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Article

Chemical compositions of white micas in eclogites and country-rock gneisses from the Aktyuz area, northern Kyrgyz Tien-Shan

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Abstract

The modes of occurrence and chemical compositions of white micas in the eclogites and surrounding country-rock gneisses in the Aktyuz area in Northern Kyrgyz Tien-Shan have been described. In the eclogites, white micas occur in the matrix and as inclusions within garnet and amphibole. They are classified as phengite, paragonite and muscovite. The highest Si contents (6.89-7.14 p.f.u.) are observed in phengite inclusions in garnets and in the cores of matrix phengites. Muscovite (Si = 5.96-6.09 p.f.u) occurs at the outermost rims of the matrix phengites. In the pelitic gneisses, phengites occur in the matrix and as inclusions within garnet, plagioclase and zircon. The cores of the matrix phengites and phengite inclusions within zircons have the highest Si contents of up to 6.83 p.f.u. and 6.88 p.f.u., respectively. The Si contents in the phengites suggest that the eclogites and the country rock gneisses experienced relatively high-pressure metamorphism. The muscovite rims of the matrix phengites indicate relatively low-pressure and high-temperature metamorphic conditions in the eclogites.

Key words: phengite, paragonite, muscovite, margarite, Aktyuz, eclogite, Kyrgyzstan, Tien-Shan

Introduction

The Aktyuz Formation is located in the Zaili Range of the Northern Kyrgyz Tien-Shan (Fig. 1). It consists of pelitic gneisses, gneissose-granites and migmatites, accompanied by exotic blocks or layers of eclogites, garnet amphibolites and amphibolites (Sobolev et al., 1986; Bakirov, 1989; Bakirov and Maksumova, 2001). The Aktyuz eclogites experienced multi-stage metamorphic evolution. Tagiri et al. (1995) estimated that the peak metamorphic conditions of the Aktyuz eclogites were $T = 600$ °C and $P > 12$ kbar. Orozbaev et al. (2007) proposed two metamorphic events for the Aktyuz eclogites. These were a pre-eclogitic relatively *MP-HT* metamorphic event under amphibolite facies conditions ($T = 560$-650 °C, $P = 4$-10 kbar), and a *HP-LT* eclogitic metamorphic event within the prograde epidote-blueschist facies ($T = 330$-570 °C, $P = 8$-16 kbar) and peak eclogite facies ($T = 600$-710 °C, $P = 15$-25 kbar) conditions. A third *HP-HT* metamorphic event after the second *HP-LT* eclogitic metamorphic event has been also identified in the Aktyuz eclogites, garnet amphibolites and country rock gneisses (Orozbaev et al., 2009).

In this paper we describe the modes of occurrence and chemistry of white micas in the Aktyuz eclogites and country rock-gneisses. The white micas are described from eclogite samples (KG-426, KG-427 and 03-18) that were collected from a lenticular garnet amphibolite - eclogite body (60 m × 500 m), and from surrounding pelitic (03-37, 03-20, KG-430 and KG-434) and granitic (KG-431) gneisses.

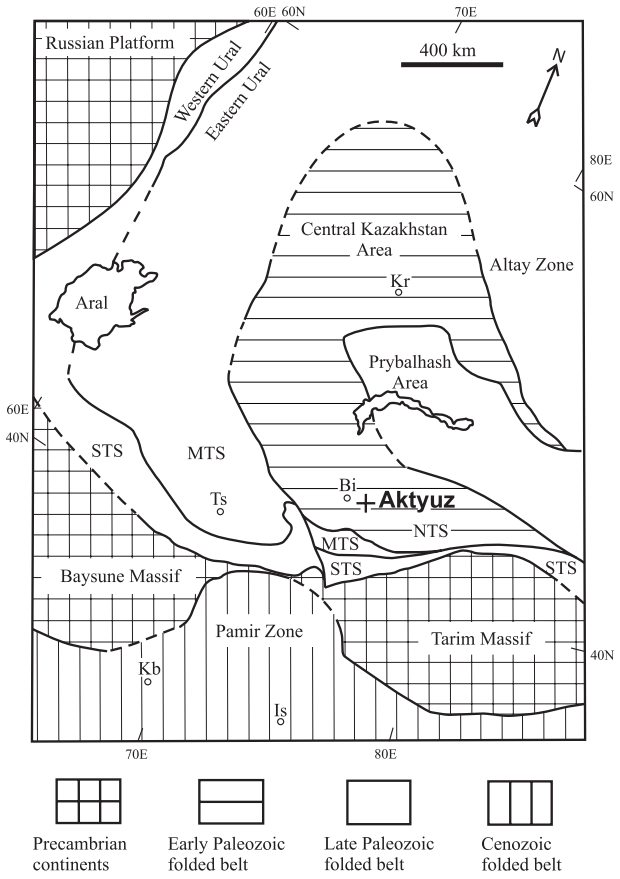

Fig. 1. Generalized tectonic division of central Asia (after Bakirov et al., 1998). NTS, Northern Tien-Shan; MTS, Middle Tien-Shan; STS, Southern Tien-Shan; Bi, Bishkek; Ts, Tashkent; Kr, Karaganda; Kb, Kabul; Is, Islamabad. Cross shows the location of the Aktyuz area.

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The mineral abbreviations used in the text, tables and figures follow those of Kretz (1983), except for Amp = amphibole and Phn = phengite.

Petrography and mode of occurrences of white micas

Eclogites

The eclogites consist mainly of garnet, clinopyroxene, Na~Ca- and Ca-amphibole and phengite, with minor plagioclase, epidote, paragonite, quartz, Na-amphibole, biotite, chlorite, apatite, rutile and ilmenite. Titanite, hematite, staurolite, zircon and K-feldspar occur as accessory minerals. The eclogites are medium- to coarse-grained, and have granoblastic texture (Fig. 2a).

The white micas in the eclogites can be divided into several modes of occurrence. Phengite (Phn1) and paragonite

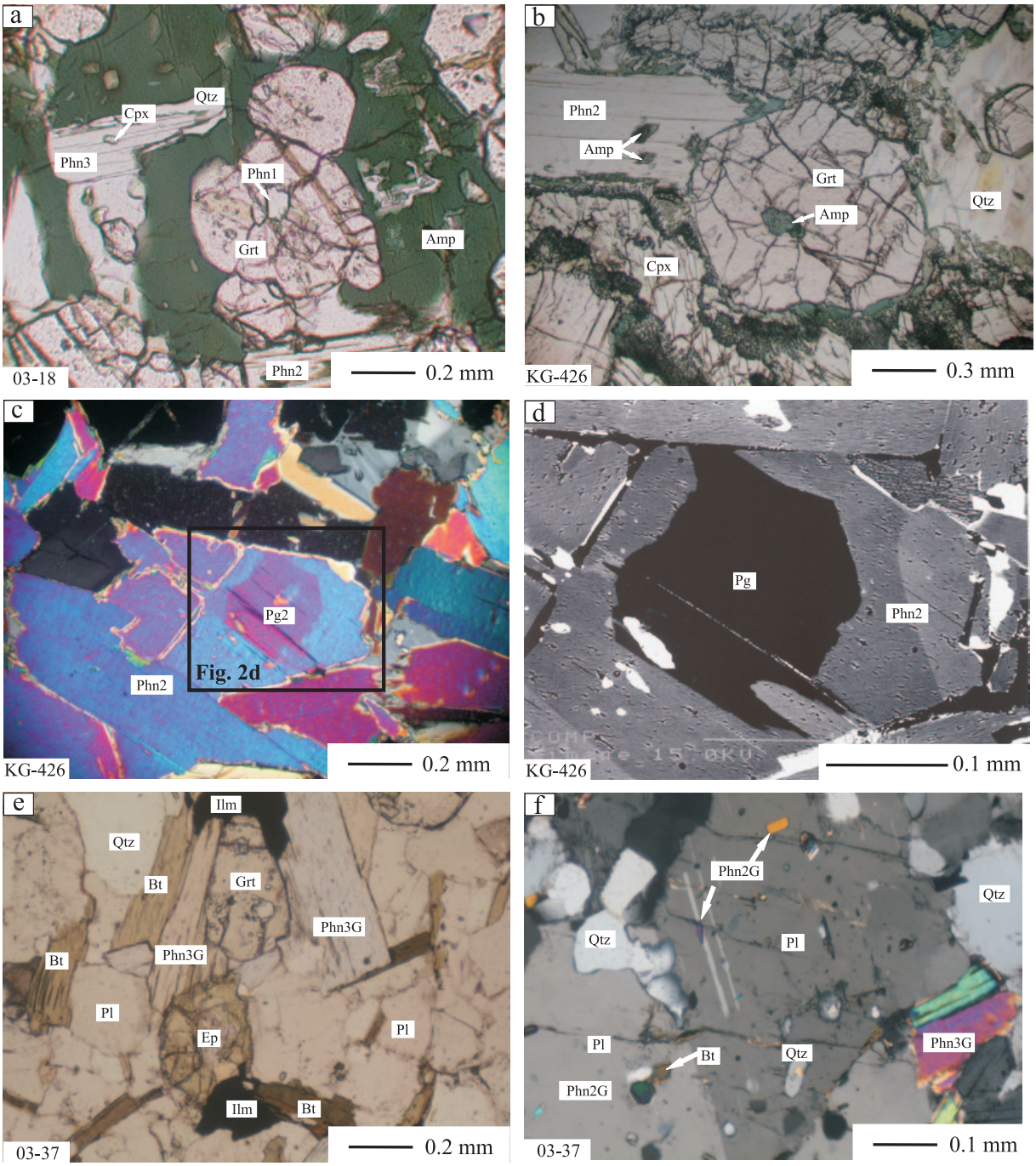

Fig. 2. Photomicrographs and backscattered electron images (BEI) showing textures and modes of occurrence of white micas in the eclogites and the country-rock gneisses. (a) Garnet in the eclogite containing phengite inclusions (Phn1). Phn2 occurs in the matrix along with garnet and amphibole. Phn3 occurs as inclusions in amphibole; (b) Garnet, clinopyroxene and phengite (Phn2) coexisting in the matrix of eclogite. Amp is included within garnet and Phn2; (c) Coexisting phengite (Phn2) and paragonite (Pg2) in the matrix of eclogite; (d) Pg occurring in the core of Phn2 (BEI); e) Phengite (Phn3G) coexisting with garnet, plagioclase, epidote and biotite in the matrix of pelitic gneiss; (f) porphyroblastic plagioclase containing phengite (Phn2G), quartz and biotite inclusions in pelitic gneiss.

(Pg1) occurring as inclusions within garnets have previously been described by Orozbaev et al. (2007) (Fig. 2a). Phn2 grains with a maximum diameter of 1.5 mm coexist with garnet and clinopyroxene in the matrix of the eclogites (Fig. 2b). Phn2 includes the inclusions of garnet, clinopyroxene, amphibole, epidote and rutile. The rims of Phn2 are replaced by symplectitic aggregates consisting of biotite and plagioclase (An_{11-22}) (Fig. 2f). Phn3 grains up to 0.4 mm across occur as inclusions in amphibole (Fig. 2a). Pg2 grains with maximum size of 0.5 mm occasionally coexist with Phn2 in the matrix (Fig. 2c, d).

Country-rock gneisses

The pelitic gneisses consist mainly of plagioclase, phengite, biotite and quartz with minor amounts of garnet, epidote, chlorite, K-feldspar, Ca-amphibole, apatite, calcite, rutile, titanite, ilmenite, hematite and zircon. Preferred orientation of phengite and biotite define a schistosity.

Phengite (Phn1G) grains up to 0.1 mm across occur as inclusions in garnet, whereas Phn2G grains up to 0.2 mm across are found as inclusions within porphyroblastic plagioclase (Fig. 2f). Phn3G are up to 2 mm across in the matrix (Fig. 2e) and it includes the inclusions of epidote, garnet, quartz, rutile and zircon. Phn3G is occasionally replaced by chlorite and biotite at the rim. Phn4G occurs as inclusion in zircons separated from pelitic and granitic gneisses.

The granitic gneisses consist mainly of K-feldspar, plagioclase and quartz, with minor amounts of biotite, garnet, chlorite, ilmenite, hematite and zircon. Phengite (Phn4G) occurs as inclusions within zircons.

Chemical compositions of white micas

Chemical compositions of the white micas were determined using an electron probe microanalyser (JEOL JXA-8800M) at the Department of Geoscience, Shimane University. The analytical conditions used were 15 kV accelerating voltage, 20 nA beam current and 5 μm beam diameter. Corrections were carried out using the procedures of Bence and Albee (1968).

White micas in the eclogites consist mainly of phengite and paragonite (Figs. 3a and 4a; Table 1). Orozbaev et al. (2007) have previously described Phn1 and Pg1 inclusions in garnets in the eclogites. Si contents of Phn1 range from 6.11 to 7.14 with $X_{Na} = Na/(Na + K) = 0.01$-$0.23$, whereas Pg1 has Si = 5.11-5.97 and $X_{Na} = 0.85$-0.99, with margarite component reaching Ca = 0.55 p.f.u. (Figs. 3 and 4). Phn2 in the eclogites are zoned from core to rim, with Si decreasing from 6.66-6.79 p.f.u. to 6.15-6.30 p.f.u. (O = 22) and X_{Na} increasing from 0.03-0.11 to 0.15-0.21 (Fig. 4a). Occasionally, the outermost rim of Phn2 has a composition of muscovite (Si = 5.96-6.09 p.f.u., $X_{Na} = 0.25$-0.38). Si contents and X_{Na} value of Phn3 inclusions in amphiboles ranges between 6.32-6.79 p.f.u. and 0.07-0.13, respectively. Pg2 in the matrix has Si contents of 5.81-5.95 p.f.u. and X_{Na} of 0.83-0.94, with a small amount of the margarite component (Ca = 0.02-0.04 p.f.u.) (Fig. 3a).

