total cations = 13, excluding Ca, Na and K (O=23). For epidote, total iron is regarded as  $\text{Fe}_2\text{O}_3$ .

### 1. Garnets

Garnets from the T-II type amphibolite (eclogite and epidote-amphibolite, Table 1) are of almandine-rich type, and show a distinct chemical zoning. Cores of garnet are rich in spessartine-molecule, and pyrope-molecule increases toward the rims.  $\text{Mg}/(\text{Mg}+\text{Fe}^{2+})$  of garnets in the eclogites is  $\leq 0.3$  and that in the epidote-amphibolites is about 0.4 (Fig. 3 a). Grossular molecule is up to 37 mol. % in eclogites, and up to 32 mol. % in epidote-amphibolites (Fig. 3 b).

### 2. Clinopyroxenes

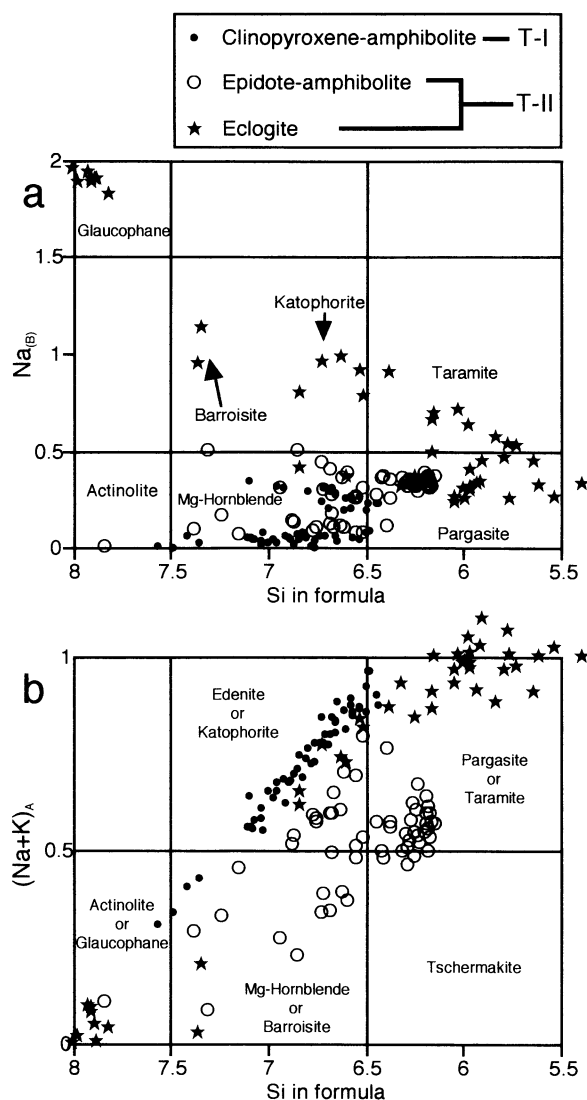
Clinopyroxenes in the T-II eclogite are classified into omphacite (Morimoto, 1988), and those in symplectite are classified into aegerine-augite. Jadeite component of the omphacite is  $\leq 45$  mol. %, and that of aegerine-augite is  $\leq 24$  mol. %. Clinopyroxenes from T-I type amphibolite are Ca-Mg-Fe pyroxenes, and their jadeite component is  $\leq 12$  mol. % (Fig. 4, Table 2).



**Fig. 4.** Chemical composition of the clinopyroxenes in the T-I type amphibolite (clinopyroxene-amphibolite) and the T-II type amphibolite (eclogite). (After Morimoto, 1988). Wo: Wollastonite, En: Enstatite, Fs: Ferrocilite, Jd: Jadeite, Ae: Aegerine.

### 3. Amphiboles

Amphiboles from the T-I type amphibolites (clinopyroxene amphibolite) and the T-II type amphibolites (epidote-

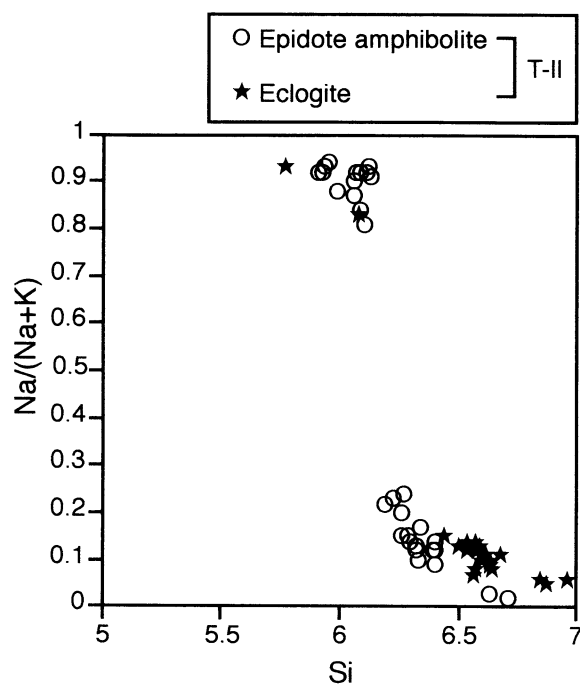


**Fig. 5.** Chemical compositions of the amphiboles in the T-I type and the T-II type amphibolites. (a) Si vs.  $Na_B$  and (b) Si vs.  $(Na+K)_A$  diagrams. In eclogite, some amphibole inclusions in garnets are classified into sodic- and sodic-calcic amphiboles. Amphiboles occur in the matrix of the T-II eclogite and in epidote-amphibolite of the T-I and the T-II, are classified into calcic amphiboles (hornblende).

amphibolite) are classified into calcic amphiboles (commonly hornblende and rarely actinolite) (Fig. 5 a and b). In the T-II eclogite, amphiboles occurring as inclusions in garnets are classified into sodic- and sodic-calcic amphiboles (glaucophane, taramite, barroisite and katophorite) (Fig. 5 a). Symplectitic amphiboles in the matrix of the T-II eclogites are classified into calcic amphiboles (pargasite and edenite) (Fig. 5 a and b, Table 3).

#### 4. Epidotes

In the T-I type amphibolites, epidotes show  $X_{Ps}$  ( $= Fe^{3+} / (Fe^{3+} + Al)$ ) = 0.23–0.26 and contains  $Cr_2O_3 < 1.8$  wt.%. Epidotes in the matrix of the T-II epidote-amphibolites show  $X_{Ps}$  = 0.12–0.24. Epidotes occurring along the



**Fig. 6.** Si vs.  $Na/(Na+K)$  diagram of white mica in the T-II type amphibolite.

cleavages show  $X_{Ps}$  = 0.29–0.30. Epidotes occurring close to hematite, show  $X_{Ps}$  = 0.31–0.32. In the T-II eclogites, epidote inclusions in garnet show  $X_{Ps}$  = 0.23–0.26. Epidote symplectites occurring around the garnet rims in the T-II eclogites show 0.06–0.19 (Table 4).

#### 5. White micas

White micas usually occur in the T-II (epidote-amphibolites and eclogites) (Fig. 6). White micas in the epidote-amphibolites are classified into two groups (Fig. 6), phengite ( $Si = 6.2-6.7$ ;  $Na / (Na+K) = 0-0.24$ ) and paragonite ( $Si = 5.8-6.1$ ;  $Na / (Na+K) = 0-0.95$ ). In the eclogites, white mica inclusions in garnet are paragonite ( $Si = 5.7, 6.0$ ;  $Na / (Na+K) = 0.9, 0.8$ ) and phengite ( $Si = 6.8-6.9$ ;  $Na / (Na+K) = 0.05$ ). White micas in the eclogite matrix are classified into phengite ( $Si = 6.4-6.7$ ;  $Na / (Na+K) = 0.05-0.15$ ; Fig. 6) (Table 5).

#### 6. Biotites

Biotites from the T-I clinopyroxene-amphibolites and the T-II (epidote-amphibolites and eclogites) contain 1–2 wt. %  $TiO_2$  (Table 6). Biotites of the T-I type amphibolites are classified into phlogopite. Biotites of the T-II type amphibolites are classified into biotite.

#### 7. Feldspars

Feldspars in the T-I (clinopyroxene-amphibolites) and the T-II (epidote-amphibolite and eclogite), show albite and oligoclase compositions (maximum anorthite content is 17 mol. %) (Table 7). K-feldspar rarely occurs in the T-

II epidote–amphibolite.

### 8. Chlorites

Chlorites occur in the T–I and the T–II type amphibolites (except of eclogite). Mg/(Mg+Fe) in chlorite ranges from 0.80 to 0.90 in the T–I type amphibolites, and from 0.45 to 0.73 in the T–II type amphibolites (Table 8).

### 9. Olivines

Olivines occur only in the T–I serpentinites. Mg/(Mg+Fe) of olivine ranges from 0.89 to 0.97 (Table 9).

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### Reference

- Bence, A.E. and Albee, A.L., 1968, Empirical correction factors for the electron microanalysis of silicates and oxides. *Jour. Geol.*, **76**, 382–403.
- Droop, G.T.R., 1987, A general equation for estimating Fe<sup>3+</sup> in ferromagnesian silicates and oxides from microprobe analyses, using stoichiometric criteria. *Mineral. Mag.*, **51**, 431–437.
- Enami, M., 1983, Petrology of pelitic schists in the oligoclase–biotite zone of the Sanbagawa metamorphic terrain, Japan: phase equilibria in the highest grade zone of a high–pressure intermediate type of metamorphic belt. *Jour. Metamorphic Geol.*, **1**, 141–161.
- Higashino, T., 1990, The higher grade metamorphic zonation of the Sambagawa metamorphic belt in central Shikoku, Japan. *Jour. Metamorphic Geol.*, **8**, 413–423.
- Kunugiza, K., 1984, Metamorphism and origin of ultramafic bodies of the Sanbagawa metamorphic belt in central Shikoku. *J. Japan. Assoc. Mineral. Petrol. Econ. Geol.*, **79**, 20–32. (in Japanese with English abstract)
- Kunugiza, K., Takasu, A. and Banno, S., 1986, The origin and metamorphic history of the ultramafic and metagabbro bodies in the Sanbagawa metamorphic belt. *Geological Society of America Memoir*, **164**, 375–385.
- Leake, B.E. et al., 1997, Nomenclature of amphiboles: Report of the Subcommittee on amphiboles of the International Mineralogical Association Commission on new minerals and mineral names. *Mineral. Mag.*, **61**, 295–321.
- Morimoto, N., 1988, Nomenclature of pyroxenes. *Mineral. Mag.*, **52**, 535–550.
- Moriyama, H., 1990, Two metamorphic paths in the Tonaru epidote amphibolite mass within the Sambagawa belt, Besshi district, central Shikoku. *Geol. Rept. Shimane Univ.*, **9**, 49–54 (in Japanese).
- Takasu, A., 1984, Prograde and retrograde eclogites in the Sambagawa metamorphic belt, Besshi district, Japan. *Jour. Petrol.*, **25**, 619–643.
- Takasu, A., 1989, P–T histories of peridotite and amphibolite tectonic blocks in the Sanbagawa metamorphic belt, Japan. In: Daly, J.S., Cliff, R. A. and Yardley, B.W.D., Eds., *Evolution of Metamorphic belt*. Geological Society Special Publication, **43**, 533–538.
- Takasu, A. and Kohsaka, Y., 1987, Eclogites from the Iratsu epidote amphibolite mass in the Sambagawa metamorphic belt, Besshi district, Japan. *Jour. Geol. Soc. Japan*, **93**, 517–520 (in Japanese).

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### (要 旨)

宮城康夫, 2001, 四国中央部別子地域三波川変成帯・東平緑れん石角閃岩体の鉱物化学組成, 島根大学地球資源環境学研究報告, **19**, 135–150

東平緑れん石角閃岩体は四国中央部三波川変成帯の中のテクトニック・ブロック岩体の一つであり, 主要な鉱物組合せは緑れん石角閃岩相を示すが, 岩体の一部にはエクロジヤイト相の鉱物組合せが残存している. 東平岩体は岩相から T–I type 角閃岩, T–II type 角閃岩の二つの岩体に区分される. T–I type 角閃岩は単斜輝石角閃岩と蛇紋岩より構成され, T–II type 角閃岩は緑れん石角閃岩とエクロジヤイトから構成される.

T–II type 角閃岩中のざくろ石は almandine に富む組成を示す. エクロジヤイト中のオンファス輝石はひすい輝石成分を最大 45 mol.% 含む. T–I および T–II type 角閃岩中の緑れん石角閃岩の角閃石はほとんどが Ca 角閃石に分類され, エクロジヤイト中のざくろ石の包有物の角閃石は Na–および Na–Ca 角閃石に, 基質中のシンプレクタイトの角閃石は Ca 角閃石に分類される. T–II type 角閃岩中の白色雲母はパラゴナイトとフェンジヤイトである.

**Table 1.** Chemical composition of garnet from the T-II type amphibolite (epidote-amphibolite and eclogite).

Lithology	Ep-Amp	264.2nd																			
Sample No.	264	rim								core								rim		525A	
Analysis No.	1	3	4	34	36	1	2	3	5	6	7	8	10	11	12	13	14	1	2	3	4
SiO <sub>2</sub>	37.42	37.26	37.54	37.12	37.66	38.05	38.03	37.46	37.69	37.62	37.35	37.20	37.50	37.48	37.79	37.85	37.99	38.90	38.70	38.55	38.31
TiO <sub>2</sub>	0.05	0.03	0.08	0.04	0.07	0.01	0.04	0.08	0.13	0.12	0.11	0.11	0.10	0.09	0.02	0.05	0.06	0.10	0.08	0.05	0.11
Al <sub>2</sub> O <sub>3</sub>	21.40	21.46	21.48	20.31	20.98	21.20	20.93	20.75	20.70	20.53	20.68	20.77	20.68	20.73	20.99	21.04	21.05	21.09	21.08	20.98	20.98
FeO*	29.72	29.57	28.60	31.29	28.34	28.47	29.17	29.69	29.24	29.46	29.42	28.85	29.51	29.81	29.53	29.29	29.25	22.32	23.08	22.84	20.98
MnO	0.34	1.18	0.49	0.86	0.33	0.61	0.82	1.10	2.29	2.91	2.94	3.11	2.16	1.53	1.01	0.89	0.80	0.17	0.42	0.75	1.65
MgO	4.77	4.24	4.79	3.50	4.63	4.29	3.94	3.77	3.14	3.10	3.06	3.15	3.40	3.42	4.10	3.96	4.00	5.71	5.05	4.81	4.53
CaO	7.11	6.64	7.45	6.67	7.92	7.75	6.94	6.68	6.75	6.24	6.22	6.34	6.47	6.72	6.76	6.99	6.92	10.78	11.07	11.25	10.15
Total	100.81	100.38	100.43	99.79	99.92	100.37	99.87	99.53	99.95	99.98	99.79	99.52	99.82	99.77	100.20	100.08	100.07	99.06	99.48	99.23	99.88
Cations per 12 O																					
Si	2.942	2.948	2.952	2.980	2.976	2.992	3.012	2.992	3.006	3.007	2.993	2.985	2.996	2.993	2.991	2.996	3.003	3.029	3.019	3.019	3.003
Ti	0.003	0.002	0.005	0.002	0.004	0.000	0.002	0.005	0.008	0.007	0.007	0.007	0.006	0.005	0.001	0.003	0.004	0.006	0.005	0.003	0.007
Al	1.983	2.001	1.991	1.922	1.954	1.964	1.954	1.953	1.946	1.934	1.953	1.964	1.947	1.951	1.958	1.962	1.961	1.936	1.938	1.936	1.938
Fe <sup>3+</sup>	0.126	0.099	0.096	0.113	0.087	0.051	0.018	0.053	0.027	0.037	0.048	0.052	0.050	0.051	0.057	0.039	0.025	0.000	0.014	0.020	0.043
Fe <sup>2+</sup>	1.828	1.857	1.784	1.988	1.785	1.821	1.914	1.930	1.923	1.932	1.924	1.884	1.921	1.939	1.897	1.899	1.908	1.453	1.491	1.476	1.541
Mn	0.023	0.079	0.033	0.059	0.022	0.041	0.055	0.074	0.155	0.197	0.200	0.211	0.146	0.104	0.068	0.060	0.054	0.011	0.028	0.050	0.110
Mg	0.559	0.500	0.561	0.419	0.546	0.503	0.465	0.448	0.373	0.370	0.366	0.377	0.405	0.407	0.483	0.467	0.472	0.662	0.587	0.562	0.529
Ca	0.599	0.563	0.627	0.574	0.670	0.653	0.589	0.571	0.577	0.535	0.534	0.545	0.554	0.575	0.573	0.593	0.586	0.899	0.925	0.944	0.852
Total	8.063	8.050	8.048	8.056	8.044	8.025	8.009	8.027	8.014	8.019	8.024	8.026	8.025	8.026	8.029	8.020	8.013	7.997	8.007	8.010	8.021
*Total Fe as FeO + Fe <sub>2</sub> O <sub>3</sub> .																					
Lithology	Ep-Amp	525A.2nd																			
Sample No.	525A	rim										core									
Analysis No.	5	6	7	8	9	10	11	12	14	16	20	22	1	2	3	4	5	6	7	8	12
SiO <sub>2</sub>	38.18	38.25	38.04	38.32	38.57	38.63	38.86	38.82	38.69	38.22	38.72	38.86	38.50	38.31	38.69	38.85	38.73	38.90	38.82	39.23	38.65
TiO <sub>2</sub>	0.00	0.06	0.07	0.06	0.06	0.05	0.02	0.07	0.10	0.09	0.08	0.06	0.03	0.08	0.07	0.09	0.05	0.10	0.02	0.05	
Al <sub>2</sub> O <sub>3</sub>	21.06	20.91	20.97	21.05	21.03	21.05	21.21	21.29	21.24	21.09	21.33	21.19	21.48	21.65	21.69	21.77	21.38	21.49	21.75	21.96	21.73
FeO*	24.70	24.37	24.87	24.26	24.00	22.75	22.89	22.32	23.77	24.25	23.06	21.96	24.24	23.60	23.31	22.26	22.16	22.62	22.47	22.64	22.44
MnO	2.39	2.80	2.57	2.10	1.28	0.31	0.20	0.21	1.33	1.36	0.26	0.11	2.55	3.12	1.47	1.03	1.05	1.20	1.16	0.87	1.04
MgO	4.21	4.13	4.21	4.58	4.77	5.18	5.62	5.77	4.91	4.37	5.49	5.85	4.74	4.82	6.44	5.35	5.67	5.60	6.01	6.33	5.80
CaO	9.15	9.03	9.05	9.47	10.16	11.02	11.18	10.62	9.82	10.52	10.97	10.77	8.73	8.45	7.86	10.10	10.34	10.17	9.40	9.17	9.63
Total	99.69	99.54	99.77	99.83	99.87	98.99	99.98	99.10	99.87	99.89	99.91	98.79	100.08	100.03	99.54	99.44	99.42	99.87	99.71	100.20	99.34
Cations per 12 O																					
Si	3.007	3.018	2.999	3.006	3.014	3.023	3.010	3.021	3.016	2.997	3.003	3.029	3.006	2.993	3.003	3.016	3.011	3.015	3.005	3.013	3.004
Ti	0.000	0.003	0.004	0.003	0.004	0.003	0.001	0.004	0.006	0.005	0.005	0.003	0.002	0.004	0.004	0.005	0.005	0.005	0.006	0.001	0.003
Al	1.955	1.944	1.949	1.946	1.937	1.941	1.937	1.953	1.952	1.948	1.950	1.946	1.977	1.993	1.984	1.992	1.969	1.963	1.983	1.988	1.990
Fe <sup>3+</sup>	0.031	0.014	0.045	0.036	0.027	0.007	0.041	0.000	0.003	0.048	0.034	0.000	0.008	0.013	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Fe <sup>2+</sup>	1.596	1.593	1.595	1.556	1.541	1.481	1.442	1.453	1.546	1.542	1.461	1.431	1.561	1.529	1.513	1.445	1.433	1.460	1.454	1.454	1.458
Mn	0.159	0.187	0.171	0.139	0.085	0.021	0.013	0.014	0.088	0.090	0.017	0.007	0.169	0.207	0.097	0.067	0.069	0.078	0.076	0.056	0.068
Mg	0.495	0.485	0.495	0.536	0.555	0.604	0.649	0.669	0.571	0.510	0.635	0.679	0.552	0.561	0.745	0.619	0.657	0.636	0.693	0.725	0.672
Ca	0.772	0.763	0.764	0.796	0.850	0.923	0.928	0.886	0.820	0.884	0.912	0.839	0.730	0.707	0.653	0.840	0.861	0.845	0.780	0.754	0.802
Total	8.015	8.008	8.022	8.018	8.014	8.003	8.020	7.999	8.002	8.024	8.017	7.995	8.004	8.007	8.000	7.983	8.004	8.001	7.997	7.992	7.998
*Total Fe as FeO + Fe <sub>2</sub> O <sub>3</sub> .																					
Lithology	Ep-Amp	671A.2nd																			
Sample No.	525A.2nd	rim										core									
Analysis No.	13	20	24	25	26	27	29	14	15	16	17	18	19	20	21	22	23	24	25	26	27
SiO <sub>2</sub>	37.93	38.71	38.33	38.35	38.61	38.88	38.98	37.81	37.69	37.75	37.95	37.96	38.30	38.13	38.40	37.65	38.12	38.43	38.07	37.44	37.61
TiO <sub>2</sub>	0.04	0.04	0.05	0.03	0.08	0.05	0.05	0.14	0.13	0.09	0.10	0.08	0.11	0.09	0.08	0.00	0.06	0.07	0.10	0.06	0.08
Al <sub>2</sub> O <sub>3</sub>	21.38	21.63	21.43	21.30	20.86	21.24	21.67	21.13	20.84	21.03	21.19	21.17	21.43	21.56	21.20	21.00	21.05	21.41	21.17	20.85	20.90
FeO*	23.89	23.80	23.85	24.04	22.38	23.93	21.54	26.69	26.45	26.41	26.79	26.97	25.72	24.42	24.16	26.17	26.96	26.05	27.15	26.84	26.23
MnO	4.31	2.34	2.61	3.44	1.17	2.68	0.61	3.64	3.55	3.09	2.76	1.74	0.73	0.59	0.62	4.83	1.55	1.13	2.11	4.21	3.72
MgO	2.59	4.87	4.76	3.89	4.60	4.36	5.54	4.47	4.49	4.47	4.81	5.30	6.26	6.37	6.29	4.83	5.22	6.18	5.01	3.72	4.34
CaO	9.11	9.19	9.11	8.45	11.07	8.69	11.41	6.54	6.83	6.71	6.82	6.56	7.31	8.60	8.89	5.81	6.89	6.54	6.50	6.61	6.67
Total	99.25	100.59	100.13	99.50	98.76	99.83	99.80	100.41	99.97	99.54	100.42	99.76	99.86	99.77	99.65	99.62	99.85	99.80	100.11	99.74	99.55
Cations per 12 O																					
Si	3.015	3.002	2.994	3.023	3.036	3.040	3.011	2.980	2.985	2.993	2.982	2.989	2.986	2.969	2.992	2.996	2.998	2.999	2.993	2.986	2.989
Ti	0.002	0.003	0.003	0.001	0.004	0.003	0.003	0.009	0.008	0.005	0.006	0.004	0.007	0.005	0.005	0.000	0.004	0.004	0.006	0.004	0.005
Al	2.003	1.977	1.973	1.949	1.933	1.957	1.973	1.963	1.944	1.965	1.962	1.964	1.968	1.978	1.947	1.969	1.952	1.969	1.961	1.960	1.957
Fe <sup>3+</sup>	0.000	0.013	0.033	0.000	0.000	0.000	0.000	0.060	0.071	0.039	0.061	0.050	0.047	0.074	0.061	0.039	0.045	0.024	0.040	0.061	0.055
Fe <sup>2+</sup>	1.588	1.530	1.525																		

Table 1. (Continued)