Phn1G inclusions within garnet in the pelitic gneisses have Si contents ranging from 6.29 to 6.45 p.f.u. with $X_{Na} = 0.41$-0.95 (Figs 3b and 4b). Phn2G inclusions in porphyroblastic plagioclase in the pelitic gneisses have Si contents and X_{Na} of 6.46-6.69 p.f.u. and 0.03-0.19, respectively. Si content of Phn3G in the matrix of pelitic gneisses range from 6.29 and 6.83 p.f.u. ($X_{Na} = 0.06$ to 0.08), with decreasing abundances from core to rim. Phn4G inclusions in Zrn separated from both the pelitic and granitic gneisses have Si contents of 6.63-6.85 p.f.u. ($X_{Na} = 0.01$-0.04) and 6.36-6.88 p.f.u. ($X_{Na} = 0.01$-0.03), respectively.

Discussion and conclusions

The mode of occurrences and chemical compositions of white micas in the eclogites and surrounding country-rock gneisses have been described above. In the eclogites, white micas occur in the matrix and as inclusions in garnet and amphibole, and are classified as phengite, paragonite and muscovite. The highest Si contents (6.89 – 7.14 p.f.u.) were observed in phengite inclusions (Phn1) in garnets and in the cores of matrix phengites (Phn2). Muscovite (Si = 5.96-6.09 p.f.u) occurs at the outermost rims of matrix phengites (Phn2). In the pelitic gneisses, phengites occur in the matrix (Phn3G) and also as inclusions in garnet (Phn1G), plagioclase (Phn2G) and zircon (Phn4G). The cores of matrix phengites and phengite inclusions in zircons have maximum Si contents of 6.83 p.f.u. and 6.88 p.f.u., respectively. These Si contents in phengites may suggest that the eclogites and country rock gneisses experienced considerably high-pressure metamorphism (Massonne and Schreyer, 1987). The muscovite observed at the rims of matrix phengites in the eclogites formed at relatively low-pressure and high-temperature metamorphic conditions, suggesting its formation was related to the third high-temperature metamorphic event in the Aktyuz area (Orozbaev et al., 2009).

Acknowledgements

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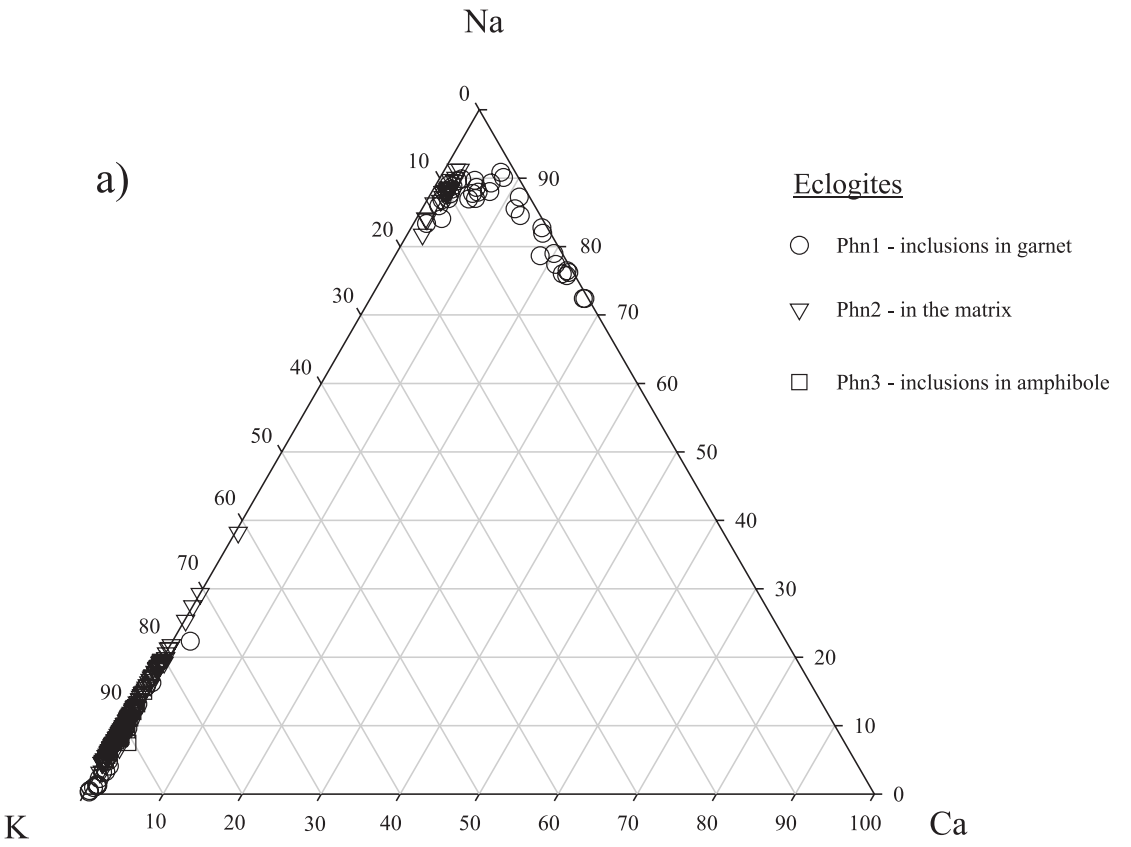

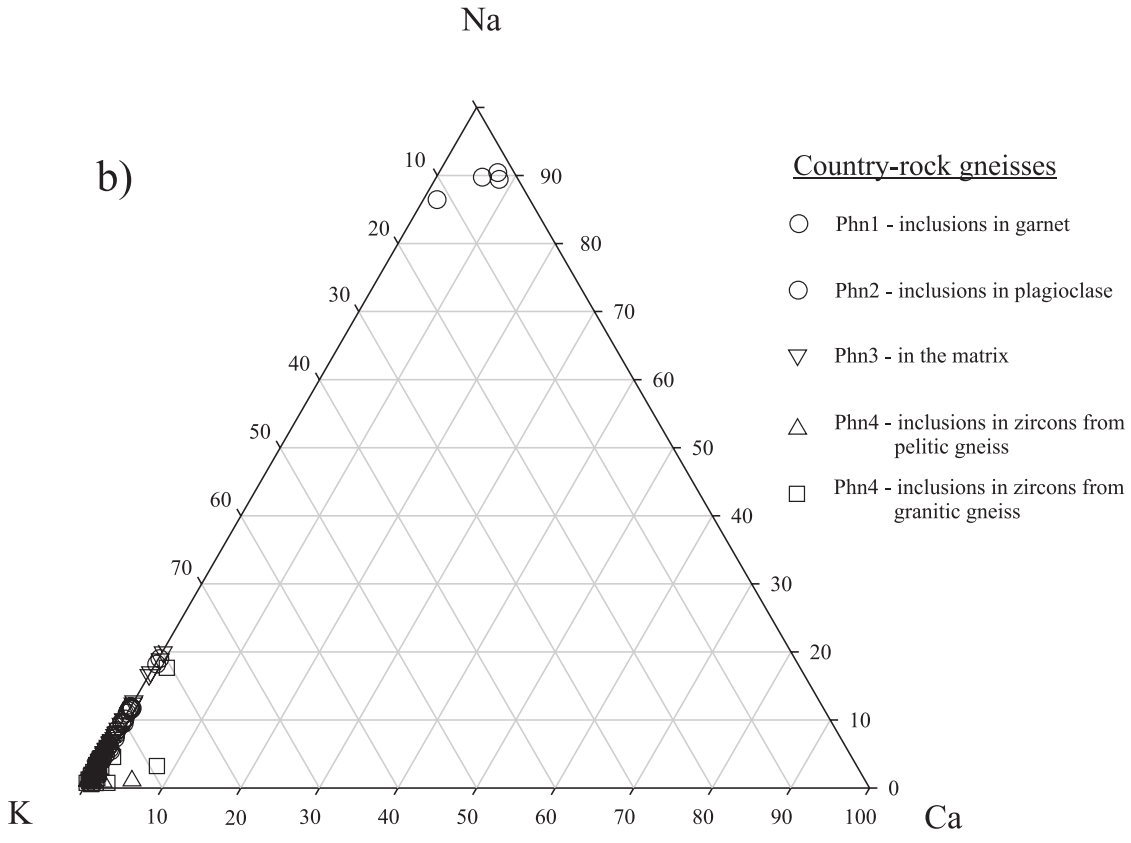

Fig. 3. Ca-Na-K ternary diagram showing the compositions of white micas: (a) in the eclogites; (b) in the country rock gneisses.

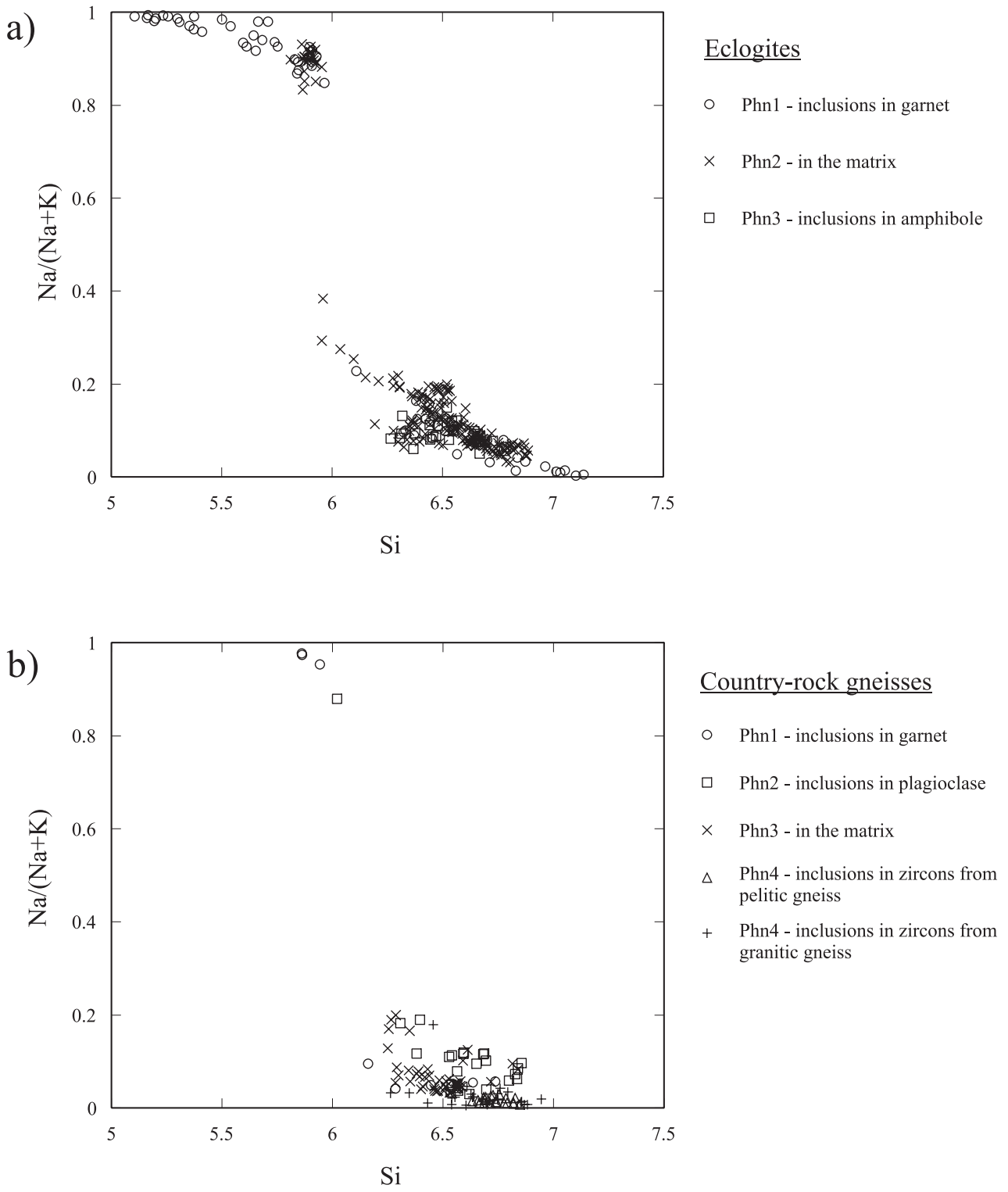

Fig. 4. Chemical compositions of white micas: (a) in the eclogites; (b) in the country-rock gneisses.

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（要　旨）

Takasu, A・Orozbaeu, R., 2009, キルギス北部天山アクチュツ地域に分布するエクロジャイト及び片麻岩中の白色雲母の化学組成，島根大学地球資源環境学研究報告，28，37-49

キルギス北部天山アクチュツ地域に分布するエクロジャイト及びその母岩である片麻岩中の白色雲母の産状と化学組成を記載した．エクロジャイト中の白色雲母は基質とざくろ石及び角閃石中の包有物として産する．これらは化学組成の上から，フェンジャイト，パラゴナイト及び白雲母に分類される．ざくろ石中の包有物及び基質のフェンジャイトの核部の化学組成は最も高い Si 含有量（6.89-7.14 pfu）を示す．白雲母は基質のフェンジャイトの縁部にのみ形成されている．この白雲母の Si 量は 5.96-6.09 pfu である．

泥質片麻岩中では，フェンジャイトは基質とざくろ石，斜長石及びジルコン中の包有物として産する．基質のフェンジャイトの核部とジルコン中包有されるフェンジャイトは高い Si 含有量を示す．Si 値の最大はそれぞれ 6.83 と 6.88 pfu である．フェンジャイト中の Si 量より，エクロジャイトとその母岩の片麻岩の両方が高圧型の変成作用を受けたことを示す．エクロジャイトの基質の白色雲母が核部はフェンジャイトで縁部が白雲母であることは，高圧型のエクロジャイト変成作用の後に低圧高温型の変成作用を受けたことを意味する．

Table 1. Chemical compositions of white micas in the eclogites.

Sample	KG-426																			
No.	22	23	25	24	26	27	28	29	30	31	32	33	40	43	48	49	126	127	128	129
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
			rim	←	←	core	→	→	rim								core	→	→	rim
SiO_2	48.85	48.62	46.63	46.71	47.02	48.34	48.21	48.89	48.73	47.18	47.42	49.05	47.13	46.55	46.47	45.52	46.96	47.80	47.26	46.81
TiO_2	0.20	0.27	0.49	0.48	0.52	0.26	0.28	0.21	0.25	0.25	0.35	0.28	0.50	0.51	0.71	0.63	0.58	0.26	0.49	0.59
Al_2O_3	27.56	27.24	28.66	28.78	28.73	27.17	26.56	25.55	26.47	28.29	28.11	26.39	28.82	29.89	29.97	31.16	29.07	28.28	28.79	30.53
FeO*	2.98	3.22	3.50	3.21	3.16	2.88	2.85	3.29	3.42	3.11	3.29	3.66	2.65	2.24	2.79	2.49	2.90	2.85	2.77	2.75
MnO	0.01	0.00	0.01	0.00	0.05	0.00	0.00	0.03	0.03	0.00	0.01	0.02	0.00	0.03	0.00	0.05	0.02	0.00	0.03	0.04
MgO	3.62	3.66	2.70	2.39	2.45	3.27	3.30	3.41	3.02	2.63	2.71	3.11	2.45	2.06	2.02	1.60	2.30	2.89	2.63	2.08
CaO	0.07	0.00	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.03	0.03	0.00	0.00	0.00	0.00	0.00
Na_2O	0.83	0.54	1.40	1.45	1.26	0.72	0.46	0.38	0.36	0.76	0.76	0.46	1.11	0.85	1.32	1.44	1.39	0.86	1.21	1.36
K_2O	10.63	10.66	8.90	9.15	9.23	10.37	10.68	10.83	10.63	10.48	10.07	10.60	9.60	10.03	9.35	9.13	9.34	10.22	9.70	9.27
Cr_2O_3	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Total	94.75	94.22	92.37	92.19	92.42	93.00	92.33	92.60	92.92	92.70	92.76	93.56	92.28	92.17	92.66	92.01	92.56	93.15	92.91	93.43
Cations on the basis of 22 oxygens																				
Si	6.622	6.632	6.462	6.482	6.504	6.660	6.698	6.790	6.736	6.541	6.559	6.741	6.519	6.444	6.405	6.306	6.483	6.571	6.506	6.390
Ti	0.021	0.028	0.052	0.051	0.054	0.027	0.029	0.022	0.026	0.026	0.037	0.029	0.052	0.053	0.074	0.066	0.060	0.027	0.051	0.061
Al	4.403	4.379	4.681	4.707	4.683	4.411	4.349	4.181	4.312	4.621	4.582	4.274	4.699	4.877	4.869	5.088	4.730	4.583	4.672	4.913
Fe*	0.337	0.367	0.405	0.372	0.366	0.332	0.331	0.382	0.395	0.361	0.381	0.420	0.307	0.260	0.321	0.288	0.335	0.327	0.319	0.314
Mn	0.001	0.000	0.001	0.000	0.006	0.000	0.000	0.004	0.004	0.000	0.002	0.003	0.000	0.003	0.000	0.006	0.003	0.000	0.003	0.005
Mg	0.731	0.745	0.559	0.495	0.504	0.671	0.683	0.705	0.623	0.544	0.559	0.637	0.505	0.425	0.414	0.329	0.473	0.592	0.540	0.423
Ca	0.010	0.000	0.010	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.002	0.004	0.004	0.001	0.000	0.000	0.000	0.000
Na	0.218	0.144	0.377	0.390	0.338	0.191	0.123	0.103	0.095	0.204	0.203	0.123	0.298	0.227	0.354	0.388	0.372	0.230	0.323	0.361
K	1.838	1.855	1.574	1.619	1.629	1.823	1.892	1.919	1.874	1.853	1.777	1.858	1.694	1.771	1.644	1.613	1.645	1.792	1.704	1.614
Cr	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Total	14.183	14.150	14.121	14.119	14.085	14.115	14.106	14.108	14.066	14.150	14.104	14.083	14.076	14.064	14.086	14.084	14.101	14.121	14.120	14.080

** Total Fe as FeO*

Sample	KG-426																			
No.	130	15	57	60	61	62	67	68	91	94	95	100	101	109	56	57	58	59	60	61
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
							core	rim		core	rim	core	rim			core	→	→	→	→
SiO_2	46.71	46.68	45.22	46.81	46.35	46.13	45.86	45.89	47.73	47.85	46.50	47.89	44.05	46.70	48.48	48.53	48.94	48.37	48.44	44.39
TiO_2	0.52	0.40	0.31	0.66	0.69	0.46	0.40	0.56	0.22	0.22	0.56	0.21	0.18	0.68	0.23	0.23	0.21	0.29	0.23	0.18
Al_2O_3	29.65	29.31	33.01	30.65	30.92	31.89	32.15	31.38	29.07	28.05	29.49	26.89	35.01	29.69	26.92	26.08	26.47	27.23	27.26	34.27
FeO*	2.75	2.72	2.16	2.37	2.45	2.57	2.60	2.92	2.47	2.98	2.87	3.28	2.21	2.44	3.25	3.14	3.34	3.16	2.91	2.00
MnO	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.03	0.03	0.00	0.02	0.00	0.00	0.02	0.02	0.02
MgO	2.14	2.10	1.24	1.89	1.89	1.56	1.49	1.59	2.60	2.86	2.34	3.34	0.81	2.15	3.22	3.42	3.56	3.31	3.13	0.94
CaO	0.00	0.02	0.02	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.02
Na_2O	1.17	0.96	1.54	1.30	1.32	1.64	1.59	1.43	0.97	0.95	1.28	0.61	2.04	1.25	0.65	0.45	0.43	0.59	0.68	1.95
K_2O	9.59	9.68	9.01	9.09	9.18	8.95	8.92	9.09	10.11	9.86	9.34	10.47	8.17	9.48	10.82	11.11	11.21	11.13	11.00	8.71
Cr_2O_3	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	92.57	91.88	92.49	92.81	92.79	93.20	93.01	92.86	93.16	92.80	92.43	92.75	92.50	92.40	93.59	92.99	94.16	94.09	93.67	92.46
Cations on the basis of 22 oxygens																				
Si	6.447	6.486	6.211	6.408	6.358	6.299	6.275	6.306	6.542	6.595	6.430	6.640	6.037	6.445	6.668	6.723	6.702	6.628	6.651	6.097
Ti	0.054	0.042	0.032	0.068	0.071	0.047	0.041	0.058	0.023	0.023	0.058	0.022	0.019	0.070	0.024	0.024	0.022	0.030	0.023	0.018
Al	4.823	4.800	5.344	4.946	4.999	5.132	5.184	5.082	4.696	4.556	4.806	4.394	5.655	4.829	4.364	4.259	4.271	4.397	4.412	5.547
Fe*	0.317	0.316	0.248	0.271	0.281	0.293	0.298	0.336	0.283	0.344	0.332	0.380	0.253	0.282	0.373	0.364	0.382	0.362	0.334	0.230
Mn	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.005	0.004	0.004	0.000	0.003	0.000	0.000	0.002	0.002	0.002
Mg	0.441	0.435	0.253	0.386	0.386	0.317	0.304	0.326	0.530	0.588	0.482	0.691	0.165	0.443	0.659	0.706	0.726	0.675	0.642	0.192
Ca	0.000	0.003	0.002	0.004	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.003
Na	0.312	0.258	0.410	0.344	0.350	0.435	0.421	0.381	0.257	0.254	0.342	0.165	0.541	0.335	0.173	0.122	0.115	0.156	0.182	0.519
K	1.689	1.716	1.579	1.587	1.606	1.559	1.556	1.594	1.768	1.734	1.647	1.852	1.428	1.669	1.898	1.964	1.959	1.945	1.926	1.525
Cr	0.000	0.002	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	0.000	0.000
Total	14.088	14.058	14.079	14.016	14.051	14.085	14.080	14.082	14.099	14.098	14.103	14.150	14.101	14.072	14.162	14.166	14.178	14.194	14.173	14.133

** Total Fe as FeO*

Sample	KG-426																			
No.	62	65	66	1	1	2	4	6	10	12	13	14	15	16	17	26	27	28	29	1
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn1	Phn1	Phn1	Phn1	Phn1
	rim				core	rim					core	→	→	→	rim					
SiO_2	43.39	47.41	47.73	50.09	50.03	47.41	47.16	46.74	47.68	46.24	49.42	49.86	49.19	45.12	44.19	50.83	50.70	49.27	50.15	51.43
TiO_2	0.12	0.27	0.26	0.27	0.26	0.34	0.52	0.54	0.34	0.50	0.19	0.26	0.31	0.28	0.17	0.00	0.01	0.03	0.05	0.00
Al_2O_3	36.17	28.81	28.89	26.20	26.13	29.61	30.69	30.84	29.16	31.85	26.14	26.05	26.88	33.19	36.92	22.68	22.68	22.70	26.75	22.50
FeO*	1.69	3.22	2.76	3.29	3.45	3.16	2.54	2.81	3.19	2.71	3.41	3.25	2.96	3.01	1.45	6.72	6.93	7.55	5.73	7.62
MnO	0.00	0.01	0.00	0.00	0.04	0.00	0.02	0.04	0.00	0.08	0.00	0.00	0.07	0.00	0.03	0.00	0.00	0.00	0.04	0.00
MgO	0.37	2.76	2.62	3.58	3.71	2.48	2.01	1.96	2.64	1.67	3.63	3.61	3.35	1.35	0.26	2.80	2.82	3.56	3.03	2.97
CaO	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.06	0.10	0.14	0.15	0.10	0.12
Na_2O	2.25	0.97	0.84	0.44	0.37	1.04	1.31	1.34	1.15	1.55	0.38	0.48	0.64	1.65	2.98	0.07	0.09	0.24	0.24	0.10
K_2O	8.26	10.48	10.62	11.05	11.33	10.24	9.72	9.72	10.09	9.63	11.21	10.77	10.95	9.22	7.29	11.40	11.34	10.84	10.92	10.55
Cr_2O_3	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00
Total	92.24	93.93	93.72	94.93	95.32	94.29	93.97	94.00	94.24	94.24	94.37	94.28	94.35	93.86	93.36	94.59	94.71	94.34	97.02	95.29
Cations on the basis of 22 oxygens																				
Si	5.954	6.495	6.533	6.783	6.766	6.456	6.405	6.362	6.493	6.279	6.749	6.788	6.700	6.151	5.959	7.033	7.017	6.876	6.714	7.054
Ti	0.012	0.028	0.027	0.027	0.026	0.034	0.053	0.055	0.035	0.051	0.020	0.026	0.032	0.029	0.017	0.000	0.001	0.003	0.005	0.000
Al	5.850	4.651	4.661	4.180	4.165	4.752	4.914	4.948	4.679	5.097	4.206	4.179	4.316	5.332	5.868	3.699	3.698	3.734	4.220	3.636
Fe*	0.193	0.369	0.316	0.373	0.391	0.360	0.288	0.320	0.363	0.307	0.389	0.370	0.337	0.343	0.164	0.778	0.802	0.882	0.641	0.874
Mn	0.000	0.001	0.000	0.000	0.005	0.000	0.003	0.005	0.000	0.010	0.000	0.000	0.008	0.000	0.003	0.000	0.000	0.000	0.005	0.000
Mg	0.075	0.564	0.535	0.722	0.748	0.504	0.407	0.397	0.535	0.337	0.738	0.733	0.680	0.274	0.053	0.577	0.582	0.740	0.606	0.608
Ca	0.001	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.008	0.014	0.021	0.022	0.014	0.017
Na	0.599	0.258	0.222	0.116	0.096	0.276	0.346	0.355	0.304	0.409	0.100	0.127	0.168	0.437	0.780	0.019	0.023	0.066	0.061	0.027
K	1.445	1.831	1.854	1.909	1.954	1.779	1.685	1.687	1.752	1.668	1.952	1.871	1.902	1.604	1.254	2.013	2.001	1.929	1.866	1.846
Cr	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000
Total	14.130	14.196	14.148	14.112	14.150	14.162	14.100	14.130	14.161	14.159	14.155	14.095	14.146	14.174	14.107	14.133	14.146	14.252	14.133	14.063

** Total Fe as FeO*

Table 1. (continued)