Lithology	Ep-Amp																				
Sample No.	767A2																				
Analysis No.	2	3	4	7	8	9	13	23	24	29	30	36	1	2	3	4	5	6	7	8	9
SiO <sub>2</sub>	38.54	38.44	38.41	38.60	38.61	38.69	38.64	38.45	38.31	37.87	38.49	38.04	37.88	38.29	38.85	38.75	38.55	38.34	38.86	38.59	38.67
TiO <sub>2</sub>	0.00	0.06	0.07	0.09	0.08	0.06	0.10	0.14	0.09	0.00	0.06	0.05	0.13	0.13	0.02	0.01	0.11	0.11	0.05	0.02	0.00
Al <sub>2</sub> O <sub>3</sub>	21.19	21.38	21.14	21.34	21.41	21.18	21.25	21.01	21.58	21.14	21.43	20.94	21.19	21.37	21.89	21.90	21.28	21.42	21.70	21.86	21.86
FeO*	27.26	27.00	27.35	27.14	26.82	27.15	26.90	27.14	27.22	27.51	27.95	27.25	27.38	24.93	23.89	23.76	25.00	27.00	24.02	24.48	23.40
MnO	1.28	1.13	1.10	1.08	1.01	1.58	1.22	0.56	0.60	3.88	1.02	3.15	2.00	0.47	0.10	0.22	0.41	0.68	0.12	0.22	0.18
MgO	5.67	5.78	5.52	5.61	5.65	5.06	5.45	5.50	5.86	4.14	5.44	4.23	5.16	6.19	6.84	7.00	6.50	6.29	7.35	6.66	6.92
CaO	6.16	6.10	6.25	6.38	6.80	6.78	6.28	6.87	6.68	5.43	6.02	6.04	6.31	7.89	8.86	8.49	8.36	6.25	8.21	8.80	9.19
Total	100.11	99.89	99.85	100.23	100.38	100.50	99.83	99.67	100.33	99.97	100.41	99.70	100.04	99.26	100.45	100.14	100.21	100.09	100.31	100.63	100.22
Cations per 12 O																					
Si	3.013	3.006	3.012	3.010	3.005	3.020	3.024	3.016	2.984	3.002	3.004	3.015	2.982	2.994	2.985	2.984	2.989	2.989	2.988	2.971	2.977
Ti	0.000	0.003	0.004	0.005	0.005	0.004	0.006	0.008	0.005	0.000	0.004	0.003	0.007	0.007	0.001	0.001	0.007	0.006	0.003	0.001	0.000
Al	1.953	1.970	1.954	1.962	1.964	1.948	1.959	1.942	1.981	1.975	1.971	1.955	1.966	1.969	1.982	1.987	1.944	1.968	1.966	1.984	1.984
Fe <sup>3+</sup>	0.020	0.010	0.014	0.008	0.017	0.006	0.000	0.009	0.041	0.022	0.013	0.008	0.056	0.028	0.046	0.043	0.065	0.041	0.053	0.073	0.063
Fe <sup>2+</sup>	1.762	1.755	1.780	1.762	1.728	1.766	1.760	1.771	1.732	1.802	1.811	1.798	1.746	1.602	1.489	1.488	1.555	1.719	1.491	1.503	1.444
Mn	0.085	0.075	0.073	0.071	0.066	0.104	0.081	0.037	0.039	0.261	0.067	0.211	0.133	0.031	0.007	0.015	0.027	0.045	0.008	0.014	0.012
Mg	0.661	0.674	0.645	0.653	0.656	0.589	0.635	0.643	0.681	0.489	0.633	0.500	0.605	0.721	0.784	0.804	0.751	0.731	0.842	0.765	0.795
Ca	0.516	0.511	0.525	0.533	0.567	0.567	0.526	0.577	0.557	0.461	0.504	0.513	0.532	0.661	0.730	0.701	0.695	0.522	0.676	0.726	0.758
Total	8.010	8.005	8.007	8.004	8.008	8.003	7.991	8.004	8.020	8.011	8.007	8.004	8.028	8.014	8.023	8.021	8.033	8.021	8.027	8.036	8.031

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>.

Lithology	Ep-Amp																				
Sample No.	797-2																				
Analysis No.	10	11	12	13	14	15	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16
SiO <sub>2</sub>	38.25	38.35	38.14	38.56	38.38	38.04	38.06	38.90	38.38	38.28	37.67	38.17	37.91	38.36	38.26	38.25	38.23	38.10	38.58	38.35	38.21
TiO <sub>2</sub>	0.10	0.06	0.05	0.01	0.06	0.04	0.05	0.05	0.03	0.09	0.22	0.01	0.06	0.02	0.06	0.02	0.01	0.09	0.09	0.03	0.08
Al <sub>2</sub> O <sub>3</sub>	21.53	21.65	21.49	21.75	21.74	21.56	21.48	21.81	21.69	21.40	21.10	21.42	21.21	21.57	21.75	21.66	21.49	21.51	21.53	21.43	21.45
FeO*	24.45	24.36	24.21	23.35	26.21	23.10	26.20	22.37	22.66	23.43	26.28	26.10	25.77	23.35	23.88	23.81	24.32	23.94	23.66	23.92	24.04
MnO	0.28	0.25	0.36	0.20	0.74	0.24	0.46	0.09	0.13	0.25	0.63	0.64	0.52	0.21	0.26	0.29	0.22	0.30	0.23	0.35	0.23
MgO	6.52	6.85	6.64	7.33	7.14	6.86	6.63	7.92	7.78	6.67	5.81	6.29	6.73	6.80	6.83	7.04	6.84	6.73	7.02	6.58	6.51
CaO	8.83	8.55	8.50	8.55	8.58	8.82	8.55	8.29	8.45	8.55	7.31	6.52	6.62	8.55	8.60	8.62	8.56	8.52	8.36	8.42	8.56
Total	99.96	100.07	99.37	99.75	100.14	98.66	99.42	99.41	99.11	98.69	99.03	99.15	98.82	98.85	99.64	99.69	99.67	99.18	99.48	99.06	99.08
Cations per 12 O																					
Si	2.969	2.969	2.974	2.978	2.976	2.975	2.978	2.995	2.974	2.994	2.974	2.995	2.983	2.991	2.969	2.967	2.972	2.973	2.991	2.993	2.985
Ti	0.006	0.003	0.003	0.001	0.003	0.002	0.003	0.003	0.002	0.005	0.013	0.001	0.003	0.001	0.004	0.001	0.000	0.005	0.005	0.002	0.005
Al	1.970	1.975	1.975	1.980	1.987	1.987	1.980	1.979	1.980	1.972	1.963	1.980	1.967	1.983	1.989	1.981	1.969	1.978	1.967	1.971	1.975
Fe <sup>3+</sup>	0.080	0.080	0.071	0.062	0.055	0.059	0.057	0.027	0.067	0.029	0.062	0.029	0.060	0.033	0.066	0.084	0.086	0.066	0.040	0.039	0.046
Fe <sup>2+</sup>	1.507	1.497	1.508	1.446	1.645	1.452	1.658	1.414	1.401	1.503	1.674	1.684	1.635	1.490	1.483	1.461	1.495	1.496	1.495	1.522	1.524
Mn	0.018	0.016	0.024	0.013	0.048	0.016	0.030	0.006	0.009	0.017	0.042	0.042	0.035	0.014	0.017	0.019	0.015	0.020	0.015	0.023	0.015
Mg	0.755	0.790	0.772	0.844	0.825	0.800	0.773	0.909	0.898	0.778	0.684	0.735	0.790	0.791	0.790	0.814	0.793	0.783	0.812	0.765	0.758
Ca	0.735	0.709	0.710	0.707	0.488	0.739	0.549	0.683	0.702	0.716	0.618	0.548	0.558	0.714	0.715	0.716	0.713	0.712	0.695	0.704	0.716
Total	8.040	8.040	8.036	8.031	8.027	8.030	8.028	8.014	8.033	8.015	8.031	8.014	8.030	8.016	8.033	8.042	8.043	8.033	8.020	8.019	8.023

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>.

Lithology	Ep-Amp														Eclogite						
Sample No.	797-3														641A.1st						
Analysis No.	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	5	6	7	1	2
SiO <sub>2</sub>	37.76	37.56	37.99	37.37	37.52	37.66	37.58	38.77	38.56	38.84	39.12	38.61	37.50	38.44	37.05	38.46	38.30	38.13	38.26	38.39	37.95
TiO <sub>2</sub>	0.01	0.00	0.07	0.06	0.06	0.09	0.05	0.00	0.04	0.01	0.09	0.00	0.00	0.07	0.04	0.05	0.07	0.10	0.10	0.03	0.03
Al <sub>2</sub> O <sub>3</sub>	21.16	21.06	21.36	20.96	21.06	21.11	21.05	21.87	21.93	21.82	21.99	21.78	21.24	21.58	21.01	21.84	21.57	21.51	21.23	21.36	20.88
FeO*	26.16	26.69	26.44	25.63	25.85	26.07	25.82	22.24	22.12	22.67	22.54	22.53	26.90	26.75	27.81	23.70	24.31	27.68	26.22	24.96	26.59
MnO	3.41	4.10	0.81	0.45	2.88	0.59	1.85	0.11	0.08	0.10	0.11	0.13	3.00	0.58	3.04	0.25	0.31	0.83	0.65	0.89	1.28
MgO	4.43	3.78	4.90	5.14	3.51	5.19	4.19	7.76	7.99	7.71	8.10	7.71	4.83	6.46	4.56	7.16	6.54	5.77	6.09	5.71	5.28
CaO	6.34	6.10	8.58	9.04	8.41	8.52	8.15	8.54	8.27	8.48	8.47	8.47	5.79	6.58	5.31	8.30	8.69	6.03	6.59	7.71	6.70
Total	99.26	99.28	100.14	98.65	99.29	99.23	98.70	99.28	99.00	99.63	100.42	99.22	99.25	100.45	98.81	99.76	99.79	100.05	99.14	99.05	98.73
Cations per 12 O																					
Si	2.999	2.999	2.977	2.969	2.988	2.975	2.995	2.990	2.980	2.990	2.984	2.985	2.981	2.983	2.972	2.974	2.975	2.984	3.005	3.011	3.011
Ti	0.000	0.000	0.004	0.004	0.003	0.005	0.003	0.000	0.002	0.001	0.005	0.000	0.000	0.004	0.002	0.003	0.004	0.006	0.006	0.002	0.002
Al	1.981	1.981	1.972	1.962	1.977	1.965	1.977	1.988	1.997	1.979	1.977	1.984	1.989	1.973	1.986	1.990	1.975	1.984	1.964	1.974	1.953
Fe <sup>3+</sup>	0.021	0.021	0.065	0.092	0.039	0.075	0.027	0.032	0.039	0.040	0.046	0.046	0.049	0.053	0.066	0.056	0.067	0.037	0.014	0.000	0.021
Fe <sup>2+</sup>	1.716	1.761	1.668	1.611	1.682	1.647	1.693	1.402	1.390	1.420	1.391	1.410	1.738	1.682	1.799	1.476	1.512	1.774	1.708	1.637	1.743
Mn	0.229	0.277	0.054	0.030	0.194	0.040	0.125	0.007	0.005	0.006	0.007	0.008	0.202	0.038	0.206	0.016	0.020	0.065	0.043	0.059	0.086
Mg	0.525	0.450	0.622	0.609	0.417	0.611	0.497	0.892	0.921	0.885	0.921	0.888	0.572	0.747	0.545	0.826	0.757	0.673	0.712	0.668	0.624
Ca	0.540	0.522	0.720	0.770	0.718	0.721	0.696	0.706	0.685	0.699	0.692	0.701	0.493	0.547	0.456	0.687	0.723	0.506	0.554	0.648	0.570
Total	8.011	8.011	8.033	8.046	8.020	8.038	8.014	8.016	8.019	8.020	8.023	8.023	8.025	8.027	8.033	8.028	8.034	8.019	8.007	8.000	8.011

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>.

Chemistry of rock-forming minerals in epidote amphibolites and eclogites in the Tonaru epidote-amphibolite mass  
in the Sambagawa metamorphic belt, Besshi district, central Shikoku, southwest Japan

Table 1. (Continued)

Lithology	666A'																				
Sample No.	core								rim												
Analysis No.	7	6	4	3	2	15	16	18	19	20	21	22	23	30	34	38	49	51	52	53	54
SiO <sub>2</sub>	37.44	37.55	37.46	37.50	37.40	36.92	37.39	37.31	37.89	37.47	37.90	37.25	37.39	38.46	38.46	38.46	38.11	37.76	38.39	38.06	37.59
TiO <sub>2</sub>	0.05	0.02	0.10	0.12	0.12	0.07	0.03	0.07	0.07	0.11	0.04	0.11	0.12	0.09	0.09	0.01	0.07	0.06	0.07	0.07	0.07
Al <sub>2</sub> O <sub>3</sub>	21.13	21.37	21.08	20.89	21.17	20.98	21.43	20.90	20.95	20.83	21.68	21.09	21.31	21.47	21.44	21.37	21.13	20.82	21.18	20.95	20.94
FeO*	26.57	26.38	26.45	25.99	26.45	27.16	27.05	24.76	24.42	23.95	24.70	27.23	26.11	23.31	22.95	23.09	25.18	23.39	24.19	24.81	25.66
MnO	1.74	2.24	2.98	3.53	3.45	2.52	1.82	1.05	0.75	0.56	1.00	3.87	2.99	0.33	0.36	0.32	0.59	0.52	0.43	0.52	0.71
MgO	4.06	3.83	3.10	2.61	2.86	3.54	3.79	3.84	4.06	3.92	4.31	2.36	3.39	4.76	4.92	4.99	4.05	4.09	3.87	3.99	3.83
CaO	8.48	8.59	8.55	9.13	9.00	7.83	8.55	10.93	11.70	11.99	10.01	8.51	8.82	11.82	11.39	11.71	11.29	12.51	12.10	12.05	11.41
Total	99.47	99.98	99.71	99.76	100.45	99.01	100.05	98.85	99.84	98.82	99.64	100.42	100.11	100.25	99.61	99.96	100.41	99.15	100.23	100.46	100.22
Cations per 12 O																					
Si	2.972	2.969	2.982	2.990	2.965	2.963	2.959	2.971	2.981	2.976	2.976	2.968	2.962	2.986	2.997	2.991	2.982	2.983	2.998	2.979	2.962
Ti	0.003	0.001	0.006	0.007	0.007	0.004	0.002	0.004	0.004	0.006	0.002	0.007	0.007	0.005	0.005	0.000	0.004	0.003	0.004	0.004	0.004
Al	1.978	1.991	1.978	1.963	1.978	1.985	1.998	1.962	1.942	1.949	2.006	1.980	1.989	1.965	1.969	1.959	1.948	1.938	1.949	1.932	1.945
Fe <sup>3+</sup>	0.071	0.069	0.047	0.043	0.077	0.082	0.082	0.088	0.089	0.087	0.037	0.071	0.073	0.052	0.026	0.057	0.079	0.089	0.046	0.101	0.124
Fe <sup>2+</sup>	1.693	1.675	1.713	1.690	1.676	1.740	1.708	1.561	1.517	1.504	1.584	1.743	1.656	1.461	1.470	1.445	1.568	1.456	1.534	1.523	1.567
Mn	0.117	0.150	0.201	0.238	0.232	0.171	0.122	0.071	0.050	0.038	0.066	0.261	0.200	0.022	0.023	0.021	0.039	0.035	0.028	0.035	0.048
Mg	0.480	0.452	0.368	0.310	0.338	0.423	0.447	0.455	0.477	0.464	0.504	0.280	0.400	0.551	0.571	0.579	0.472	0.482	0.451	0.466	0.450
Ca	0.721	0.728	0.729	0.780	0.764	0.673	0.725	0.932	0.986	1.020	0.842	0.726	0.749	0.983	0.951	0.976	0.947	1.059	1.012	1.010	0.963
Total	8.036	8.034	8.024	8.021	8.038	8.041	8.041	8.044	8.045	8.043	8.019	8.036	8.037	8.026	8.013	8.029	8.040	8.045	8.023	8.051	8.062

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>.

Lithology	666A13																				
Sample No.	rim								core												
Analysis No.	56	60	61	65	67	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SiO <sub>2</sub>	37.92	37.61	38.21	37.86	37.94	38.24	38.31	38.45	38.17	37.85	37.59	37.82	37.70	37.48	37.35	37.24	37.64	37.79	38.09	38.11	
TiO <sub>2</sub>	0.12	0.18	0.13	0.12	0.11	0.07	0.11	0.11	0.16	0.16	0.06	0.07	0.04	0.06	0.18	0.17	0.09	0.15	0.03	0.05	0.09
Al <sub>2</sub> O <sub>3</sub>	20.82	21.04	21.32	21.10	20.77	20.46	20.38	20.53	20.07	20.19	20.38	20.35	20.42	20.47	19.95	20.02	20.27	20.23	20.45	20.78	20.26
FeO*	25.31	24.57	24.10	24.06	24.61	24.51	25.42	27.50	27.39	28.75	29.04	30.12	29.67	29.24	27.49	26.46	27.84	29.24	29.87	29.53	28.00
MnO	0.80	0.71	0.63	0.46	0.51	0.17	0.30	0.53	0.77	1.24	1.73	2.52	2.58	3.36	4.66	5.60	3.19	2.73	1.97	1.18	0.84
MgO	3.63	3.79	4.03	4.02	3.88	4.37	3.73	3.69	3.48	2.97	2.88	2.46	2.18	1.80	1.59	1.40	2.08	2.11	2.66	3.16	3.28
CaO	11.56	11.65	11.95	11.80	11.97	11.41	11.14	9.52	9.27	8.58	7.15	6.80	6.95	7.80	8.29	8.45	8.13	7.65	7.10	7.14	9.19
Total	100.14	99.55	100.38	99.40	99.78	99.23	99.38	100.31	99.31	99.74	98.82	100.14	99.53	100.22	99.52	99.33	99.24	99.56	99.87	99.93	99.77
Cations per 12 O																					
Si	2.985	2.970	2.981	2.982	2.988	3.017	3.029	3.026	3.038	3.021	3.027	3.026	3.031	3.007	3.020	3.017	3.031	3.016	3.023	3.026	3.028
Ti	0.007	0.011	0.008	0.007	0.006	0.004	0.006	0.006	0.010	0.010	0.004	0.004	0.002	0.004	0.011	0.010	0.006	0.009	0.002	0.003	0.005
Al	1.931	1.968	1.960	1.969	1.928	1.902	1.898	1.904	1.883	1.899	1.934	1.918	1.935	1.935	1.901	1.911	1.924	1.921	1.928	1.946	1.897
Fe <sup>3+</sup>	0.085	0.081	0.062	0.062	0.083	0.057	0.032	0.032	0.020	0.039	0.004	0.021	0.000	0.043	0.038	0.034	0.004	0.030	0.021	0.000	0.035
Fe <sup>2+</sup>	1.581	1.541	1.511	1.523	1.537	1.560	1.648	1.778	1.803	1.880	1.952	1.994	1.995	1.918	1.821	1.758	1.870	1.940	1.977	1.962	1.825
Mn	0.053	0.047	0.042	0.031	0.034	0.011	0.020	0.035	0.052	0.084	0.118	0.171	0.176	0.228	0.319	0.384	0.218	0.186	0.133	0.079	0.056
Mg	0.426	0.447	0.468	0.472	0.455	0.514	0.439	0.433	0.413	0.354	0.346	0.294	0.262	0.216	0.192	0.169	0.249	0.253	0.317	0.374	0.388
Ca	0.975	0.986	0.999	0.996	1.010	0.964	0.944	0.803	0.791	0.734	0.617	0.583	0.599	0.671	0.718	0.733	0.701	0.660	0.608	0.608	0.782
Total	8.042	8.040	8.031	8.031	8.042	8.029	8.016	8.016	8.010	8.020	8.002	8.011	7.999	8.022	8.019	8.017	8.002	8.015	8.010	7.998	8.018

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>.

Lithology	666A13 666B4-big																				
Sample No.	rim								core												
Analysis No.	17	18	2	3	4	5	6	7	8	9	10	11	12	13	14	21	25	29	31	35	44
SiO <sub>2</sub>	38.27	38.01	38.11	38.45	37.94	38.17	38.05	38.22	37.44	37.18	37.67	37.86	37.75	38.12	38.20	38.07	38.21	38.49	38.37	38.02	38.07
TiO <sub>2</sub>	0.05	0.20	0.27	0.13	0.14	0.27	0.20	0.26	0.21	0.24	0.25	0.13	0.14	0.07	0.06	0.11	0.17	0.02	0.27	0.10	0.12
Al <sub>2</sub> O <sub>3</sub>	20.54	20.59	20.52	20.96	20.97	20.73	21.04	20.99	21.02	21.12	21.21	20.98	21.25	21.58	20.97	20.82	20.81	20.81	20.82	20.92	20.80
FeO*	24.37	22.31	22.68	22.53	23.16	23.18	22.60	23.48	23.72	23.61	23.86	24.00	23.61	23.90	25.28	23.21	23.28	23.19	23.19	23.46	23.37
MnO	0.20	2.22	2.26	2.13	2.06	1.37	1.35	1.11	1.01	0.94	0.82	0.73	0.65	0.77	1.28	1.37	1.38	1.45	1.29	0.91	1.14
MgO	4.11	3.24	3.37	3.58	3.09	3.35	3.56	3.57	3.57	3.64	3.59	3.84	3.95	4.15	3.72	3.60	3.58	3.46	3.49	3.65	3.54
CaO	11.31	12.42	12.67	12.46	12.70	12.75	12.55	12.50	12.46	12.48	12.37	12.12	12.16	11.71	10.26	12.39	12.68	12.16	12.44	12.38	12.42
Total	98.84	98.98	99.88	100.24	100.06	99.81	99.34	99.86	99.41	99.11	99.68	99.90	99.23	99.96	100.38	99.72	100.12	99.58	99.86	99.43	99.46
Cations per 12 O																					
Si	3.027	3.013	3.001	3.006	2.986	3.002	2.996	3.002	2.962	2.951	2.968	2.973	2.980	2.985	2.988	2.994	2.996	3.027	3.010	2.997	3.002
Ti	0.003	0.012	0.016	0.008	0.008	0.016	0.012	0.015	0.012	0.014	0.015	0.008	0.008	0.004	0.003	0.006	0.010	0.001	0.016	0.006	0.007
Al	1.915	1.923	1.905	1.932	1.945	1.921	1.953	1.920	1.957	1.966	1.961	1.963	1.952	1.960	1.990	1.944	1.924	1.928	1.925	1.943	1.933
Fe <sup>3+</sup>	0.025	0.026	0.061	0.040	0.067	0.043	0.031	0.045	0.093	0.105	0.073	0.075	0.070	0.062	0.055	0.063	0.015	0.023	0.052	0.049	
Fe <sup>2+</sup>	1.587	1.452	1.433	1.433	1.457	1.481	1.458	1.497	1.477	1.462	1.499	1.501	1.488	1.502	1.627	1.471	1.463	1.510	1.498	1.494	1.492
Mn	0.014	0.149	0.150	0.141	0.138	0.091	0.090	0.074	0.067	0.063	0.055	0.049	0.043	0.051	0.085	0.091	0.092	0.096	0.086	0.061	0.076
Mg	0.484	0.382	0.395	0.417	0.363	0.393	0.418	0.418	0.421	0.431	0.422	0.450	0.464	0.484	0.434	0.421	0.419	0.406	0.409	0.429	0.416
Ca	0.958	1.054	1.069	1.043	1.071	1.074	1.059	1.052	1.056	1.061	1.044	1.020	1.028	0.982	0.860	1.044	1.065	1.024	1.045	1.045	1.049
Total	8.013	8.013	8.031	8.020	8.034	8.022	8.015	8													



**Table 2.** Chemical composition of clinopyroxenes from the T-I type amphibolite (cpx-amphibolite) and the T-II type amphibolite (eclogite).

Rock type	T-I type amphibolite					T-II type amphibolite															
	Lithology					Eclogite					Eclogite										
	Cpx:amp		cpx:amp			Eclogite					Eclogite										
Sample No.	398	398.2nd	398.3rd	477c	641A.G-Cp					666A					666A13						
Analysis No.	32	9	2	40	1	2	42	47	79	83	86	90	92	93	94	35	36	41	42	43	50
SiO <sub>2</sub>	53.41	53.89	52.96	54.05	54.40	54.67	52.41	51.69	53.85	54.24	53.71	51.80	51.98	54.31	54.22	54.70	54.43	54.59	54.58	54.70	54.88
TiO <sub>2</sub>	0.08	0.05	0.06	0.04	0.06	0.14	0.02	0.00	0.20	0.17	0.21	0.08	0.25	0.15	0.17	0.09	0.12	0.15	0.15	0.16	0.16
Al <sub>2</sub> O <sub>3</sub>	1.48	1.86	1.15	2.80	8.35	8.39	2.14	3.17	10.18	10.22	10.15	4.04	7.84	10.85	10.46	9.39	9.38	10.54	9.09	9.62	10.74
FeO*	4.39	4.93	4.80	8.30	7.51	8.07	13.23	12.16	6.97	6.67	6.89	7.93	7.70	6.83	6.99	6.58	6.89	6.40	7.35	6.65	6.99
MnO	0.18	0.13	0.05	0.09	0.22	0.12	0.27	0.23	0.07	0.12	0.11	0.17	0.09	0.03	0.04	0.12	0.06	0.02	0.09	0.10	0.06
MgO	15.26	14.12	15.26	11.78	8.34	8.13	9.30	9.50	7.93	8.03	7.78	11.28	9.52	7.24	7.45	7.66	7.89	6.92	7.77	7.78	6.97
CaO	24.75	23.26	23.93	19.22	13.47	13.32	19.16	18.46	14.12	14.24	14.04	20.36	18.13	13.08	13.61	14.12	14.24	12.77	14.00	13.77	12.65
Na <sub>2</sub> O	0.86	1.83	0.95	3.89	6.80	6.65	3.33	3.77	6.67	6.75	6.49	3.06	4.39	7.02	6.87	6.44	6.39	7.13	6.46	6.73	7.15
Cr <sub>2</sub> O <sub>3</sub>	0.06	0.34	0.24	0.11	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.03	0.01	0.02	0.01	0.00	0.00
Total	100.47	100.41	99.39	100.29	99.15	99.49	99.85	99.00	100.01	100.43	99.39	98.71	99.91	99.53	99.80	99.13	99.41	98.54	99.50	99.50	99.61
Cations per 6 oxygens																					
Si	1.959	1.977	1.965	2.000	1.995	1.999	1.996	1.976	1.954	1.958	1.959	1.952	1.918	1.970	1.967	1.994	1.983	1.993	1.990	1.987	1.986
Ti	0.002	0.001	0.002	0.001	0.002	0.004	0.001	0.000	0.006	0.005	0.006	0.002	0.007	0.004	0.004	0.003	0.004	0.003	0.004	0.004	0.004
Al	0.064	0.080	0.050	0.122	0.361	0.362	0.096	0.143	0.435	0.435	0.436	0.179	0.341	0.464	0.447	0.403	0.403	0.454	0.391	0.412	0.458
Fe <sup>3+</sup>	0.074	0.093	0.084	0.156	0.129	0.104	0.157	0.184	0.114	0.113	0.093	0.135	0.122	0.081	0.093	0.058	0.075	0.056	0.077	0.079	0.062
Fe <sup>2+</sup>	0.061	0.059	0.065	0.101	0.102	0.143	0.265	0.204	0.097	0.088	0.117	0.115	0.115	0.126	0.119	0.142	0.135	0.139	0.147	0.123	0.150
Mn	0.006	0.004	0.002	0.003	0.007	0.004	0.009	0.008	0.002	0.004	0.003	0.005	0.003	0.001	0.001	0.004	0.002	0.001	0.003	0.003	0.002
Mg	0.835	0.773	0.844	0.650	0.466	0.443	0.528	0.542	0.429	0.432	0.423	0.633	0.523	0.392	0.403	0.416	0.428	0.377	0.423	0.421	0.376
Ca	0.973	0.914	0.951	0.762	0.529	0.522	0.782	0.756	0.549	0.550	0.549	0.822	0.717	0.509	0.529	0.551	0.556	0.499	0.547	0.536	0.491
Na	0.061	0.130	0.068	0.279	0.484	0.472	0.246	0.279	0.469	0.472	0.469	0.223	0.314	0.494	0.483	0.455	0.451	0.505	0.457	0.474	0.502
Cr	0.002	0.010	0.007	0.003	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
Total	4.036	4.041	4.038	4.076	4.064	4.052	4.078	4.092	4.057	4.056	4.046	4.068	4.061	4.041	4.046	4.029	4.037	4.028	4.038	4.039	4.031