Sample	KG-426																			
No.	3	4	10	73	74	98	99	46	47	61	94	95	96	97	104	105	114	115	116	136
Mode	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1
								core	rim					rim	rim	rim				
SiO_2	51.18	51.48	48.37	50.99	51.70	47.30	46.56	44.68	44.92	45.04	42.53	43.81	43.07	38.61	38.64	40.01	43.07	44.68	43.89	44.94
TiO_2	0.08	0.05	0.10	0.05	0.01	0.54	0.27	0.09	0.03	0.10	0.06	0.07	0.06	0.00	0.00	0.00	0.05	0.09	0.08	0.09
Al_2O_3	23.68	26.97	22.21	21.46	21.85	29.16	30.94	38.94	39.06	39.63	40.59	39.30	39.96	42.05	43.73	43.02	41.05	38.87	38.79	39.01
FeO*	6.97	5.68	9.53	6.37	6.87	3.37	3.22	0.96	1.09	1.35	1.07	0.88	0.85	2.41	1.28	1.23	1.20	0.75	1.38	1.01
MnO	0.00	0.00	0.00	0.01	0.00	0.03	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.00	0.08	0.04	0.00	0.01
MgO	3.12	2.98	3.68	3.33	3.63	2.05	1.60	0.16	0.16	0.30	0.24	0.20	0.15	1.62	0.62	0.56	0.26	0.13	0.24	0.23
CaO	0.10	0.12	0.12	0.05	0.06	0.00	0.01	0.31	0.38	0.45	0.67	0.31	0.68	2.32	3.89	3.30	0.96	0.25	0.34	0.32
Na_2O	0.16	0.24	0.08	0.04	0.02	0.89	0.91	6.55	6.72	6.53	6.20	6.24	6.30	6.17	5.77	6.09	6.43	6.41	6.27	6.43
K_2O	10.32	8.39	9.32	10.57	10.66	9.34	9.72	1.05	0.83	1.50	0.85	1.07	0.66	0.12	0.08	0.08	0.52	1.27	1.14	0.87
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Total	95.60	95.90	93.40	92.87	94.81	92.67	93.23	92.77	93.21	94.89	92.21	91.88	91.73	93.32	94.07	94.29	93.62	92.49	92.14	92.90
Cations on the basis of 22 oxygens																				
Si	6.965	6.838	6.832	7.139	7.105	6.517	6.386	5.895	5.898	5.842	5.656	5.830	5.740	5.162	5.107	5.257	5.645	5.909	5.846	5.910
Ti	0.008	0.005	0.010	0.005	0.001	0.056	0.028	0.009	0.003	0.010	0.006	0.007	0.006	0.000	0.000	0.000	0.005	0.009	0.008	0.009
Al	3.797	4.223	3.698	3.541	3.538	4.735	5.002	6.054	6.045	6.057	6.362	6.165	6.277	6.626	6.811	6.663	6.342	6.058	6.090	6.046
Fe*	0.793	0.631	1.125	0.746	0.789	0.388	0.370	0.106	0.120	0.146	0.119	0.098	0.095	0.269	0.141	0.135	0.132	0.083	0.154	0.111
Mn	0.000	0.000	0.000	0.001	0.000	0.003	0.001	0.004	0.000	0.000	0.000	0.000	0.000	0.003	0.008	0.000	0.009	0.004	0.000	0.001
Mg	0.633	0.591	0.774	0.696	0.744	0.421	0.327	0.032	0.031	0.058	0.048	0.039	0.029	0.322	0.122	0.109	0.051	0.025	0.047	0.044
Ca	0.014	0.017	0.018	0.008	0.009	0.000	0.002	0.044	0.054	0.062	0.095	0.045	0.098	0.333	0.550	0.464	0.135	0.035	0.048	0.045
Na	0.042	0.061	0.022	0.010	0.005	0.237	0.241	1.675	1.710	1.641	1.597	1.610	1.629	1.600	1.479	1.551	1.633	1.645	1.620	1.640
K	1.791	1.421	1.679	1.888	1.869	1.642	1.700	0.177	0.139	0.248	0.145	0.181	0.111	0.020	0.013	0.014	0.087	0.214	0.194	0.146
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
Total	14.044	13.787	14.159	14.034	14.062	14.000	14.056	13.995	14.001	14.064	14.028	13.976	13.986	14.335	14.233	14.193	14.039	13.983	14.008	13.951

** Total Fe as FeO*

Sample	KG-426																			
No.	137	140	141	21	22	26	89	114	117	45	46	1	12	15	49	53	56	67	70	72
Mode	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1	Pg1
		rim																		
SiO_2	45.64	39.75	43.03	41.91	40.63	41.97	40.64	44.42	40.75	44.04	43.59	45.27	41.71	43.30	39.88	38.95	40.27	44.95	39.73	39.94
TiO_2	0.08	0.11	0.07	0.06	0.00	0.11	0.11	0.12	0.05	0.00	0.00	0.30	0.05	0.15	0.10	0.00	0.15	0.07	0.08	0.08
Al_2O_3	38.38	42.70	40.57	40.83	41.97	40.61	40.08	39.09	41.87	40.35	40.73	38.43	40.59	39.75	40.61	42.73	42.29	38.66	43.27	42.21
FeO*	1.34	1.64	1.06	1.22	1.70	1.31	2.11	1.68	1.48	1.67	1.71	1.21	1.93	1.35	2.14	1.46	1.60	2.09	1.85	1.55
MnO	0.01	0.00	0.00	0.01	0.00	0.02	0.00	0.02	0.03	0.00	0.02	0.04	0.00	0.00	0.01	0.03	0.00	0.00	0.02	0.00
MgO	0.28	0.58	0.26	0.30	0.87	0.28	2.34	0.14	0.65	0.43	0.45	0.28	1.06	0.17	0.91	0.81	0.79	0.41	0.67	0.50
CaO	0.23	3.40	0.60	0.74	1.87	0.75	0.92	0.25	2.37	1.04	1.11	0.23	1.59	0.66	2.45	3.09	2.81	0.30	3.29	2.86
Na_2O	6.38	6.17	6.52	6.14	6.78	6.00	6.61	6.36	6.54	7.14	6.87	6.84	6.71	6.07	5.79	5.78	6.14	6.49	5.94	5.82
K_2O	1.75	0.07	0.64	0.66	0.32	0.73	0.44	1.37	0.09	0.22	0.22	1.09	0.16	0.74	0.34	0.17	0.13	0.99	0.13	0.19
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Total	94.08	94.42	92.75	91.88	94.13	91.78	93.24	93.46	93.86	94.89	94.70	93.69	93.80	92.18	92.22	93.03	94.21	93.95	94.98	93.15
Cations on the basis of 22 oxygens																				
Si	5.965	5.235	5.685	5.597	5.354	5.613	5.411	5.849	5.375	5.711	5.665	5.929	5.503	5.754	5.373	5.195	5.301	5.888	5.202	5.310
Ti	0.007	0.011	0.007	0.006	0.000	0.011	0.011	0.012	0.005	0.000	0.000	0.030	0.004	0.015	0.010	0.000	0.015	0.007	0.008	0.008
Al	5.912	6.627	6.317	6.426	6.518	6.400	6.290	6.067	6.509	6.168	6.239	5.932	6.312	6.226	6.448	6.718	6.561	5.968	6.678	6.614
Fe*	0.147	0.181	0.117	0.137	0.188	0.146	0.234	0.185	0.163	0.181	0.186	0.133	0.213	0.150	0.241	0.163	0.176	0.229	0.203	0.173
Mn	0.001	0.000	0.000	0.001	0.000	0.002	0.000	0.002	0.003	0.000	0.002	0.004	0.000	0.000	0.001	0.003	0.000	0.000	0.003	0.000
Mg	0.054	0.114	0.051	0.060	0.170	0.056	0.465	0.028	0.128	0.083	0.086	0.055	0.209	0.034	0.182	0.161	0.156	0.080	0.132	0.098
Ca	0.032	0.480	0.085	0.106	0.264	0.107	0.131	0.036	0.334	0.144	0.154	0.032	0.225	0.094	0.353	0.442	0.396	0.041	0.461	0.407
Na	1.616	1.574	1.669	1.590	1.731	1.554	1.707	1.625	1.673	1.796	1.731	1.736	1.716	1.563	1.512	1.495	1.567	1.647	1.508	1.501
K	0.291	0.012	0.107	0.112	0.053	0.125	0.074	0.230	0.014	0.037	0.037	0.182	0.026	0.125	0.058	0.029	0.021	0.166	0.021	0.032
Cr	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000
Total	14.025	14.234	14.038	14.035	14.279	14.015	14.324	14.033	14.208	14.121	14.100	14.034	14.208	13.961	14.177	14.208	14.196	14.027	14.215	14.143

** Total Fe as FeO*

Sample	KG-426																			
No.	100	102	38	39	40	41	42	43	51	54	55	56	70	92	93	112	63	64	67	3
Mode	Pg1	Pg1	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2	Pg2
					core	rim	core	rim		core	→	rim								
SiO_2	38.46	42.02	44.51	44.54	45.31	45.04	45.64	45.18	45.29	45.36	45.34	45.12	45.42	43.76	44.49	45.15	45.55	44.22	44.27	45.42
TiO_2	0.00	0.03	0.11	0.05	0.08	0.19	0.04	0.12	0.05	0.08	0.12	0.07	0.14	0.07	0.06	0.10	0.13	0.09	0.09	0.05
Al_2O_3	41.47	41.29	39.13	39.18	39.30	38.74	39.29	39.27	38.90	39.04	39.40	39.50	39.45	39.41	39.09	39.05	38.73	38.80	39.20	39.70
FeO*	3.60	1.39	0.94	0.73	0.69	0.77	0.69	0.74	0.85	0.82	0.84	0.80	0.95	0.94	0.86	1.01	0.85	0.92	0.79	1.11
MnO	0.01	0.01	0.02	0.02	0.00	0.00	0.05	0.00	0.02	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.00	0.01	0.00	0.01
MgO	0.73	0.40	0.14	0.16	0.14	0.19	0.15	0.18	0.19	0.16	0.09	0.15	0.10	0.16	0.19	0.17	0.21	0.15	0.14	0.13
CaO	3.74	1.58	0.25	0.28	0.30	0.19	0.29	0.21	0.24	0.26	0.25	0.21	0.26	0.28	0.29	0.21	0.24	0.27	0.25	0.31
Na_2O	5.51	6.34	6.80	7.23	7.12	6.62	7.15	6.93	7.10	7.13	7.07	6.82	6.97	6.51	6.63	7.13	6.64	6.57	5.94	7.01
K_2O	0.05	0.31	1.13	0.82	1.00	1.21	0.96	1.03	1.25	1.17	1.25	1.24	1.17	1.12	1.06	0.86	1.34	1.17	1.80	1.12
Cr_2O_3	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03
Total	93.57	93.36	93.02	93.00	93.95	92.94	94.26	93.65	93.90	94.02	94.37	93.91	94.49	92.26	92.67	93.69	93.67	92.21	92.49	94.89
Cations on the basis of 22 oxygens																				
Si	5.168	5.540	5.865	5.863	5.903	5.928	5.924	5.901	5.917	5.915	5.892	5.885	5.893	5.812	5.876	5.903	5.953	5.875	5.866	5.874
Ti	0.000	0.003	0.011	0.005	0.008	0.019	0.004	0.011	0.005	0.008	0.012	0.007	0.013	0.007	0.006	0.010	0.012	0.008	0.009	0.005
Al	6.568	6.415	6.077	6.079	6.034	6.008	6.011	6.045	5.991	6.000	6.035	6.071	6.033	6.169	6.084	6.017	5.966	6.075	6.122	6.051
Fe*	0.405	0.153	0.103	0.080	0.075	0.085	0.075	0.081	0.093	0.089	0.091	0.087	0.103	0.104	0.095	0.111	0.093	0.102	0.088	0.120
Mn	0.001	0.001	0.002	0.002	0.000	0.000	0.005	0.000	0.002	0.001	0.001	0.000	0.004	0.001	0.000	0.001	0.000	0.001	0.000	0.001
Mg	0.147	0.079	0.028	0.032	0.027	0.036	0.029	0.036	0.038	0.031	0.017	0.029	0.020	0.031	0.036	0.033	0.040	0.030	0.028	0.025
Ca	0.538	0.223	0.036	0.039	0.042	0.027	0.040	0.029	0.033	0.036	0.035	0.030	0.036	0.040	0.040	0.029	0.034	0.039	0.036	0.043
Na	1.435	1.619	1.737	1.846	1.798	1.688	1.799	1.755	1.799	1.802	1.781	1.724	1.754	1.675	1.697	1.806	1.682	1.693	1.525	1.757
K	0.009	0.052	0.190	0.137	0.166	0.203	0.158	0.171	0.208	0.194	0.206	0.207	0.194	0.190	0.178	0.144	0.224	0.198	0.304	0.185
Cr	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.003
Total	14.271	14.085	14.049	14.084	14.054	13.995	14.045	14.029	14.086	14.076	14.072	14.038	14.050	14.029	14.014	14.053	14.004	14.024	13.979	14.065

** Total Fe as FeO*

Table 1. (continued)