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>

Rock type	T-II type amphibolite																				
	Lithology																				
	Eclogite																				
Sample No.	666A13 666B4-big																				
Analysis No.	51	17	18	19	20	26	27	28	34	39	41	43	45	47	48	49	53	57	60	61	65
SiO <sub>2</sub>	55.01	53.89	54.32	53.74	53.79	55.30	54.87	55.76	54.35	54.59	54.49	55.03	55.11	53.99	53.92	54.83	54.88	54.26	54.83	54.63	53.32
TiO <sub>2</sub>	0.17	0.19	0.16	0.22	0.20	0.11	0.14	0.10	0.11	0.16	0.26	0.13	0.15	0.16	0.19	0.09	0.12	0.17	0.09	0.15	0.14
Al <sub>2</sub> O <sub>3</sub>	10.47	9.92	9.91	10.12	10.25	11.23	9.24	10.50	9.43	9.47	9.21	10.77	10.96	8.83	9.31	7.37	8.75	9.23	9.24	8.81	9.54
FeO*	6.79	7.02	6.80	7.21	7.01	6.45	6.95	5.93	7.43	7.36	7.27	6.91	6.64	7.42	7.23	7.56	7.14	7.04	6.64	7.19	7.29
MnO	0.03	0.09	0.03	0.07	0.00	0.02	0.06	0.04	0.10	0.01	0.11	0.07	0.10	0.02	0.03	0.04	0.10	0.06	0.09	0.05	0.05
MgO	7.27	7.90	7.93	7.62	7.69	7.01	8.00	7.25	8.10	7.63	8.00	7.13	6.93	8.12	7.77	9.00	8.12	7.78	7.98	8.12	7.89
CaO	13.04	14.06	13.74	13.90	13.81	12.51	14.09	12.97	13.92	13.70	13.68	12.65	12.68	14.39	13.97	15.49	14.63	14.00	13.80	14.30	13.53
Na <sub>2</sub> O	6.86	6.31	6.61	6.38	6.49	7.31	6.47	7.22	6.79	6.62	6.35	7.05	7.15	6.38	6.39	5.85	6.12	6.73	6.76	6.36	6.73
Cr <sub>2</sub> O <sub>3</sub>	0.02	0.01	0.00	0.00	0.04	0.02	0.01	0.07	0.01	0.08	0.01	0.01	0.01	0.05	0.00	0.02	0.00	0.04	0.04	0.03	0.02
Total	99.66	99.39	99.50	99.26	99.27	99.96	99.82	99.84	100.24	99.62	99.37	99.75	99.73	99.36	98.82	100.24	99.86	99.41	99.46	99.62	98.51
Cations per 6 oxygens																					
Si	1.989	1.965	1.975	1.964	1.963	1.987	1.990	2.003	1.971	1.986	1.987	1.987	1.988	1.978	1.980	1.995	1.994	1.981	1.994	1.990	1.967
Ti	0.005	0.005	0.004	0.006	0.005	0.003	0.004	0.003	0.003	0.004	0.007	0.003	0.004	0.004	0.005	0.002	0.003	0.005	0.002	0.004	0.004
Al	0.446	0.426	0.424	0.436	0.441	0.476	0.395	0.445	0.403	0.406	0.396	0.458	0.466	0.381	0.403	0.316	0.375	0.397	0.396	0.378	0.415
Fe <sup>3+</sup>	0.047	0.078	0.083	0.077	0.082	0.054	0.073	0.046	0.126	0.080	0.065	0.054	0.050	0.108	0.082	0.101	0.062	0.108	0.089	0.083	0.125
Fe <sup>2+</sup>	0.158	0.136	0.124	0.143	0.132	0.140	0.138	0.132	0.100	0.144	0.156	0.154	0.151	0.119	0.140	0.129	0.154	0.107	0.113	0.136	0.099
Mn	0.001	0.003	0.001	0.002	0.000	0.001	0.002	0.001	0.003	0.000	0.003	0.002	0.003	0.000	0.001	0.001	0.003	0.002	0.003	0.001	0.001
Mg	0.392	0.430	0.430	0.415	0.418	0.376	0.432	0.388	0.438	0.414	0.435	0.384	0.373	0.443	0.425	0.488	0.440	0.429	0.432	0.441	0.434
Ca	0.505	0.549	0.535	0.544	0.540	0.481	0.548	0.499	0.541	0.534	0.534	0.489	0.490	0.565	0.549	0.604	0.569	0.548	0.537	0.558	0.535
Na	0.481	0.446	0.466	0.452	0.459	0.509	0.455	0.503	0.478	0.467	0.449	0.494	0.500	0.453	0.455	0.413	0.431	0.476	0.476	0.449	0.482
Cr	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000
Total	4.023	4.039	4.041	4.038	4.040	4.027	4.036	4.022	4.063	4.039	4.033	4.027	4.025	4.053	4.041	4.050	4.031	4.053	4.044	4.041	4.062

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>

Rock type	T-II type amphibolite									
	Lithology									
	Eclogite									
Sample No.	666B4-big									
Analysis No.	66	68	69	71	72	1	3	20	21	22
SiO <sub>2</sub>	54.17	54.41	54.87	53.78	53.80	55.48	54.72	52.74	54.30	54.69
TiO <sub>2</sub>	0.10	0.10	0.14	0.12	0.16	0.16	0.34	0.02	0.15	0.17
Al <sub>2</sub> O <sub>3</sub>	9.93	8.90	10.54	9.07	9.67	10.61	11.17	1.60	9.90	10.84
FeO*	6.69	6.63	6.68	6.98	7.29	6.81	7.00	11.48	7.36	6.79
MnO	0.01	0.03	0.09	0.07	0.05	0.00	0.12	0.24	0.01	0.04
MgO	7.69	8.38	7.62	8.12	7.72	7.13	6.75	10.02	7.54	6.97
CaO	13.39	14.39	13.26	14.10	13.67	13.13	12.52	19.43	13.73	12.49
Na <sub>2</sub> O										

Table 3. Chemical composition of amphiboles from the T-I type and the T-II type amphibolites.

Rock type	T-I type amphibolite																				
Lithology	cpx:amp																				
Sample No.	398.2nd																				
Analysis No.	24	25	26	27	28	33	34	38	40	42	47	48	49	5	8	11	12	13	14	15	16
SiO <sub>2</sub>	46.38	48.83	48.33	47.52	49.45	52.92	48.74	44.93	45.29	47.28	46.24	53.54	48.38	49.55	49.17	47.99	51.73	47.70	46.87	46.01	45.67
TiO <sub>2</sub>	0.24	0.15	0.17	0.21	0.27	0.09	0.26	0.57	0.48	0.17	0.28	0.04	0.16	0.23	0.30	0.25	0.11	0.31	0.42	0.36	0.38
Al <sub>2</sub> O <sub>3</sub>	9.14	7.35	7.79	8.26	7.18	3.72	8.20	11.49	10.89	8.94	9.59	3.26	8.04	7.41	8.05	8.91	5.29	9.00	9.28	10.23	10.20
FeO*	8.19	8.31	7.87	8.02	6.94	5.83	7.28	8.70	8.96	8.35	8.58	5.95	7.87	7.09	7.09	7.69	6.34	8.10	8.25	8.62	8.78
MnO	0.16	0.22	0.18	0.13	0.08	0.09	0.14	0.11	0.12	0.17	0.17	0.11	0.15	0.12	0.19	0.18	0.11	0.13	0.22	0.18	0.13
MgO	16.59	17.07	17.44	17.25	18.36	19.83	17.41	15.55	15.79	16.78	16.20	19.84	17.61	17.62	17.16	16.88	18.61	16.82	16.24	15.76	15.97
CaO	12.83	12.50	12.47	12.54	12.70	13.22	12.64	12.41	12.39	12.17	12.27	13.07	12.46	12.69	12.54	12.54	12.94	12.36	12.38	12.29	12.24
Na <sub>2</sub> O	2.17	1.83	2.02	2.10	1.88	1.10	1.94	2.36	2.33	2.23	2.20	0.95	2.08	1.79	1.85	2.13	1.39	2.19	2.08	2.18	2.23
K <sub>2</sub> O	0.91	0.65	0.68	0.73	0.56	0.23	0.82	1.37	1.35	0.84	1.10	0.34	0.64	0.61	0.66	0.76	0.43	0.95	1.13	1.34	1.32
Cr <sub>2</sub> O <sub>3</sub>	0.36	0.46	0.39	0.28	0.21	0.01	0.16	0.16	0.16	0.24	0.15	0.09	0.16	0.37	0.56	0.17	0.18	0.22	0.24	0.18	0.17
Total	96.95	97.37	97.33	97.04	97.63	97.03	97.57	97.64	97.75	97.17	96.86	97.19	97.54	97.46	97.58	97.49	97.11	97.79	97.11	97.13	97.09
Cation per 23 oxygens																					
Si	6.759	7.038	6.953	6.869	7.037	7.487	6.978	6.530	6.570	6.823	6.737	7.561	6.916	7.080	7.023	6.898	7.354	6.851	6.807	6.705	6.652
Ti	0.026	0.016	0.018	0.023	0.029	0.009	0.028	0.062	0.052	0.018	0.031	0.005	0.017	0.024	0.032	0.027	0.012	0.033	0.046	0.039	0.041
Al	1.570	1.248	1.320	1.407	1.205	0.620	1.383	1.968	1.862	1.521	1.647	0.543	1.355	1.247	1.356	1.509	0.885	1.524	1.588	1.756	1.751
Fe <sup>3+</sup>	0.000	0.000	0.071	0.107	0.101	0.033	0.000	0.009	0.084	0.172	0.095	0.019	0.216	0.000	0.000	0.000	0.000	0.045	0.000	0.000	0.110
Fe <sup>2+</sup>	0.997	1.001	0.877	0.864	0.727	0.657	0.872	1.048	1.004	0.839	0.953	0.683	0.730	0.847	0.847	0.924	0.754	0.929	1.002	1.050	0.963
Mn	0.019	0.027	0.022	0.016	0.009	0.011	0.017	0.013	0.015	0.020	0.021	0.013	0.018	0.014	0.023	0.022	0.013	0.016	0.027	0.022	0.017
Mg	3.603	3.668	3.740	3.716	3.895	4.182	3.716	3.370	3.414	3.610	3.519	4.177	3.753	3.753	3.655	3.617	3.944	3.602	3.517	3.424	3.469
Ca	2.003	1.931	1.922	1.941	1.937	2.003	1.933	1.925	1.882	1.915	1.977	1.908	1.943	1.919	1.931	1.971	1.903	1.926	1.918	1.911	1.911
Na	0.612	0.512	0.564	0.590	0.518	0.302	0.537	0.666	0.654	0.624	0.620	0.261	0.575	0.496	0.512	0.593	0.382	0.611	0.587	0.615	0.629
K	0.168	0.119	0.124	0.134	0.102	0.041	0.149	0.253	0.250	0.154	0.222	0.060	0.117	0.111	0.120	0.138	0.078	0.173	0.209	0.249	0.245
Cr	0.042	0.052	0.045	0.032	0.023	0.001	0.018	0.018	0.018	0.027	0.017	0.010	0.019	0.041	0.064	0.019	0.020	0.024	0.028	0.021	0.019
Total	15.800	15.612	15.656	15.699	15.582	15.348	15.637	15.870	15.850	15.691	15.776	15.309	15.623	15.556	15.551	15.677	15.412	15.712	15.737	15.799	15.805
*Total Fe as FeO + Fe <sub>2</sub> O <sub>3</sub>																					

Rock type	T-I type amphibolite																				
Lithology	cpx:amp																				
Sample No.	398.2nd																				
Analysis No.	17	18	19	20	22	6	10	11	21	10	15	31	1	2	4	5	6	8	12	13	16
SiO <sub>2</sub>	47.30	52.20	49.63	46.81	49.40	47.91	49.34	49.02	47.08	45.48	44.52	44.73	45.63	45.60	47.52	49.95	46.58	46.31	46.81	45.96	45.03
TiO <sub>2</sub>	0.26	0.07	0.16	0.30	0.27	0.31	0.24	0.23	0.28	0.42	0.28	0.33	0.33	0.33	0.33	0.22	0.37	0.35	0.34	0.36	0.42
Al <sub>2</sub> O <sub>3</sub>	9.07	4.75	7.06	9.56	7.33	8.47	7.16	7.49	9.34	10.40	11.18	11.10	12.00	10.71	9.73	7.74	11.30	10.99	10.76	11.15	11.80
FeO*	8.25	6.15	7.35	8.20	7.67	7.09	7.69	6.34	8.25	8.58	9.67	9.94	6.33	5.88	5.68	5.21	6.07	6.35	5.71	6.62	6.97
MnO	0.19	0.19	0.16	0.13	0.14	0.14	0.13	0.19	0.15	0.20	0.13	0.19	0.18	0.18	0.18	0.15	0.08	0.11	0.19	0.14	0.14
MgO	16.53	18.97	17.76	16.59	17.34	17.02	17.60	17.89	16.58	15.92	15.46	15.43	17.00	17.56	17.92	18.59	17.01	17.17	17.75	17.26	16.81
CaO	12.56	12.70	12.59	12.47	12.55	12.41	12.45	12.56	12.59	12.42	12.12	12.17	11.23	11.18	11.10	10.85	10.98	11.12	11.13	11.23	11.41
Na <sub>2</sub> O	2.13	1.40	1.83	2.20	1.79	2.04	1.82	1.88	2.14	2.64	2.99	2.63	3.71	3.45	3.48	3.30	3.76	3.65	3.62	3.80	3.96
K <sub>2</sub> O	1.04	0.45	0.60	0.84	0.66	0.89	0.68	0.89	0.78	0.93	1.10	1.10	0.59	0.54	0.52	0.42	0.61	0.54	0.52	0.49	0.51
Cr <sub>2</sub> O <sub>3</sub>	0.09	0.07	0.13	0.23	0.12	0.82	0.64	0.55	0.81	0.18	0.16	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Total	97.41	96.96	97.25	97.33	97.24	97.09	97.73	97.06	97.94	96.98	97.82	97.64	97.05	95.42	96.46	96.45	96.83	96.56	96.75	97.07	97.03
Cation per 23 oxygens																					
Si	6.842	7.419	7.104	6.761	7.087	6.888	7.068	7.003	6.782	6.643	6.480	6.501	6.532	6.607	6.800	7.101	6.673	6.653	6.681	6.561	6.486
Ti	0.028	0.008	0.017	0.033	0.029	0.034	0.026	0.025	0.031	0.046	0.031	0.036	0.036	0.035	0.024	0.040	0.038	0.036	0.039	0.046	0.046
Al	1.546	0.796	1.190	1.627	1.239	1.435	1.209	1.262	1.586	1.789	1.918	1.901	2.024	1.828	1.640	1.296	1.907	1.861	1.810	1.881	2.002
Fe <sup>3+</sup>	0.004	0.000	0.048	0.078	0.013	0.000	0.000	0.000	0.000	0.146	0.261	0.251	0.344	0.226	0.164	0.140	0.219	0.254	0.287	0.215	0.215
Fe <sup>2+</sup>	0.993	0.731	0.833	0.914	0.907	0.924	0.892	0.979	1.048	1.035	0.954	0.511	0.374	0.457	0.590	0.547	0.431	0.510	0.628	0.628	0.628
Mn	0.023	0.023	0.019	0.016	0.017	0.015	0.023	0.019	0.019	0.025	0.016	0.023	0.022	0.022	0.021	0.018	0.010	0.013	0.023	0.017	0.017
Mg	3.564	4.020	3.790	3.573	3.708	3.649	3.759	3.809	3.560	3.467	3.354	3.344	3.628	3.794	3.822	3.939	3.634	3.676	3.778	3.685	3.610
Ca	1.946	1.934	1.930	1.929	1.929	1.911	1.911	1.922	1.942	1.943	1.890	1.895	1.722	1.736	1.701	1.653	1.685	1.712	1.702	1.723	1.760
Na	0.597	0.387	0.507	0.615	0.497	0.568	0.504	0.521	0.597	0.747	0.845	0.740	1.029	0.970	0.966	0.910	1.045	1.016	1.003	1.056	1.106
K	0.192	0.082	0.109	0.155	0.120	0.163	0.125	0.163	0.144	0.174	0.203	0.203	0.108	0.100	0.095	0.075	0.111	0.099	0.094	0.089	0.093
Cr	0.010	0.007	0.015	0.027	0.013	0.093	0.072	0.062	0.092	0.021	0.018	0.014	0.003	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000
Total	15.745	15.406	15.562	15.728	15.560	15.681	15.580	15.652	15.725	15.882	15.961	15.859	15.866	15.811	15.765	15.640	15.843	15.830	15.802	15.873	15.963
*Total Fe as FeO + Fe <sub>2</sub> O <sub>3</sub>																					

Rock type	T-I type amphibolite																			T-II type amphibolite							
Lithology	cpx:amp																			Ep:Amf							
Sample No.	765																			264.2nd				455B			
Analysis No.	18	19	26	29	30	31	39	42	43	46	47	48	25	43	44	18	28	2	3	4	5						
SiO <sub>2</sub>	48.97	46.96	45.91	44.81	46.99	44.75	46.30	47.37	48.88	44.80	46.77	45.99	42.01	42.21	41.69	44.06	41.74	46.63	44.89	48.45	44.99						
TiO <sub>2</sub>	0.25	0.35	0.36	0.41	0.35	0.38	0.37	0.36	0.28	0.43	0.38	0.41	0.48	0.39	0.43	0.32	0.89	0.45	0.54	0.38	0.48						
Al <sub>2</sub> O <sub>3</sub>	8.67	10.20	10.84	11.42	10.76	12.21	10.84	10.69	9.03	12.01	11.31	11.52	15.07	14.80	15.30	12.50	15.07	12.10	13.14	10.17	13.18						
FeO*	5.72	6.42	6.75	7.05	5.72	7.25	6.69	6.03	5.53	6.82	5.96	6.68	16.59	16.97	17.26	16.64	16.07	10.73									

Table 3. (Continued)

Rock type	T-II type amphibolite																								
Lithology	Ep-Amp																								
Sample No.	525A					525.2nd					671A.1st					700					767A2				
Analysis No.	21	19	21	35	36	37	38	44	21	23	24	30	34	35	36	37	39	41	43	18	21				
SiO <sub>2</sub>	43.11	43.90	45.63	42.55	42.95	45.41	43.36	41.75	41.65	43.50	42.20	41.55	46.29	41.96	43.31	42.80	41.69	41.29	50.98	41.88	42.35				
TiO <sub>2</sub>	0.52	0.33	0.39	0.40	0.35	0.23	0.32	0.51	0.55	0.40	0.44	0.48	0.34	0.50	0.48	0.39	0.47	0.51	0.18	0.49	0.57				
Al <sub>2</sub> O <sub>3</sub>	15.61	14.97	13.40	14.89	13.91	11.43	14.32	15.09	15.85	14.44	15.52	16.31	11.66	15.70	14.51	15.38	16.07	16.29	6.64	15.78	15.49				
FeO*	12.97	13.93	11.98	15.01	15.21	14.30	14.75	15.53	15.38	14.82	14.94	14.97	13.78	15.17	14.32	15.05	15.43	15.51	12.41	14.30	15.20				
MnO	0.26	0.23	0.22	0.20	0.27	0.22	0.24	0.28	0.22	0.33	0.24	0.22	0.30	0.27	0.29	0.27	0.34	0.29	0.30	0.14	0.15				
MgO	10.03	10.02	11.33	10.18	10.79	11.99	10.35	9.87	9.20	9.87	9.36	8.99	11.65	9.57	9.89	9.48	9.06	8.89	14.14	9.68	9.74				
CaO	10.84	10.94	10.97	10.42	10.34	10.26	10.30	10.24	10.21	10.16	10.33	10.34	9.85	9.96	10.19	10.21	10.16	10.07	9.61	10.62	10.41				
Na <sub>2</sub> O	2.49	2.67	2.46	3.04	2.81	2.52	2.97	2.95	2.89	2.69	2.82	2.96	2.57	2.91	2.70	2.72	3.01	2.84	1.99	3.10	2.78				
K <sub>2</sub> O	0.56	0.49	0.38	0.47	0.46	0.25	0.44	0.54	0.61	0.48	0.54	0.64	0.32	0.58	0.49	0.46	0.61	0.64	0.20	0.38	0.34				
Cr <sub>2</sub> O <sub>3</sub>	0.20	0.00	0.04	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.00				
Total	96.58	97.48	96.78	97.17	97.09	96.62	97.06	96.76	96.58	96.68	96.39	96.46	96.76	96.63	96.16	96.76	96.84	96.31	96.45	96.37	97.02				
Cation per 23 oxygens	6.375	6.443	6.680	6.265	6.299	6.627	6.373	6.177	6.187	6.412	6.272	6.191	6.729	6.197	6.419	6.311	6.182	6.147	7.310	6.232	6.229				
Si	0.058	0.037	0.042	0.045	0.038	0.025	0.035	0.057	0.061	0.044	0.049	0.054	0.037	0.056	0.053	0.043	0.052	0.057	0.020	0.055	0.062				
Al	2.721	2.589	2.312	2.583	2.405	1.966	2.480	2.632	2.774	2.508	2.718	2.864	1.997	2.732	2.533	2.673	2.808	2.858	1.123	2.768	2.685				
Fe <sup>3+</sup>	0.092	0.163	0.022	0.555	0.788	0.754	0.528	0.710	0.526	0.512	0.435	0.367	0.618	0.664	0.420	0.530	0.516	0.584	0.677	0.304	0.595				
Fe <sup>2+</sup>	1.515	1.552	1.444	1.315	1.110	1.020	1.307	1.242	1.407	1.335	1.440	1.514	1.079	1.237	1.370	1.347	1.419	1.371	0.833	1.488	1.299				
Mn	0.033	0.029	0.027	0.025	0.034	0.027	0.029	0.035	0.028	0.041	0.030	0.027	0.037	0.034	0.037	0.034	0.042	0.036	0.036	0.018	0.019				
Mg	2.210	2.193	2.473	2.235	2.359	2.610	2.269	2.178	2.038	2.168	2.074	1.998	2.525	2.108	2.184	2.083	2.003	1.972	3.023	2.147	2.135				
Ca	1.717	1.719	1.721	1.643	1.625	1.604	1.623	1.623	1.626	1.605	1.645	1.650	1.534	1.575	1.617	1.613	1.614	1.605	1.476	1.693	1.640				
Na	0.714	0.759	0.697	0.869	0.799	0.713	0.847	0.845	0.831	0.769	0.813	0.854	0.723	0.834	0.774	0.777	0.864	0.818	0.552	0.893	0.794				
K	0.105	0.092	0.071	0.088	0.085	0.047	0.083	0.101	0.115	0.089	0.103	0.122	0.060	0.108	0.092	0.087	0.116	0.122	0.037	0.071	0.064				
Cr	0.023	0.000	0.004	0.000	0.000	0.002	0.000	0.000	0.002	0.000	0.000	0.001	0.000	0.002	0.001	0.000	0.000	0.000	0.001	0.000	0.000				
Total	15.562	15.576	15.494	15.623	15.542	15.396	15.574	15.599	15.595	15.484	15.578	15.642	15.341	15.547	15.500	15.498	15.616	15.570	15.087	15.670	15.522				