Sample	KG-427																			
No.	130	136	137	138	15	16	17	18	19	20	73	74	75	45	46	62	98	99	100	101
Mode	Phn1	Phn1	Phn1	Phn1	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
					rim	←	core	→	→	rim	core	→	rim							
SiO_2	46.78	50.35	47.45	49.55	47.87	47.39	47.38	47.13	47.25	47.11	48.47	48.11	48.00	46.30	46.79	47.12	46.13	46.67	47.00	46.06
TiO_2	1.24	1.23	1.32	1.36	0.64	0.57	0.50	0.54	0.55	0.59	0.58	0.61	0.53	0.61	0.53	0.44	0.59	0.54	0.54	0.59
Al_2O_3	30.48	26.54	29.70	27.07	30.73	28.82	28.95	28.68	29.04	28.87	30.21	30.05	30.11	29.77	28.63	28.67	29.73	29.34	28.55	29.16
FeO*	2.20	2.21	2.57	1.93	2.47	2.86	2.76	2.61	2.64	2.59	2.87	2.88	2.78	3.26	3.34	3.60	3.31	3.78	3.78	3.27
MnO	0.02	0.01	0.01	0.05	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.02	0.02	0.00	0.00	0.00	0.01	0.01	0.00
MgO	2.08	3.47	2.44	3.29	2.27	2.54	2.48	2.43	2.48	2.61	2.69	2.54	2.55	2.05	2.40	2.51	2.12	2.29	2.73	2.29
CaO	0.06	0.01	0.00	0.03	0.00	0.03	0.00	0.00	0.02	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.05	0.00
Na_2O	1.18	0.57	1.12	0.58	1.44	1.37	1.35	1.36	1.39	1.39	1.36	1.39	1.31	1.09	0.94	0.87	1.23	1.10	1.12	1.05
K_2O	9.20	10.07	9.18	10.09	9.02	8.87	9.12	9.08	8.88	8.44	8.96	8.93	8.55	9.45	9.63	9.76	9.30	9.41	8.97	9.45
Cr_2O_3	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Total	93.22	94.47	93.79	93.95	94.44	92.44	92.53	91.84	92.24	91.64	95.13	94.53	93.86	92.55	92.26	92.95	92.40	93.16	92.77	91.87
Cations on the basis of 22 oxygens																				
Si	6.380	6.775	6.439	6.704	6.436	6.525	6.522	6.534	6.513	6.519	6.476	6.473	6.482	6.405	6.498	6.503	6.393	6.430	6.487	6.424
Ti	0.127	0.125	0.134	0.138	0.065	0.059	0.052	0.056	0.057	0.061	0.059	0.062	0.054	0.063	0.055	0.046	0.062	0.056	0.056	0.062
Al	4.898	4.208	4.750	4.317	4.870	4.677	4.697	4.685	4.719	4.709	4.758	4.765	4.793	4.854	4.687	4.664	4.855	4.764	4.643	4.793
Fe*	0.250	0.248	0.291	0.218	0.278	0.329	0.317	0.302	0.305	0.300	0.320	0.324	0.314	0.377	0.388	0.415	0.384	0.436	0.437	0.381
Mn	0.002	0.001	0.001	0.006	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.004	0.002	0.002	0.000	0.000	0.000	0.001	0.001	0.000
Mg	0.423	0.696	0.494	0.663	0.455	0.522	0.508	0.502	0.509	0.537	0.536	0.509	0.514	0.423	0.497	0.516	0.437	0.471	0.561	0.475
Ca	0.008	0.002	0.000	0.004	0.000	0.004	0.000	0.000	0.002	0.007	0.000	0.000	0.002	0.000	0.000	0.000	0.001	0.003	0.008	0.000
Na	0.312	0.149	0.295	0.153	0.376	0.365	0.360	0.366	0.370	0.372	0.352	0.364	0.342	0.292	0.253	0.232	0.330	0.292	0.300	0.285
K	1.601	1.729	1.589	1.742	1.547	1.558	1.601	1.606	1.562	1.491	1.527	1.532	1.473	1.668	1.706	1.719	1.644	1.654	1.580	1.682
Cr	0.000	0.001	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	0.002	0.000
Total	14.001	13.935	13.994	13.946	14.026	14.039	14.058	14.053	14.037	13.996	14.026	14.031	13.976	14.085	14.083	14.094	14.105	14.106	14.074	14.102

** Total Fe as FeO*

Sample	KG-427																			
No.	102	108	109	110	111	112	122	126	32	31	30	35	29	40	36	39	37	38	42	43
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
		rim	→	core	→	rim			rim	←	←	←	core	→	→	→	→	rim		
SiO_2	47.16	47.36	47.72	48.13	48.40	47.97	46.76	47.02	49.55	50.03	49.52	49.19	48.61	49.29	49.64	49.64	49.04	46.58	45.05	45.08
TiO_2	0.56	0.54	0.53	0.38	0.25	0.27	0.67	0.64	0.28	0.27	0.28	0.24	0.23	0.24	0.27	0.30	0.38	0.63	0.84	0.57
Al_2O_3	29.46	29.40	28.67	27.95	27.15	28.18	29.41	29.80	25.98	25.71	25.51	25.73	25.84	25.59	25.74	25.30	26.34	30.07	29.31	29.78
FeO*	3.27	3.15	3.01	3.04	3.36	3.18	2.96	3.03	2.39	2.85	2.89	3.04	3.22	3.13	3.11	3.03	2.87	2.71	2.95	2.91
MnO	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.04	0.00	0.00	0.05	0.02	0.00	0.04	0.04	0.04
MgO	2.31	2.46	2.65	2.93	3.04	2.79	2.36	2.29	3.77	3.95	3.86	3.84	3.56	3.74	3.71	3.85	3.48	2.27	2.40	2.38
CaO	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.05	0.01	0.02	0.01	0.02	0.03	0.01	0.00	0.03	0.04	0.01	0.02
Na_2O	1.02	0.89	1.19	1.09	0.53	0.57	1.01	1.04	0.23	0.43	0.53	0.48	0.48	0.47	0.50	0.49	0.53	0.57	0.77	0.57
K_2O	9.63	9.76	9.29	9.60	10.26	10.24	9.47	9.51	10.70	10.29	10.16	10.13	10.24	10.19	10.11	10.12	10.08	10.44	9.46	9.79
Cr_2O_3	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Total	93.46	93.60	93.05	93.12	93.00	93.19	92.64	93.34	92.96	93.55	92.77	92.69	92.18	92.66	93.15	92.75	92.76	93.35	90.83	91.12
Cations on the basis of 22 oxygens																				
Si	6.460	6.474	6.543	6.604	6.673	6.593	6.448	6.437	6.806	6.829	6.820	6.786	6.758	6.805	6.812	6.839	6.752	6.396	6.351	6.338
Ti	0.058	0.056	0.054	0.039	0.025	0.028	0.069	0.066	0.028	0.028	0.029	0.024	0.024	0.024	0.027	0.031	0.040	0.065	0.089	0.060
Al	4.757	4.737	4.632	4.520	4.411	4.565	4.780	4.807	4.205	4.135	4.141	4.184	4.234	4.163	4.163	4.109	4.275	4.867	4.870	4.934
Fe*	0.375	0.360	0.346	0.349	0.388	0.365	0.341	0.347	0.275	0.325	0.333	0.351	0.374	0.361	0.357	0.349	0.330	0.311	0.347	0.342
Mn	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.000	0.004	0.000	0.000	0.006	0.003	0.000	0.004	0.005	0.005
Mg	0.471	0.500	0.541	0.600	0.626	0.572	0.486	0.467	0.771	0.803	0.791	0.790	0.737	0.769	0.759	0.791	0.715	0.465	0.505	0.498
Ca	0.002	0.003	0.000	0.000	0.000	0.000	0.001	0.000	0.008	0.001	0.002	0.002	0.003	0.004	0.002	0.000	0.004	0.005	0.002	0.003
Na	0.270	0.235	0.317	0.291	0.143	0.152	0.269	0.275	0.061	0.114	0.141	0.128	0.130	0.127	0.134	0.131	0.141	0.151	0.210	0.154
K	1.682	1.702	1.624	1.680	1.805	1.795	1.667	1.661	1.876	1.791	1.786	1.783	1.816	1.795	1.770	1.780	1.770	1.829	1.702	1.756
Cr	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Total	14.079	14.069	14.058	14.083	14.070	14.070	14.061	14.061	14.032	14.028	14.044	14.053	14.075	14.049	14.031	14.031	14.026	14.094	14.081	14.090

** Total Fe as FeO*

Sample	03-18																			
No.	2	37	14	35	165	166	167	168	169	170	8	31	8	12	20	45	46	2	62	64
Mode	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn1	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
					rim	core	rim	rim	core	rim										
SiO_2	44.90	46.06	44.11	44.94	47.17	47.60	46.73	47.17	47.39	48.12	47.78	47.31	48.12	47.48	48.04	47.57	48.66	47.58	48.90	48.43
TiO_2	0.70	0.51	0.09	0.24	0.69	0.70	0.76	0.73	0.58	0.72	0.70	0.73	0.47	0.64	0.46	0.72	0.18	0.58	0.60	0.36
Al_2O_3	28.45	29.36	31.42	29.73	28.84	27.54	29.06	29.08	29.24	28.73	27.31	28.68	27.35	27.22	26.69	28.56	27.19	27.07	28.34	27.55
FeO*	4.71	4.31	7.44	4.60	4.60	4.56	4.61	4.49	4.32	4.29	4.34	4.29	3.93	3.94	4.09	3.32	3.50	3.95	4.08	3.85
MnO	0.02	0.01	0.05	0.04	0.02	0.01	0.00	0.03	0.02	0.04	0.00	0.02	0.02	0.04	0.06	0.00	0.01	0.00	0.04	0.06
MgO	2.55	2.28	0.85	1.89	2.36	2.61	2.20	2.24	2.29	2.55	2.81	2.63	2.82	2.72	3.07	2.65	3.15	2.74	2.74	2.89
CaO	0.00	0.02	0.30	0.09	0.02	0.05	0.02	0.01	0.05	0.00	0.09	0.00	0.00	0.00	0.00	0.01	0.00	0.06	0.00	0.00
Na_2O	0.73	0.67	1.66	0.68	0.95	0.81	0.89	0.86	0.62	0.72	0.37	0.75	0.58	0.81	0.49	0.72	0.75	0.78	0.67	0.52
K_2O	10.04	10.28	8.53	9.60	9.49	9.83	9.50	9.72	10.30	9.95	10.83	9.92	10.26	9.75	10.27	10.02	10.10	9.81	9.91	10.29
Cr_2O_3	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.00	0.01	0.00	0.00	0.02	0.00	0.00
Total	92.10	93.50	94.49	91.79	94.14	93.70	93.77	94.35	94.81	95.11	94.24	94.34	93.56	92.60	93.16	93.58	93.54	92.60	95.26	93.94
Cations on the basis of 22 oxygens																				
Si	6.331	6.371	6.109	6.323	6.456	6.556	6.423	6.445	6.452	6.512	6.566	6.465	6.620	6.594	6.647	6.519	6.672	6.609	6.588	6.628
Ti	0.074	0.053	0.009	0.025	0.071	0.072	0.079	0.075	0.059	0.073	0.073	0.075	0.048	0.067	0.047	0.074	0.019	0.061	0.061	0.037
Al	4.728	4.787	5.129	4.930	4.652	4.470	4.707	4.683	4.691	4.582	4.424	4.619	4.434	4.454	4.354	4.351	4.613	4.393	4.432	4.499	4.443
Fe*	0.555	0.499	0.862	0.541	0.526	0.525	0.529	0.513	0.492	0.486	0.498	0.490	0.452	0.458	0.473	0.380	0.402	0.458	0.460	0.441
Mn	0.003	0.001	0.006	0.005	0.003	0.001	0.000	0.003	0.003	0.004	0.000	0.002	0.002	0.005	0.007	0.000	0.001	0.000	0.005	0.007
Mg	0.536	0.470	0.176	0.396	0.481	0.536	0.451	0.457	0.465	0.514	0.575	0.535	0.579	0.562	0.632	0.542	0.643	0.568	0.551	0.589
Ca	0.000	0.002	0.045	0.014	0.004	0.007	0.003	0.002	0.007	0.000	0.013	0.000	0.000	0.000	0.000	0.001	0.000	0.009	0.000	0.000
Na	0.201	0.180	0.446	0.184	0.252	0.215	0.237	0.229	0.163	0.188	0.098	0.199	0.154	0.218	0.130	0.192	0.200	0.210	0.174	0.138
K	1.805	1.814	1.507	1.723	1.656	1.728	1.665	1.694	1.788	1.719	1.898	1.729	1.801	1.728	1.813	1.752	1.766	1.739	1.703	1.797
Cr	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.002	0.000	0.001	0.000	0.000	0.002	0.000	0.000
Total	14.233	14.179	14.292	14.140	14.100	14.109	14.095	14.101	14.119	14.077	14.147	14.115	14.091	14.085	14.101	14.073	14.096	14.087	14.040	14.080

** Total Fe as FeO*

Table 1. (continued)

Sample	03-18																			
No.	65	74	76	77	78	79	82	99	100	101	102	103	104	105	113	114	115	116	1	16
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
					core	rim		rim	←	←	core	→	→	rim	rim	→	←	rim		core
SiO_2	46.53	48.67	48.86	48.21	46.87	44.87	50.17	48.28	48.62	48.55	48.79	48.29	48.78	47.61	47.68	48.62	48.26	47.64	50.08	47.45
TiO_2	0.74	0.51	0.50	0.68	0.50	0.53	0.57	0.42	0.40	0.37	0.38	0.49	0.39	0.49	0.71	0.48	0.51	0.74	0.14	0.50
Al_2O_3	29.71	27.59	27.01	27.80	29.75	30.24	25.71	27.81	27.48	27.27	27.11	27.43	27.48	28.71	28.13	27.46	27.25	28.11	27.26	29.23
FeO*	4.01	3.92	4.00	3.80	4.11	4.35	4.41	3.50	3.71	4.16	4.16	4.20	4.32	4.15	4.14	3.85	3.94	3.86	4.18	3.74
MnO	0.00	0.02	0.02	0.01	0.06	0.05	0.01	0.05	0.06	0.05	0.00	0.05	0.02	0.00	0.01	0.00	0.00	0.01	0.00	0.04
MgO	2.19	2.85	3.01	2.83	2.18	1.84	3.60	2.84	2.84	2.95	2.96	2.90	2.93	2.51	2.64	2.89	2.84	2.60	3.04	2.33
CaO	0.02	0.00	0.00	0.00	0.00	0.01	0.08	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Na_2O	0.77	0.74	0.67	0.82	0.59	0.70	0.23	0.49	0.53	0.65	0.63	0.56	0.58	0.51	0.85	0.60	0.53	0.80	0.71	0.52
K_2O	9.58	9.85	10.19	9.97	10.02	9.59	10.30	10.35	10.21	10.13	10.01	10.22	10.26	10.45	9.80	10.16	10.25	9.79	10.32	10.25
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.00
Total	93.54	94.14	94.25	94.12	94.06	92.18	95.08	93.75	93.85	94.13	94.04	94.15	94.77	94.42	93.96	94.06	93.56	93.56	95.78	94.06
Cations on the basis of 22 oxygens																				
Si	6.391	6.633	6.668	6.582	6.414	6.278	6.789	6.611	6.651	6.639	6.669	6.608	6.631	6.502	6.530	6.639	6.635	6.541	6.722	6.483
Ti	0.076	0.052	0.052	0.070	0.052	0.056	0.058	0.043	0.041	0.038	0.039	0.050	0.040	0.050	0.074	0.049	0.052	0.076	0.014	0.052
Al	4.809	4.431	4.344	4.473	4.797	4.987	4.100	4.489	4.430	4.396	4.367	4.424	4.402	4.622	4.540	4.420	4.415	4.548	4.312	4.707
Fe*	0.460	0.447	0.457	0.434	0.470	0.509	0.499	0.400	0.424	0.476	0.475	0.481	0.491	0.474	0.474	0.440	0.453	0.443	0.470	0.428
Mn	0.000	0.002	0.002	0.002	0.006	0.005	0.001	0.006	0.006	0.006	0.000	0.006	0.002	0.000	0.002	0.000	0.000	0.001	0.000	0.004
Mg	0.448	0.578	0.612	0.575	0.444	0.384	0.725	0.580	0.579	0.601	0.603	0.592	0.593	0.511	0.538	0.589	0.582	0.533	0.609	0.474
Ca	0.003	0.000	0.000	0.000	0.000	0.001	0.012	0.001	0.000	0.001	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.002	0.000	0.001
Na	0.206	0.196	0.176	0.216	0.157	0.189	0.061	0.131	0.142	0.173	0.166	0.148	0.153	0.134	0.225	0.158	0.140	0.214	0.184	0.138
K	1.678	1.712	1.773	1.737	1.748	1.712	1.778	1.808	1.782	1.766	1.745	1.784	1.780	1.821	1.712	1.770	1.797	1.715	1.767	1.786
Cr	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	0.000	0.000	0.004	0.000
Total	14.070	14.052	14.083	14.088	14.088	14.122	14.023	14.070	14.055	14.095	14.064	14.095	14.094	14.115	14.095	14.065	14.074	14.073	14.081	14.073