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>

Rock type	T-II type amphibolite																				
Lithology	Ep-Amp																				
Sample No.	767A2																				
Analysis No.	26	28	29	45	5	6	7	8	9	10	13	14	15	16	17	26	27	28	31	34	4
SiO <sub>2</sub>	53.80	46.05	42.33	42.02	49.58	51.39	50.59	47.23	45.02	43.87	46.40	45.67	47.45	45.63	43.20	46.18	46.21	45.52	46.04	44.18	42.65
TiO <sub>2</sub>	0.02	0.33	0.44	0.52	0.22	0.12	0.14	0.23	0.34	0.38	0.31	0.26	0.30	0.37	0.45	0.45	0.47	0.50	0.32	0.45	0.49
Al <sub>2</sub> O <sub>3</sub>	1.32	12.04	15.28	16.00	7.06	4.97	6.22	8.82	10.41	11.28	9.15	10.35	8.98	10.31	12.19	9.69	10.09	10.67	9.70	10.91	15.53
FeO*	12.90	14.03	15.11	15.63	9.65	8.63	9.65	10.82	11.97	12.92	11.26	11.58	10.53	11.51	12.79	10.93	10.92	11.71	12.22	12.02	14.54
MnO	0.36	0.11	0.22	0.15	0.19	0.17	0.13	0.18	0.20	0.13	0.19	0.23	0.18	0.13	0.13	0.19	0.14	0.15	0.16	0.18	0.27
MgO	15.28	11.54	9.70	9.35	15.97	17.29	16.54	14.98	13.93	12.83	14.83	14.09	15.10	14.22	12.87	14.51	14.20	13.95	14.36	13.48	9.83
CaO	12.74	10.07	10.27	10.10	12.45	12.34	11.87	11.87	11.90	12.01	12.15	11.57	11.86	12.00	11.79	11.98	12.03	11.97	11.96	11.89	10.30
Na <sub>2</sub> O	0.38	2.51	2.69	2.83	1.61	1.15	1.50	1.94	2.39	2.57	2.05	2.06	1.92	2.25	2.53	2.02	1.92	2.10	2.19	2.16	2.89
K <sub>2</sub> O	0.11	0.27	0.36	0.38	0.43	0.38	0.48	0.69	0.70	0.71	0.56	1.03	0.67	0.67	0.84	0.64	0.72	0.72	0.56	0.83	0.31
Cr <sub>2</sub> O <sub>3</sub>	0.00	0.01	0.00	0.02	0.01	0.00	0.02	0.04	0.09	0.01	0.00	0.00	0.03	0.01	0.00	0.06	0.02	0.02	0.01	0.18	0.00
Total	96.90	96.95	96.38	97.00	97.17	96.44	97.14	96.79	96.96	96.70	96.89	96.83	97.01	97.10	96.79	96.66	96.71	97.29	97.52	96.26	96.81
Cation per 23 oxygens	7.836	6.689	6.256	6.179	7.154	7.384	7.239	6.873	6.613	6.518	6.771	6.675	6.875	6.666	6.390	6.755	6.760	6.636	6.689	6.562	6.275
Si	0.002	0.036	0.049	0.058	0.024	0.013	0.015	0.025	0.038	0.042	0.033	0.028	0.032	0.041	0.050	0.049	0.051	0.054	0.035	0.050	0.055
Al	0.226	2.061	2.662	2.774	1.200	0.842	1.048	1.513	1.802	1.975	1.573	1.783	1.534	1.775	2.125	1.671	1.740	1.833	1.661	1.906	2.692
Fe <sup>3+</sup>	0.000	0.596	0.640	0.686	0.066	0.176	0.294	0.301	0.309	0.202	0.336	0.413	0.296	0.289	0.375	0.253	0.179	0.313	0.444	0.275	0.516
Fe <sup>2+</sup>	1.572	1.130	1.253	1.265	1.101	0.865	0.869	1.024	1.171	1.411	1.048	1.015	0.988	1.126	1.219	1.092	1.162	1.124	1.055	1.224	1.293
Mn	0.045	0.013	0.028	0.019	0.023	0.021	0.016	0.022	0.025	0.016	0.023	0.028	0.022	0.016	0.017	0.023	0.017	0.018	0.019	0.023	0.034
Mg	3.318	2.498	2.138	2.049	3.436	3.704	3.527	3.249	3.051	2.842	3.225	3.070	3.261	3.097	2.837	3.165	3.096	3.031	3.111	2.979	2.155
Ca	1.987	1.567	1.626	1.591	1.924	1.899	1.819	1.851	1.872	1.912	1.899	1.811	1.842	1.879	1.868	1.877	1.886	1.870	1.862	1.889	1.624
Na	0.106	0.707	0.769	0.807	0.451	0.319	0.417	0.546	0.680	0.740	0.579	0.583	0.539	0.636	0.725	0.574	0.545	0.593	0.617	0.620	0.826
K	0.020	0.049	0.067	0.072	0.080	0.070	0.088	0.128	0.132	0.134	0.105	0.192	0.123	0.125	0.159	0.119	0.135	0.134	0.104	0.156	0.058
Cr	0.000	0.001	0.000	0.002	0.001	0.000	0.003	0.004	0.010	0.001	0.000	0.000	0.003	0.001	0.000	0.007	0.002	0.002	0.001	0.020	0.000
Total	15.112	15.347	15.488	15.501	15.457	15.293	15.334	15.538	15.704	15.795	15.593	15.599	15.516	15.650	15.765	15.584	15.573	15.608	15.598	15.694	15.528

\*Total Fe as FeO + Fe<sub>2</sub>O<sub>3</sub>

Rock type	T-II type amphibolite										T-II type amphibolite										
Lithology	Ep-Amp										Eclogite										
Sample No.	797					666B4-big					666B4*					666A13					
Analysis No.	9	10	16	21	26	27	37	16	32	55	21	22	27	33	5	24	25	16	1	23	24
SiO <sub>2</sub>	45.36	42.59	41.93	41.94	47.63	42.69	42.42	36.11	36.93	35.96	57.38	50.89	39.60	55.53	37.42	44.36	45.08	39.20	57.46	40.62	38.34
TiO <sub>2</sub>	0.39	0.48	0.54	0.47	0.29	0.44	0.51	0.28	0.34	0.16	0.00	0.01	0.85	0.06	0.11	0.11	0.11	0.16	0.01	0.32	0.16
Al <sub>2</sub> O <sub>3</sub>	12.88	15.51	16.15	16.14	10.86	15.56	16.09	19.58	19.67	21.15	9.50	7.11	17.18	9.73	19.97	15.26	14.72	18.93	10.67	14.67	16.47
FeO*	13.63	14.35	15.10	15.18	13.67	14.70	15.35	21.49	17.94	17.90	12.64	16.35	20.06	13.4							





Table 5. Chemical composition of white micas from the T-II type amphibolite (epidote-amphibolite and eclogite).

Rock type	T-II amphibolite																				
Lithology	Ep-Amp																				
Sample No.	264.3nd	455B	525A				525A.2nd			671A.1st			671A.2nd								
Analysis No.	37	10	11	17	18	17	18	8	9	23	24	25	26	42	46	47	48	70	41	42	43
SiO <sub>2</sub>	45.09	47.46	47.94	46.93	47.13	47.30	47.41	46.65	47.02	46.51	45.68	46.00	46.00	45.20	46.21	47.01	47.23	46.89	46.15	45.26	45.54
TiO <sub>2</sub>	0.16	0.35	0.26	0.65	0.55	0.62	0.65	0.14	0.02	0.11	0.55	0.12	0.58	0.52	0.16	0.23	0.34	0.42	0.51	0.49	0.45
Al <sub>2</sub> O <sub>3</sub>	38.58	26.13	25.32	32.10	31.30	31.28	31.41	37.92	38.37	38.05	31.93	38.93	32.30	32.06	38.07	38.00	37.72	30.39	30.44	32.56	30.94
FeO*	1.17	4.78	4.83	1.73	1.80	1.56	1.71	0.90	0.68	1.12	2.94	0.88	2.46	2.78	0.95	0.73	0.92	3.64	2.75	2.56	2.72
MnO	0.05	0.00	0.00	0.00	0.00	0.06	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.04	0.00	0.06	0.03	0.03	0.00
MgO	0.09	2.85	2.98	1.85	1.98	1.85	1.90	0.13	0.13	0.17	1.45	0.07	1.26	1.28	0.18	0.23	0.34	1.96	1.77	1.10	1.58
CaO	0.65	0.06	0.01	0.00	0.01	0.00	0.00	0.18	0.20	0.26	0.00	0.44	0.03	0.00	0.29	0.19	0.23	0.08	0.02	0.02	0.04
Na <sub>2</sub> O	6.37	0.19	0.12	0.72	0.68	0.96	0.95	6.91	5.41	5.27	1.48	6.00	1.83	1.80	5.69	5.88	6.39	1.02	1.42	1.84	1.22
K <sub>2</sub> O	0.69	11.28	11.14	10.19	10.31	10.49	10.53	0.89	0.85	1.56	9.15	1.19	8.98	9.11	1.29	0.69	0.88	9.56	10.79	9.90	10.86
Cr <sub>2</sub> O <sub>3</sub>	0.00	0.17	0.39	0.02	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Total	92.84	93.27	93.01	94.18	93.75	94.15	94.55	93.73	92.70	93.04	93.20	93.61	93.45	92.78	92.86	93.00	94.05	94.00	93.88	93.77	93.34
Cations per 2 O																					
Si	5.938	6.629	6.708	6.334	6.396	6.401	6.390	6.074	6.133	6.090	6.260	5.993	6.268	6.228	6.063	6.124	6.115	6.395	6.340	6.194	6.293
Ti	0.016	0.037	0.027	0.066	0.056	0.063	0.066	0.014	0.002	0.010	0.057	0.012	0.059	0.054	0.015	0.023	0.033	0.043	0.052	0.050	0.046
Al	5.987	4.301	4.176	5.105	5.005	4.987	4.990	5.819	5.898	5.872	5.156	5.977	5.187	5.205	5.886	5.835	5.755	4.884	4.929	5.252	5.038
Fe <sup>2+</sup>	0.129	0.558	0.565	0.196	0.204	0.176	0.193	0.098	0.074	0.122	0.337	0.096	0.280	0.321	0.104	0.079	0.100	0.415	0.315	0.293	0.315
Mn	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.003	0.000	0.000	0.000	0.001	0.005	0.000	0.007	0.004	0.004	0.000
Mg	0.017	0.593	0.622	0.373	0.401	0.373	0.381	0.025	0.026	0.033	0.296	0.013	0.255	0.263	0.034	0.045	0.065	0.398	0.363	0.225	0.324
Ca	0.092	0.010	0.002	0.000	0.001	0.000	0.000	0.025	0.027	0.037	0.000	0.061	0.005	0.000	0.041	0.026	0.032	0.011	0.003	0.002	0.006
Na	1.625	0.052	0.033	0.187	0.179	0.252	0.248	1.743	1.368	1.337	0.392	1.516	0.483	0.480	1.448	1.485	1.605	0.269	0.377	0.487	0.327
K	0.115	2.009	1.988	1.754	1.785	1.811	1.810	0.148	0.142	0.261	1.599	0.197	1.561	1.601	0.216	0.114	0.145	1.663	1.891	1.729	1.914
Cr	0.000	0.019	0.043	0.002	0.000	0.002	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.001	0.000	0.000
Total	13.924	14.206	14.166	14.017	14.027	14.073	14.078	13.948	13.671	13.762	14.100	13.864	14.100	14.155	13.810	13.735	13.849	14.085	14.277	14.238	14.263
*Total Fe as eO																					