** Total Fe as FeO*

Sample	03-18																			
No.	1	14	15	2	3	4	5	28	29	30	31	37	38	39	40	41	42	43	44	45
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
	→	→	→	→	→	→	rim	core	→	→	rim							core	→	→
SiO_2	47.20	46.67	46.62	46.21	46.01	45.97	45.49	48.71	48.09	45.93	45.81	48.77	50.67	51.00	49.42	50.25	48.91	50.72	50.99	50.22
TiO_2	0.60	0.65	0.61	0.60	0.51	0.58	0.26	0.64	0.70	0.63	0.58	0.23	0.27	0.28	0.30	0.26	0.58	0.25	0.27	0.26
Al_2O_3	29.92	30.23	30.28	29.95	30.03	30.13	31.04	28.49	28.54	29.92	30.46	27.75	25.26	25.39	27.63	25.37	28.29	25.08	25.60	26.74
FeO*	3.83	3.91	3.94	3.96	4.24	4.01	4.04	3.71	3.56	3.62	3.59	3.40	3.36	3.31	3.47	3.33	3.25	3.34	3.02	3.34
MnO	0.00	0.01	0.00	0.03	0.00	0.03	0.03	0.02	0.01	0.00	0.04	0.03	0.02	0.00	0.03	0.00	0.03	0.00	0.00	0.01
MgO	2.23	2.13	2.13	2.17	2.08	2.01	1.71	2.89	2.66	2.14	2.10	3.23	4.03	4.05	3.50	3.91	2.92	3.96	3.98	3.66
CaO	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.05	0.00	0.04	0.04	0.00	0.02	0.14	0.02	0.10	0.00	0.02
Na_2O	0.67	0.88	0.82	0.87	0.78	0.70	0.52	0.78	0.69	0.54	0.46	0.60	0.34	0.32	0.50	0.49	0.61	0.41	0.33	0.37
K_2O	9.95	9.96	9.61	9.52	9.55	9.67	9.72	9.77	9.90	9.69	10.04	10.03	10.38	10.34	10.42	10.22	10.21	10.41	10.46	10.42
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	94.39	94.44	94.01	93.30	93.20	93.10	92.79	95.00	94.18	92.52	93.07	94.07	94.37	94.69	95.28	93.97	94.81	94.27	94.64	95.04
Cations on the basis of 22 oxygens																				
Si	6.421	6.360	6.367	6.364	6.351	6.349	6.299	6.568	6.544	6.368	6.324	6.637	6.871	6.882	6.653	6.845	6.605	6.888	6.879	6.762
Ti	0.062	0.067	0.062	0.062	0.053	0.060	0.027	0.064	0.071	0.066	0.060	0.023	0.028	0.029	0.030	0.027	0.059	0.026	0.027	0.026
Al	4.797	4.855	4.874	4.861	4.886	4.904	5.065	4.528	4.578	4.889	4.957	4.452	4.037	4.039	4.384	4.073	4.503	4.014	4.069	4.244
Fe*	0.436	0.446	0.450	0.456	0.489	0.463	0.467	0.418	0.406	0.419	0.415	0.387	0.381	0.374	0.390	0.379	0.367	0.379	0.340	0.376
Mn	0.000	0.001	0.000	0.004	0.000	0.003	0.003	0.002	0.001	0.000	0.004	0.004	0.002	0.000	0.004	0.000	0.003	0.000	0.000	0.001
Mg	0.452	0.434	0.434	0.445	0.429	0.414	0.353	0.580	0.540	0.442	0.433	0.655	0.815	0.814	0.701	0.794	0.587	0.801	0.800	0.735
Ca	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.004	0.008	0.000	0.006	0.006	0.000	0.003	0.021	0.002	0.014	0.000	0.002
Na	0.176	0.231	0.217	0.232	0.208	0.188	0.140	0.203	0.183	0.144	0.122	0.159	0.090	0.085	0.130	0.130	0.159	0.108	0.087	0.096
K	1.727	1.732	1.674	1.672	1.682	1.703	1.716	1.681	1.718	1.714	1.768	1.741	1.795	1.780	1.790	1.776	1.759	1.804	1.800	1.789
Cr	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	0.000	0.000	0.000	0.000
Total	14.070	14.127	14.079	14.096	14.098	14.085	14.070	14.046	14.046	14.050	14.082	14.064	14.025	14.002	14.085	14.045	14.045	14.035	14.002	14.032

** Total Fe as FeO*

Sample	03-18																			
No.	46	47	48	49	50	51	52	53	54	55	56	58	60	65	29	36	10	35	7	8
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3
	→	→	→	→	→	→	→	→	→	→	rim									
SiO_2	50.01	50.66	49.33	49.40	49.46	49.60	49.08	48.38	47.73	46.26	44.45	50.58	48.29	49.78	46.43	45.71	45.86	47.13	46.76	46.63
TiO_2	0.37	0.28	0.41	0.28	0.25	0.29	0.29	0.55	0.71	0.96	0.73	0.33	0.73	0.25	0.67	0.56	0.36	0.77	0.64	0.70
Al_2O_3	25.52	25.49	27.14	27.26	27.35	27.55	27.49	28.33	28.63	29.49	31.65	25.33	28.72	27.51	28.13	29.80	30.01	28.32	27.00	27.03
FeO*	3.56	3.35	3.49	3.62	3.60	3.61	3.81	3.52	3.77	3.56	3.46	3.58	3.69	3.41	3.86	4.40	3.82	3.98	4.31	4.45
MnO	0.00	0.03	0.02	0.01	0.01	0.04	0.04	0.00	0.00	0.00	0.00	0.03	0.05	0.03	0.00	0.00	0.02	0.00	0.00	0.02
MgO	3.82	3.84	3.33	3.32	3.22	3.21	3.25	2.95	2.62	2.11	1.45	3.76	2.67	3.29	2.81	2.23	1.99	2.83	2.63	2.61
CaO	0.00	0.02	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.01	0.00	0.04	0.03	0.00	0.01	0.02	0.01	0.04	0.00	0.03
Na_2O	0.42	0.45	0.54	0.53	0.51	0.60	0.65	0.71	0.75	0.89	0.81	0.51	0.93	0.48	0.64	0.98	0.43	0.80	0.87	0.87
K_2O	10.28	10.09	10.29	10.05	10.22	10.22	10.13	10.06	9.90	9.41	9.56	10.07	9.73	10.35	10.22	9.80	10.23	9.70	9.62	9.64
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00
Total	93.99	94.19	94.57	94.47	94.61	95.14	94.73	94.50	94.13	92.69	92.10	94.23	94.84	95.09	92.79	93.50	92.73	93.55	91.82	91.97
Cations on the basis of 22 oxygens																				
Si	6.820	6.870	6.689	6.696	6.697	6.682	6.651	6.566	6.512	6.397	6.194	6.868	6.530	6.703	6.457	6.317	6.368	6.480	6.564	6.544
Ti	0.038	0.028	0.042	0.028	0.026	0.029	0.029	0.056	0.073	0.100	0.076	0.034	0.074	0.025	0.070	0.058	0.038	0.080	0.067	0.074
Al	4.102	4.074	4.336	4.355	4.364	4.373	4.391	4.531	4.604	4.806	5.199	4.053	4.577	4.365	4.611	4.855	4.911	4.588	4.467	4.472
Fe*	0.406	0.380	0.395	0.410	0.407	0.406	0.432	0.400	0.430	0.411	0.403	0.406	0.417	0.384	0.448	0.508	0.444	0.457	0.506	0.522
Mn	0.000	0.003	0.003	0.001	0.001	0.004	0.005	0.000	0.000	0.000	0.000	0.003	0.005	0.004	0.000	0.000	0.002	0.000	0.000	0.003
Mg	0.777	0.775	0.674	0.670	0.649	0.644	0.656	0.596	0.532	0.434	0.301	0.761	0.538	0.660	0.582	0.460	0.411	0.579	0.550	0.545
Ca	0.001	0.003	0.003	0.000	0.000	0.005	0.000	0.000	0.003	0.002	0.000	0.006	0.005	0.000	0.001	0.002	0.001	0.005	0.000	0.004
Na	0.110	0.118	0.141	0.140	0.134	0.157	0.171	0.188	0.199	0.239	0.219	0.135	0.244	0.125	0.171	0.262	0.117	0.212	0.238	0.236
K	1.789	1.745	1.781	1.738	1.765	1.756	1.751	1.741	1.723	1.660	1.699	1.745	1.678	1.777	1.813	1.727	1.812	1.701	1.723	1.727
Cr	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	0.005	0.001	0.000	0.000	0.000	0.000
Total	14.041	13.996	14.062	14.038	14.044	14.058	14.085	14.077	14.075	14.049	14.090	14.011	14.068	14.041	14.157	14.191	14.103	14.103	14.115	14.127

** Total Fe as FeO*

Table 1. (continued)

Sample	03-18																	
No.	9	10	11	12	63	106	107	108	23	24	28	29	49	55	80	81	83	93
Mode	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3
		rim	core	rim		rim	core	rim										
SiO_2	45.74	47.64	47.64	47.98	46.55	49.37	49.82	48.07	47.21	47.48	47.88	46.85	48.98	49.75	44.53	44.24	45.27	48.32
TiO_2	0.50	0.47	0.52	0.40	0.58	0.46	0.33	0.70	0.66	0.56	0.73	0.49	0.65	0.28	0.26	0.30	0.36	0.43
Al_2O_3	28.26	26.66	26.45	26.66	29.63	26.51	25.96	27.85	28.77	28.18	28.08	29.15	26.69	26.50	29.53	30.12	30.19	27.08
FeO*	4.47	3.88	3.81	3.91	4.28	3.87	3.94	4.22	4.15	3.91	3.58	3.72	3.46	3.21	4.67	4.43	4.33	3.33
MnO	0.00	0.03	0.00	0.04	0.00	0.02	0.00	0.00	0.04	0.08	0.00	0.02	0.04	0.05	0.00	0.04	0.00	0.01
MgO	2.31	2.92	2.92	2.92	2.46	3.34	3.47	2.91	2.40	2.60	2.76	2.45	3.28	3.41	1.88	1.63	1.85	2.85
CaO	0.01	0.04	0.01	0.00	0.03	0.02	0.00	0.01	0.00	0.04	0.03	0.06	0.24	0.01	0.10	0.07	0.07	0.03
Na_2O	0.79	0.71	0.67	0.63	0.68	0.55	0.46	0.72	0.65	0.59	0.76	0.59	0.54	0.40	0.65	0.59	0.61	0.37
K_2O	9.53	9.87	9.92	9.87	9.88	10.00	10.19	10.06	10.25	10.19	10.12	10.25	9.89	10.09	9.50	9.92	10.04	10.67
Cr_2O_3	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00
Total	91.61	92.21	91.95	92.40	94.08	94.14	94.18	94.53	94.13	93.65	93.94	93.59	93.76	93.72	91.12	91.34	92.71	93.10
Cations on the basis of 22 oxygens																		
Si	6.441	6.644	6.660	6.671	6.377	6.727	6.789	6.551	6.471	6.530	6.550	6.445	6.692	6.780	6.314	6.266	6.307	6.669
Ti	0.053	0.049	0.055	0.041	0.060	0.047	0.034	0.071	0.068	0.057	0.075	0.050	0.067	0.029	0.028	0.032	0.038	0.044
Al	4.690	4.382	4.359	4.368	4.784	4.257	4.169	4.475	4.647	4.568	4.526	4.725	4.298	4.256	4.935	5.028	4.958	4.405
Fe*	0.526	0.452	0.446	0.455	0.490	0.441	0.449	0.481	0.476	0.450	0.409	0.428	0.395	0.366	0.554	0.524	0.505	0.384
Mn	0.000	0.004	0.000	0.004	0.000	0.002	0.000	0.000	0.005	0.009	0.000	0.002	0.005	0.006	0.000	0.005	0.000	0.002
Mg	0.485	0.606	0.608	0.604	0.503	0.679	0.704	0.591	0.490	0.534	0.564	0.502	0.669	0.692	0.397	0.344	0.384	0.586
Ca	0.001	0.005	0.001	0.000	0.005	0.003	0.000	0.001	0.000	0.006	0.005	0.009	0.035	0.002	0.015	0.010	0.010	0.004
Na	0.214	0.191	0.181	0.170	0.180	0.146	0.123	0.191	0.173	0.156	0.200	0.158	0.142	0.104	0.178	0.161	0.165	0.099
K	1.713	1.756	1.770	1.751	1.726	1.738	1.771	1.749	1.792	1.788	1.766	1.799	1.723	1.755	1.718	1.793	1.784	1.879
Cr	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.003	0.000	0.000	0.000	0.000
Total	14.124	14.090	14.081	14.064	14.124	14.039	14.039	14.110	14.121	14.100	14.095	14.120	14.025	13.992	14.139	14.164	14.150	14.073

** Total Fe as FeO*

Table 2. Chemical compositions of white micas in the country-rock gneisses.

Sample	03-37																			
No.	13	31	57	58	67	5	6	7	8	19	20	28	37	38	13	16	17	18	19	20
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3
						rim	→	←	rim	core	rim					core/rim	→	→	→	→
SiO_2	47.38	46.94	45.59	45.93	46.63	46.58	46.74	46.76	46.67	45.80	46.40	46.38	45.65	46.88	46.33	45.83	45.85	46.58	46.62	45.83
TiO_2	0.90	0.96	1.12	1.16	1.17	1.12	1.08	1.13	1.04	1.10	1.22	1.15	1.08	1.30	1.13	0.95	1.17	1.19	1.19	1.18
Al_2O_3	24.57	25.53	25.48	25.28	26.07	25.39	25.62	25.76	25.44	25.71	25.95	26.09	27.15	26.61	25.74	27.00	26.47	25.65	25.64	26.59
FeO*	6.01	6.14	6.12	5.85	6.35	6.56	6.39	6.69	6.33	6.65	6.12	6.87	6.81	6.42	5.94	5.92	6.62	6.49	6.22	6.51
MnO	0.07	0.13	0.00	0.00	0.00	0.12	0.10	0.10	0.14	0.10	0.05	0.08	0.04	0.10	0.10	0.00	0.04	0.00	0.21	0.33
MgO	2.67	2.19	2.27	2.29	2.17	2.31	2.27	2.23	2.29	2.14	2.23	2.16	1.92	2.17	2.19	1.86	2.04	2.25	2.22	1.92
CaO	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.01	0.01
Na_2O	0.29	0.22	0.25	0.28	0.37	0.34	0.42	0.29	0.34	0.34	0.25	0.32	0.34	0.27	0.34	0.26	0.34	0.39	0.32	0.30
K_2O	10.58	10.72	10.72	10.94	10.77	10.50	10.49	10.66	10.79	10.63	10.79	10.59	10.74	10.78	10.55	10.93	10.87	10.58	10.67	10.62
Cr_2O_3	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	92.47	92.82	91.55	91.73	93.54	92.91	93.10	93.61	93.04	92.48	93.01	93.66	93.76	94.52	92.36	92.76	93.39	93.13	93.09	93.27
Cations on the basis of 22 oxygens																				
Si	6.697	6.619	6.535	6.568	6.539	6.578	6.579	6.559	6.585	6.515	6.538	6.511	6.408	6.504	6.564	6.473	6.461	6.561	6.568	6.460
Ti	0.096	0.101	0.120	0.124	0.124	0.119	0.114	0.119	0.111	0.118	0.130	0.122	0.114	0.135	0.121	0.101	0.124	0.127	0.126	0.125
Al	4.092	4.243	4.304	4.260	4.308	4.226	4.250	4.259	4.231	4.311	4.310	4.317	4.492	4.351	4.298	4.494	4.396	4.257	4.257	4.417
Fe*	0.710	0.724	0.733	0.700	0.745	0.774	0.752	0.784	0.746	0.791	0.721	0.807	0.800	0.745	0.704	0.700	0.780	0.764	0.733	0.767
Mn	0.009	0.016	0.000	0.000	0.000	0.014	0.011	0.011	0.017	0.012	0.006	0.009	0.005	0.012	0.012	0.000	0.005	0.000	0.025	0.040
Mg	0.563	0.460	0.484	0.488	0.453	0.485	0.476	0.467	0.482	0.454	0.469	0.452	0.403	0.448	0.462	0.392	0.428	0.472	0.466	0.402
Ca	0.000	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.005	0.000	0.000	0.000	0.001	0.001
Na	0.079	0.059	0.069	0.078	0.101	0.094	0.113	0.080	0.092	0.094	0.068	0.088	0.093	0.072	0.094	0.072	0.093	0.106	0.086	0.082
K	1.907	1.929	1.960	1.995	1.927	1.891	1.884	1.908	1.942	1.928	1.939	1.897	1.924	1.908	1.907	1.970	1.954	1.901	1.918	1.909
Cr	0.000	0.000	0.000	0.001	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
Total	14.154	14.152	14.207	14.214	14.197	14.182	14.180	14.187	14.206	14.223	14.181	14.202	14.241	14.176	14.167	14.201	14.241	14.187	14.181	14.202

** Total Fe as FeO*

Sample	03-37								KG-430											
No.	21	22	34	35	36	37	43	60	94	31	58	59	7	15	16	89	90	91	97	99
Mode	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn1	Phn1	Phn1	Phn1	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3
	core/rim		core/rim		→ core/rim															
SiO_2	45.58	46.14	45.74	46.23	46.33	46.69	45.99	46.10	45.99	46.67	49.02	48.28	46.82	46.21	46.33	45.03	45.48	44.71	45.38	45.87
TiO_2	1.06	0.99	1.16	1.18	1.06	0.95	1.14	0.94	0.87	0.81	0.89	0.94	1.19	1.24	1.26	1.20	1.31	1.06	1.22	1.20
Al_2O_3	27.69	25.58	26.18	25.94	25.53	25.74	27.02	25.48	30.52	28.89	26.15	27.12	27.39	28.60	27.59	27.98	27.48	29.42	29.21	29.13
FeO*	6.04	6.36	6.49	6.11	6.52	6.33	6.05	6.22	4.69	4.74	4.21	4.33	4.31	4.66	4.23	4.43	4.56	4.28	5.67	4.70
MnO	0.01	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.13	0.18	0.28	0.25	0.08	0.04	0.02	0.07	0.04	0.04	0.08	0.12
MgO	1.77	2.25	2.13	2.19	2.22	2.27	1.82	2.23	1.69	2.03	2.83	2.54	2.36	2.01	2.19	1.99	2.27	1.66	1.95	1.78
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.05	0.09	0.00	0.00	0.01	0.02	0.01	0.00	0.07	0.00
Na_2O	0.31	0.39	0.28	0.24	0.31	0.38	0.28	0.39	0.30	0.32	0.38	0.36	0.43	0.50	0.44	0.55	0.49	0.52	0.39	0.42
K_2O	10.94	10.71	10.95	11.05	10.73	10.80	11.00	10.73	10.74	9.55	9.56	9.54	10.48	10.57	10.43	10.40	10.43	10.31	10.11	10.56
Cr_2O_3	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Total	93.39	92.44	92.92	92.94	92.71	93.30	93.28	92.08	94.97	93.27	93.37	93.45	93.05	93.83	92.49	91.67	92.06	91.99	94.07	93.78
Cations on the basis of 22 oxygens																				
Si	6.400	6.553	6.477	6.530	6.563	6.568	6.464	6.568	6.285	6.447	6.736	6.636	6.514	6.394	6.483	6.380	6.420	6.298	6.286	6.352
Ti	0.112	0.106	0.124	0.125	0.113	0.101	0.120	0.101	0.089	0.084	0.092	0.097	0.124	0.129	0.132	0.128	0.139	0.112	0.127	0.125
Al	4.583	4.282	4.369	4.318	4.263	4.268	4.477	4.279	4.916	4.704	4.235	4.392	4.490	4.664	4.549	4.674	4.571	4.884	4.767	4.754
Fe*	0.709	0.755	0.769	0.722	0.772	0.745	0.711	0.741	0.536	0.548	0.483	0.498	0.502	0.539	0.495	0.525	0.538	0.504	0.657	0.544
Mn	0.002	0.000	0.000	0.000	0.000	0.017	0.000	0.000	0.015	0.021	0.032	0.029	0.010	0.004	0.002	0.008	0.004	0.004	0.010	0.014
Mg	0.370	0.476	0.450	0.462	0.469	0.476	0.381	0.473	0.344	0.418	0.580	0.520	0.489	0.415	0.457	0.421	0.478	0.348	0.402	0.367
Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.006	0.008	0.013	0.000	0.000	0.002	0.003	0.001	0.000	0.010	0.000
Na	0.083	0.108	0.077	0.065	0.086	0.104	0.075	0.108	0.080	0.086	0.102	0.097	0.115	0.135	0.119	0.150	0.133	0.141	0.103	0.114
K	1.960	1.940	1.977	1.992	1.940	1.939	1.972	1.950	1.872	1.684	1.676	1.673	1.859	1.866	1.862	1.879	1.878	1.852	1.787	1.865

Table 2. (continued)

Sample	KG-430							KG-434												
No.	3	18	20	39	40	44	68	3	6	7	13	17	3	4	5	6	7	19	33	37
Mode	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn1	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2
		rim	core	core	rim															
SiO_2	46.22	45.36	46.60	46.00	44.54	45.29	48.41	44.73	45.99	48.18	44.53	43.73	49.15	50.72	49.06	50.25	48.24	48.73	46.63	48.38
TiO_2	1.05	1.07	1.14	1.33	0.83	1.04	0.95	1.11	3.42	1.05	0.99	0.48	0.36	0.21	0.48	0.20	0.52	0.63	0.52	0.63
Al_2O_3	28.89	28.68	27.38	28.13	30.15	29.60	25.75	26.99	26.17	26.00	28.86	30.35	28.30	26.73	28.62	26.31	29.32	29.14	31.03	29.60
FeO*	4.02	4.17	4.05	4.49	4.03	4.09	4.17	4.74	4.11	4.21	5.41	5.83	2.12	2.24	2.20	2.62	2.19	2.40	2.18	2.37
MnO	0.00	0.02	0.02	0.04	0.06	0.09	0.09	0.07	0.11	0.07	0.03	0.19	0.00	0.00	0.05	0.04	0.02	0.00	0.04	0.00
MgO	2.02	2.04	2.45	2.06	1.44	1.72	3.07	2.64	2.46	2.94	1.94	1.70	2.58	3.29	2.61	3.51	2.29	2.45	1.61	2.36
CaO	0.05	0.00	0.00	0.01	0.00	0.01	0.02	0.02	0.01	0.02	0.04	0.05	0.03	0.00	0.02	0.00	0.02	0.00	0.04	0.00
Na_2O	0.57	0.54	0.43	0.48	0.59	0.54	0.38	0.43	0.43	0.34	0.57	0.65	0.84	0.69	0.68	0.60	0.58	0.84	0.88	0.83
K_2O	9.43	9.58	9.82	9.65	9.41	9.41	9.73	10.34	10.45	10.76	9.94	9.40	9.83	9.75	9.89	9.85	10.39	9.75	10.08	9.87
Cr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.17	0.06	0.08	0.01	0.08	0.00	0.25	0.11
Total	92.25	91.45	91.89	92.18	91.07	91.79	92.58	91.07	93.16	93.58	92.30	92.41	93.37	93.68	93.68	93.39	93.64	93.94	93.25	94.14
Cations on the basis of 22 oxygens																				
Si	6.432	6.389	6.528	6.438	6.290	6.344	6.718	6.397	6.416	6.663	6.283	6.162	6.683	6.857	6.651	6.839	6.565	6.593	6.380	6.539
Ti	0.110	0.113	0.120	0.140	0.088	0.110	0.100	0.120	0.359	0.109	0.105	0.051	0.037	0.021	0.049	0.021	0.053	0.064	0.054	0.064
Al	4.739	4.760	4.520	4.639	5.019	4.885	4.212	4.549	4.302	4.237	4.798	5.040	4.535	4.259	4.572	4.220	4.703	4.646	5.005	4.716
Fe*	0.468	0.491	0.474	0.525	0.476	0.480	0.484	0.567	0.480	0.487	0.638	0.687	0.241	0.253	0.249	0.298	0.249	0.272	0.249	0.268
Mn	0.000	0.002	0.003	0.005	0.007	0.010	0.010	0.008	0.013	0.009	0.003	0.022	0.000	0.000	0.006	0.004	0.002	0.000	0.005	0.000
Mg	0.420	0.428	0.511	0.430	0.304	0.360	0.635	0.563	0.512	0.607	0.408	0.358	0.523	0.663	0.527	0.713	0.464	0.494	0.328	0.476
Ca	0.008	0.001	0.000	0.001	0.000	0.002	0.003	0.003	0.001	0.003	0.006	0.007	0.005	0.000	0.002	0.000	0.003	0.000	0.006	0.000
Na	0.153	0.146	0.117	0.129	0.162	0.148	0.103	0.118	0.117	0.092	0.155	0.178	0.223	0.180	0.179	0.158	0.153	0.221	0.234	0.218
K	1.675	1.722	1.756	1.722	1.696	1.681	1.723	1.886	1.859	1.899	1.790	1.690	1.705	1.681	1.710	1.710	1.804	1.683	1.759	1.702
Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.003	0.018	0.006	0.008	0.001	0.009	0.000	0.027	0.011
Total	14.003	14.052	14.028	14.028	14.042	14.019	13.989	14.211	14.061	14.105	14.185	14.199	13.968	13.920	13.954	13.964	14.004	13.972	14.046	13.993