Rock type	T-II type amphibolite																				
Lithology	Ep-Amp																				
Sample No.	700				797				666A'						666B2'						
Analysis No.	18	19	26	31	13	14	17	22	28	38	32	35	36	78	82	95	96	99	7	5	10
SiO <sub>2</sub>	46.33	46.40	46.29	46.42	45.39	45.27	46.90	45.93	46.56	45.33	47.36	48.30	47.91	47.19	47.80	48.50	50.53	47.28	48.26	47.85	47.76
TiO <sub>2</sub>	0.53	0.61	0.40	0.55	0.09	0.18	0.08	0.11	0.11	0.14	0.27	0.28	0.34	0.84	0.82	0.35	0.19	0.50	0.40	0.62	0.66
Al <sub>2</sub> O <sub>3</sub>	32.25	32.05	33.11	31.92	38.92	39.50	38.89	36.01	38.53	39.28	27.85	27.26	27.71	29.31	28.95	27.70	25.20	28.12	28.97	28.50	28.88
FeO*	2.62	2.48	2.48	2.51	0.69	0.88	0.98	1.88	0.84	0.86	3.02	3.26	2.41	2.39	2.27	2.28	2.30	2.24	3.10	2.98	2.65
MnO	0.01	0.00	0.06	0.00	0.02	0.00	0.00	0.00	0.03	0.04	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.05
MgO	1.39	1.43	1.29	1.53	0.07	0.10	0.11	1.15	0.16	0.09	2.66	2.82	2.99	2.45	2.71	3.08	4.01	2.80	2.40	2.29	2.29
CaO	0.01	0.03	0.03	0.04	0.68	1.02	0.28	0.31	0.19	0.88	0.02	0.00	0.01	0.02	0.00	0.00	0.00	0.06	0.00	0.03	0.05
Na <sub>2</sub> O	0.98	0.88	1.05	0.95	6.38	5.75	5.86	5.33	5.44	5.79	0.67	0.63	0.78	1.23	1.03	0.71	0.37	0.99	0.50	1.03	1.08
K <sub>2</sub> O	9.32	9.53	9.15	9.62	0.58	0.73	0.94	1.94	0.76	0.81	11.27	11.39	11.19	10.62	10.84	11.29	11.89	10.66	10.81	9.95	9.79
Cr <sub>2</sub> O <sub>3</sub>	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.02	0.00
Total	93.46	93.41	93.84	93.54	92.85	93.43	94.05	92.66	92.61	93.20	93.11	93.95	93.36	94.04	94.41	94.41	93.92	94.49	92.70	93.30	93.20
Cations per 2 O																					
Si	6.304	6.320	6.261	6.320	5.953	5.905	6.061	6.098	6.086	5.927	6.566	6.640	6.600	6.445	6.497	6.632	6.873	6.544	6.558	6.565	6.543
Ti	0.054	0.062	0.041	0.056	0.009	0.018	0.007	0.011	0.011	0.014	0.028	0.029	0.035	0.086	0.083	0.036	0.020	0.052	0.041	0.064	0.068
Al	5.173	5.145	5.279	5.123	6.016	6.073	5.923	5.634	5.936	6.053	4.549	4.417	4.498	4.717	4.638	4.464	4.039	4.587	4.640	4.608	4.663
Fe <sup>2+</sup>	0.298	0.283	0.281	0.286	0.076	0.096	0.106	0.209	0.092	0.094	0.350	0.375	0.278	0.273	0.258	0.261	0.262	0.259	0.353	0.342	0.304
Mn	0.001	0.000	0.006	0.000	0.003	0.000	0.000	0.000	0.003	0.004	0.000	0.002	0.003	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.005
Mg	0.283	0.290	0.260	0.311	0.013	0.019	0.022	0.227	0.030	0.017	0.550	0.577	0.614	0.499	0.548	0.628	0.814	0.578	0.486	0.468	0.468
Ca	0.001	0.004	0.004	0.006	0.096	0.143	0.039	0.044	0.026	0.123	0.002	0.000	0.001	0.003	0.000	0.000	0.000	0.009	0.000	0.005	0.007
Na	0.258	0.231	0.274	0.251	1.621	1.454	1.469	1.371	1.377	1.467	1.180	1.167	1.209	0.325	0.271	0.188	0.098	0.265	0.132	0.274	0.288
K	1.618	1.655	1.578	1.671	0.097	0.121	0.156	0.329	0.126	0.135	1.992	1.997	1.965	1.851	1.879	1.969	2.062	1.883	1.874	1.741	1.710
Cr	0.003	0.000	0.000	0.000	0.003	0.000	0.000	0.002	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.003	0.000	0.002	0.000
Total	13.992	13.989	13.985	14.023	13.887	13.829	13.783	13.923	13.687	13.833	14.218	14.204	14.203	14.198	14.176	14.179	14.168	14.183	14.084	14.073	14.056
*Total Fe as FeO																					

Rock type	T-II type amphibolite											
Lithology	Eclogite						Eclogite					
Sample No.	666B2'		666B3		666A13		666A13.2nd(d)					
Analysis No.	11	26	27	34	35	36	25	26	38	10	22	35
SiO <sub>2</sub>	47.95											



Table 7. (Continued)

Rock type	T-II type amphibolite										
Lithology	Eclogite										
Sample No.	666B4					666A13.2nd(mc)					666B4-big
Analysis No.	53	55	56	63	65	98	103	5	7	18	50
SiO <sub>2</sub>	67.61	68.03	67.12	67.39	67.59	68.23	68.01	67.89	71.33	67.39	66.72
TiO <sub>2</sub>	0.00	0.01	0.02	0.00	0.00	0.03	0.00	0.01	0.01	0.07	0.00
Al <sub>2</sub> O <sub>3</sub>	20.28	19.81	20.09	20.30	19.86	20.09	20.09	19.50	17.34	19.09	20.35
FeO*	0.24	0.25	0.21	0.14	0.23	0.21	0.22	0.41	0.66	0.51	0.21
MnO	0.00	0.03	0.00	0.00	0.03	0.01	0.03	0.10	0.00	0.05	0.00
MgO	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01
CaO	0.99	0.55	1.05	0.82	0.52	0.63	0.77	0.11	0.11	0.59	1.53
Na <sub>2</sub> O	10.79	11.09	10.50	11.09	10.86	11.13	10.63	11.68	10.68	11.17	10.83
K <sub>2</sub> O	0.10	0.09	0.08	0.07	0.09	0.09	0.08	0.10	0.06	0.04	0.05
Cr <sub>2</sub> O <sub>3</sub>	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00
Total	100.01	99.87	99.08	99.81	99.18	100.42	99.86	99.78	100.19	98.92	99.68
Cations per 8 O											
Si	2.958	2.978	2.961	2.955	2.977	2.971	2.974	2.981	3.095	2.985	2.937
Ti	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.002	0.000
Al	1.045	1.022	1.045	1.049	1.031	1.031	1.035	1.009	0.886	0.997	1.056
Fe <sup>3+</sup>	0.009	0.009	0.008	0.005	0.009	0.008	0.008	0.015	0.024	0.019	0.008
Mn	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.004	0.000	0.002	0.000
Mg	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000
Ca	0.046	0.026	0.050	0.038	0.025	0.029	0.036	0.005	0.005	0.028	0.072
Na	0.915	0.941	0.898	0.943	0.927	0.939	0.901	0.994	0.898	0.959	0.924
K	0.006	0.005	0.004	0.004	0.005	0.005	0.005	0.005	0.003	0.002	0.003
Cr	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	4.979	4.983	4.967	4.994	4.974	4.985	4.961	5.014	4.913	4.995	4.999
*Total Fe as FeO											
XAn	0.05	0.03	0.05	0.04	0.03	0.03	0.04	0.01	0.01	0.03	0.07

Table 8. Chemical composition of chlorites from the T-I type and the T-II type amphibolites.

Rock type	T-I type	T-II type amphibolite									
Lithology	Cpx+amp	Ep-Amp									
Sample No.	477c	525A		671A.1st		671A.2m		700.767A2		795	797
Analysis No.	5	16	13	7	43	44	8	29	11	25	31
SiO <sub>2</sub>	28.79	28.98	25.97	26.96	27.14	26.66	26.42	25.59	27.27	29.13	25.44
TiO <sub>2</sub>	0.00	0.01	0.01	0.04	0.04	0.05	0.03	0.07	0.01	0.01	0.02
Al <sub>2</sub> O <sub>3</sub>	19.49	19.46	19.95	20.60	20.38	20.58	20.33	21.39	19.28	18.78	20.36
FeO*	10.23	10.45	26.67	17.81	20.59	20.24	20.08	23.49	23.18	16.21	24.00
MnO	0.22	0.22	0.65	0.31	0.40	0.37	0.48	0.28	0.54	0.21	0.44
MgO	26.92	27.10	13.99	20.93	19.46	18.80	18.67	15.92	16.30	21.60	15.65
CaO	0.08	0.14	0.08	0.03	0.04	0.05	0.00	0.07	0.10	0.36	0.10
Na <sub>2</sub> O	0.03	0.01	0.04	0.03	0.04	0.02	0.00	0.00	0.01	0.07	0.01
K <sub>2</sub> O	0.10	0.09	0.04	0.04	0.03	0.08	0.04	0.01	0.08	0.08	0.03
Cr <sub>2</sub> O <sub>3</sub>	0.21	0.14	0.05	0.00	0.00	0.00	0.01	0.00	0.02	0.07	0.00
Total	86.07	86.61	87.45	86.75	88.11	86.83	86.07	86.83	86.77	86.51	86.04
Cations per 28 O											
Si	5.704	5.711	5.545	5.516	5.545	5.523	5.525	5.395	5.742	5.910	5.445
Ti	0.000	0.002	0.002	0.007	0.006	0.007	0.004	0.011	0.002	0.001	0.004
Al	4.550	4.520	5.020	4.968	4.908	5.024	5.010	5.316	4.785	4.492	5.136
Fe <sup>3+</sup>	1.695	1.722	4.762	3.048	3.518	3.507	3.510	4.141	4.081	2.750	4.296
Mn	0.038	0.036	0.117	0.053	0.069	0.065	0.086	0.049	0.095	0.035	0.079
Mg	7.950	7.962	4.454	6.385	5.928	5.807	5.821	5.003	5.118	6.535	4.995
Ca	0.018	0.030	0.017	0.006	0.009	0.010	0.000	0.017	0.023	0.079	0.022
Na	0.011	0.003	0.016	0.012	0.015	0.009	0.000	0.002	0.005	0.026	0.003
K	0.026	0.023	0.011	0.011	0.009	0.020	0.009	0.004	0.020	0.021	0.008
Cr	0.033	0.022	0.009	0.000	0.000	0.000	0.002	0.000	0.003	0.011	0.001
Total	20.024	20.030	19.952	20.004	20.007	19.972	19.969	19.938	19.875	19.860	19.989
*Total Fe as FeO											
Mg/(Mg+Fe)	0.82	0.82	0.48	0.68	0.63	0.62	0.62	0.55	0.56	0.70	0.54

Table 9. Chemical composition of olivine from the T-I type amphibolite (serpentinite).

Lithology	Serpentinite																
Sample No.	149							477E							839B		
Analysis No.	1	2	3	4	5	6	14	15	18	2	4	9	1	2	3	7	16
SiO <sub>2</sub>	40.90	40.94	40.88	41.16	40.83	40.93	41.12	40.92	40.98	41.93	41.71	41.72	41.04	40.86	40.79	41.16	40.99
TiO <sub>2</sub>	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.05	0.00	0.02	0.02
Al <sub>2</sub> O <sub>3</sub>	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02
FeO*	9.74	10.09	9.81	9.87	10.07	10.04	9.50	9.93	10.10	2.70	3.06	4.34	10.42	10.17	9.81	10.03	9.84
MnO	0.34	0.24	0.24	0.24	0.25	0.23	0.20	0.21	0.21	0.36	0.22	0.30	0.31	0.22	0.39	0.34	0.31
MgO	47.99	47.95	47.62	48.43	47.97	48.13	48.44	47.78	48.06	54.41	54.17	53.93	48.38	47.92	47.92	48.35	47.88
CaO	0.00	0.04	0.00	0.00	0.00	0.01	0.02	0.00	0.01	0.00	0.03	0.04	0.04	0.03	0.02	0.01	0.03
Total	98.97	99.26	98.57	99.70	99.12	99.35	99.28	98.87	99.35	99.39	99.19	100.36	100.19	99.25	98.93	99.91	99.09
Cations per 4 oxygens																	
Si	1.011	1.010	1.014	1.010	1.009	1.009	1.012	1.013	1.010	1.001	0.999	0.994	1.006	1.009	1.010	1.009	1.012
Ti	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Al	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Fe	0.201	0.208	0.204	0.203	0.208	0.207	0.195	0.206	0.208	0.054	0.061	0.087	0.213	0.210	0.203	0.206	0.203
Mn	0.007	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.007	0.004	0.006	0.006	0.005	0.008	0.007	0.006
Mg	1.769	1.765	1.762	1.772	1.768	1.769	1.777	1.763	1.766	1.937	1.935	1.917	1.767	1.764	1.769	1.768	1.763
Ca	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001
Total	2.989	2.990	2.985	2.990	2.991	2.991	2.988	2.987	2.990	2.999	3.001	3.005	2.994	2.990	2.990	2.990	2.987
*Total Fe as FeO																	