** Total Fe as FeO*

Sample	KG-434																			
No.	38	55	59	61	71	73	74	75	76	39	40	46	50	51	69	70	81	82	11	12
Mode	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn2	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Phn3	Pg1	Pg1
													core	rim	core	rim				
SiO_2	48.23	50.60	49.18	48.96	46.29	50.39	50.11	47.56	48.78	46.49	46.01	45.37	49.05	45.95	46.71	48.85	50.68	50.46	44.37	45.52
TiO_2	0.54	0.22	0.42	0.44	0.59	0.17	0.20	0.57	0.48	0.58	0.47	0.44	0.53	0.55	0.57	0.49	0.20	0.27	0.04	0.08
Al_2O_3	29.92	26.84	28.14	27.86	31.62	26.52	26.76	31.25	28.82	32.34	32.61	32.18	28.67	32.33	31.49	29.13	27.27	26.46	38.64	38.37
FeO*	2.34	2.51	2.29	2.48	2.56	2.44	2.45	2.61	2.78	2.41	2.63	2.57	2.62	2.34	2.59	2.56	2.46	2.58	1.08	1.20
MnO	0.00	0.00	0.07	0.00	0.00	0.03	0.02	0.02	0.06	0.02	0.03	0.00	0.00	0.00	0.03	0.04	0.01	0.05	0.00	0.00
MgO	2.19	3.36	2.66	2.65	1.56	3.49	3.54	2.03	2.72	1.52	1.27	1.31	2.82	1.40	1.62	2.55	3.08	3.35	0.09	0.11
CaO	0.00	0.05	0.02	0.02	0.02	0.02	0.00	0.02	0.00	0.02	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.01	1.17	0.86
Na_2O	0.81	0.52	0.86	0.73	1.34	0.44	0.42	1.39	0.86	1.51	1.28	0.95	0.92	1.42	1.24	0.74	0.69	0.60	7.13	7.27
K_2O	9.93	9.95	9.80	9.86	9.13	10.12	10.14	8.98	9.61	9.16	9.47	9.91	9.80	9.22	9.44	9.94	9.97	10.09	0.30	0.54
Cr_2O_3	0.06	0.06	0.06	0.01	0.39	0.07	0.08	0.04	0.11	0.04	0.08	0.05	0.10	0.07	0.07	0.10	0.04	0.00	0.00	0.04
Total	94.01	94.10	93.50	93.01	93.49	93.67	93.72	94.47	94.21	94.08	93.84	92.76	94.51	93.31	93.76	94.39	94.39	93.86	92.81	93.99
Cations on the basis of 22 oxygens																				
Si	6.527	6.827	6.685	6.695	6.309	6.836	6.799	6.396	6.594	6.286	6.253	6.251	6.611	6.267	6.349	6.590	6.816	6.839	5.863	5.942
Ti	0.055	0.022	0.042	0.046	0.060	0.018	0.020	0.057	0.049	0.059	0.048	0.045	0.053	0.056	0.058	0.050	0.020	0.027	0.004	0.008
Al	4.771	4.268	4.508	4.489	5.079	4.241	4.280	4.953	4.592	5.155	5.224	5.225	4.554	5.197	5.044	4.631	4.322	4.227	6.017	5.904
Fe*	0.265	0.283	0.261	0.283	0.291	0.277	0.278	0.293	0.314	0.273	0.299	0.296	0.295	0.267	0.294	0.289	0.277	0.292	0.119	0.131
Mn	0.000	0.000	0.008	0.000	0.000	0.003	0.002	0.003	0.007	0.002	0.003	0.000	0.000	0.000	0.004	0.004	0.001	0.006	0.000	0.000
Mg	0.442	0.676	0.539	0.540	0.317	0.705	0.715	0.406	0.548	0.306	0.257	0.268	0.566	0.285	0.329	0.512	0.617	0.676	0.017	0.022
Ca	0.000	0.007	0.002	0.003	0.004	0.003	0.000	0.003	0.000	0.002	0.000	0.000	0.001	0.005	0.000	0.000	0.001	0.001	0.166	0.120
Na	0.211	0.135	0.226	0.194	0.354	0.116	0.110	0.362	0.224	0.395	0.337	0.255	0.240	0.376	0.326	0.193	0.179	0.156	1.825	1.839
K	1.713	1.713	1.699	1.721	1.588	1.751	1.756	1.541	1.657	1.580	1.642	1.741	1.685	1.603	1.636	1.710	1.711	1.745	0.050	0.090
Cr	0.006	0.006	0.006	0.001	0.042	0.007	0.008	0.004	0.012	0.004	0.009	0.006	0.011	0.008	0.007	0.011	0.004	0.000	0.000	0.004
Total	13.992	13.938	13.978	13.972	14.042	13.956	13.969	14.019	13.996	14.063	14.072	14.086	14.016	14.064	14.048	13.990	13.947	13.971	14.062	14.061

** Total Fe as FeO*

Sample	KG-434		03-20																
No.	15	36	16	21	22	28	32	3	4	5	9	16	54	63	69	70	94	100	114
Mode	Pg1	Pg2	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4
SiO_2	44.60	46.03	48.24	47.87	49.00	48.61	49.84	48.64	47.39	48.08	48.22	46.91	48.75	47.54	49.14	47.33	48.22	47.46	47.44
TiO_2	0.08	0.19	0.55	0.71	0.63	0.75	0.74	0.83	0.89	0.78	0.61	0.60	0.41	0.54	0.41	0.84	0.48	0.77	0.70
Al_2O_3	38.76	38.02	26.18	25.85	25.35	26.30	25.44	25.60	25.60	24.47	25.95	27.43	24.48	25.51	24.67	25.20	24.14	24.42	24.65
FeO*	1.14	0.68	5.05	4.80	5.68	5.57	5.05	5.75	6.02	4.98	4.98	3.70	4.92	5.31	4.88	5.11	4.82	6.11	5.47
MnO	0.03	0.00	0.07	0.08	0.11	0.04	0.07	0.04	0.10	0.02	0.03	0.02	0.10	0.09	0.08	0.02	0.10	0.08	0.06
MgO	0.05	0.16	2.70	2.59	2.94	2.74	2.87	2.61	2.32	2.64	2.59	2.56	3.05	2.77	2.83	2.46	3.36	2.48	2.43
CaO	1.10	0.25	0.02	0.75	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.04	0.00	0.06	0.01	0.07	0.00	0.00
Na_2O	7.36	6.82	0.16	0.08	0.09	0.12	0.08	0.14	0.11	0.08	0.08	0.31	0.15	0.08	0.05	0.17	0.08	0.20	0.09
K_2O	0.26	1.42	10.46	10.47	10.63	10.75	11.06	11.33	11.17	11.43	11.43	10.58	10.60	11.26	10.78	10.92	10.10	10.84	11.02
Cr_2O_3	0.04	0.02	0.00	0.00	0.00	0.03	0.00	0.04	0.03	0.02	0.02	0.00	0.03	0.02	0.00	0.00	0.01	0.01	0.00
Total	93.43	93.58	93.44	93.19	94.43	94.92	95.15	94.99	93.62	92.49	93.91	92.11	92.52	93.11	92.90	92.05	91.38	92.35	91.87
Cations on the basis of 22 oxygens																			
Si	5.861	6.021	6.685	6.665	6.744	6.658	6.791	6.691	6.632	6.776	6.686	6.565	6.826	6.666	6.848	6.693	6.819	6.726	6.739
Ti	0.008	0.019	0.057	0.074	0.065	0.077	0.076	0.086	0.093	0.082	0.064	0.063	0.043	0.057	0.043	0.090	0.051	0.082	0.075
Al	6.002	5.862	4.276	4.242	4.112	4.245	4.085	4.151	4.222	4.065	4.240	4.524	4.039	4.215	4.053	4.200	4.023	4.079	4.126
Fe*	0.125	0.075	0.586	0.559	0.654	0.638	0.575	0.661	0.704	0.587	0.577	0.433	0.576	0.623	0.569	0.604	0.570	0.724	0.650
Mn	0.003	0.000	0.008	0.010	0.012	0.005	0.008	0.005	0.012	0.002	0.003	0.002	0.012	0.010	0.010	0.003	0.012	0.010	0.007
Mg	0.011	0.031	0.558	0.538	0.604	0.560	0.583	0.534	0.484	0.554	0.536	0.534	0.637	0.578	0.588	0.518	0.708	0.523	0.515
Ca	0.155	0.034	0.003	0.111	0.000	0.000	0.000	0.002	0.000	0.000	0.001	0.001	0.006	0.000	0.010	0.001	0.011	0.000	0.000
Na	1.875	1.730	0.043	0.021	0.024	0.032	0.021	0.037	0.030	0.022	0.021	0.084	0.042	0.022	0.014	0.047	0.021	0.055	0.025
K	0.044	0.237	1.849	1.860	1.865	1.879	1.923	1.988	1.994	2.056	2.022	1.890	1.893	2.014	1.916	1.969	1.823	1.960	1.996
Cr	0.004	0.002	0.000	0.000	0.000	0.003	0.000	0.005	0.003	0.002	0.002	0.000	0.003	0.002	0.000	0.000	0.001	0.001	0.000
Total	14.088	14.012	14.066	14.080	14.080	14.097	14.062	14.158	14.174	14.147	14.151	14.097	14.077	14.187	14.048	14.125	14.039	14.160	14.134

** Total Fe as FeO*

Table 2. (continued)

Sample	KG-431																			
No.	27	101	52	103	58	80	91	93	100	8	9	17	30	31	34	50	57	67	71	73
Mode	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4	Phn4
SiO_2	48.17	47.18	48.10	48.06	48.78	49.25	45.12	48.74	45.59	47.87	46.50	45.78	45.64	41.60	50.38	46.26	47.97	46.65	47.69	47.55
TiO_2	0.13	0.20	0.12	0.21	0.09	0.55	0.18	0.29	0.38	0.10	0.34	0.16	0.44	2.14	0.12	0.20	0.05	0.21	0.80	0.20
Al_2O_3	27.08	27.74	27.41	27.36	29.05	24.25	31.10	23.49	29.41	23.48	22.84	24.53	25.52	25.50	24.91	25.02	31.91	28.45	23.04	26.47
FeO*	5.49	4.88	4.33	5.86	3.14	7.74	5.54	8.42	5.32	9.75	11.08	10.09	9.34	13.12	6.32	9.21	3.15	6.07	8.47	8.33
MnO	0.07	0.01	0.04	0.07	0.02	0.17	0.17	0.12	0.02	0.10	0.18	0.13	0.11	0.05	0.01	0.11	0.01	0.01	0.05	0.13
MgO	1.34	1.41	1.19	1.17	1.37	1.62	0.80	1.51	0.39	0.76	0.81	0.86	1.55	1.92	1.67	0.94	1.11	0.38	1.73	1.02
CaO	0.13	0.19	0.01	0.00	0.08	0.00	0.00	0.00	0.04	0.03	0.00	0.07	0.08	0.07	0.08	0.10	0.22	0.01	0.98	0.01
Na_2O	0.10	0.33	0.12	0.14	0.08	0.09	0.23	0.05	0.08	0.10	0.30	0.16	0.05	0.17	0.13	0.17	1.21	0.17	0.23	0.22
K_2O	10.39	10.44	10.02	10.52	9.99	10.65	10.70	10.84	11.04	10.55	10.25	10.31	9.63	8.02	10.35	10.69	8.42	10.72	9.52	10.71
Cr_2O_3	0.00	0.00	0.02	0.00	0.03	0.00	0.01	0.00	0.01	0.00	0.01	0.03	0.01	0.00	0.00	0.02	0.00	0.00	0.05	0.00
Total	92.88	92.37	91.35	93.39	92.61	94.32	93.85	93.46	92.27	92.73	92.29	92.12	92.37	92.58	93.97	92.73	94.05	92.67	92.56	94.64
Cations on the basis of 22 oxygens																				
Si	6.711	6.608	6.749	6.678	6.696	6.853	6.262	6.883	6.431	6.856	6.760	6.633	6.538	6.072	6.946	6.636	6.455	6.555	6.794	6.627
Ti	0.014	0.021	0.012	0.021	0.009	0.057	0.019	0.031	0.040	0.011	0.037	0.018	0.048	0.235	0.013	0.022	0.005	0.022	0.086	0.021
Al	4.446	4.580	4.533	4.480	4.699	3.977	5.086	3.908	4.889	3.962	3.913	4.189	4.309	4.387	4.048	4.230	5.060	4.711	3.868	4.348
Fe*	0.640	0.572	0.508	0.681	0.361	0.901	0.644	0.995	0.627	1.168	1.347	1.222	1.119	1.601	0.728	1.105	0.355	0.713	1.009	0.971
Mn	0.008	0.001	0.005	0.008	0.002	0.020	0.020	0.014	0.003	0.012	0.022	0.016	0.014	0.007	0.002	0.013	0.001	0.001	0.006	0.016
Mg	0.277	0.294	0.249	0.242	0.279	0.335	0.166	0.318	0.081	0.161	0.175	0.186	0.331	0.417	0.343	0.201	0.222	0.080	0.368	0.212
Ca	0.019	0.029	0.001	0.000	0.011	0.000	0.000	0.000	0.006	0.004	0.000	0.011	0.012	0.011	0.012	0.015	0.031	0.001	0.150	0.001
Na	0.028	0.090	0.031	0.037	0.020	0.024	0.063	0.015	0.022	0.028	0.084	0.045	0.013	0.047	0.036	0.048	0.316	0.046	0.062	0.059
K	1.846	1.865	1.793	1.865	1.748	1.891	1.895	1.952	1.988	1.928	1.900	1.905	1.761	1.493	1.820	1.957	1.445	1.922	1.730	1.904
Cr	0.000	0.000	0.002	0.000	0.004	0.000	0.001	0.000	0.001	0.000	0.001	0.004	0.001	0.000	0.000	0.002	0.000	0.000	0.006	0.000
Total	13.989	14.059	13.883	14.012	13.829	14.058	14.155	14.115	14.088	14.130	14.238	14.228	14.146	14.269	13.946	14.229	13.890	14.052	14.079	14.159

** Total Fe as FeO*