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Chemical Composition of Petrographic Assemblages of Igneous and Related Rocks in South Korea*

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ABSTRACT

Results of 359 chemical analyses of igneous and related rocks of the south Korea were collected from 35 papers to see preliminarily some trends of chemical properties of spatial igneous rock assemblages according to five geotectonic provinces: (1) Kyonggi land, (2) Ryongnam land (on diagram these are jointed together as a massif), (3) Ogcheon zone, (4) Kyongsang basin and (5) Alkali rock province. The data were plotted on the diagrams; SiO_2 vs. Na_2O+K_2O and CaO, D. I. vs. oxides, AFM triangle, AKF triangle, and normative An-Ab-Or and Q-Or-Ab triangles for each rock assemblages of individual provinces.

1. Introduction

Results of about 360 chemical analyses of igneous and related rocks in the south Korea have been collected from the papers quoted in this study. The localities of the data cover roughly over the whole area in the South Korea, although many of them are biased in some specific locations. Large amount of available data are derived from Ogcheon zone, Kyongsang basin and volcanic islands. The main scope of this paper is to see preliminarily some trends of chemical properties of spatial igneous rock assemblages according to the geotectonic provinces in south Korea. Consequently, the chemical data are only used in the diagrams forms.

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2. Geotectonic province

A geotectonic lineament of Korea and her adjacence has been first noticed by T. Kobayashi in 1953. Thereafter, with more detailed geological survey in Korea, a newly modified tectonic classification on the southern part of Korean peninsula was proposed by O. J. Kim in 1975. Basically the author follows the Kim's classification, with some exceptions of several modifications, such as different subdivision of Ogcheon zone and adding of alkali rock province to the Kim's division as shown in Fig. 1.

The Kyong-gi and Ryongnam lands are distributed in separated areas as seen in the figure. However, they are intimately related in terms of geotectonics and geologic age. So that, in this paper these two lands are considered to be identical, and jointed together as a Precambrian cratonic basement in the southern part of Korea as noticed by Kim as "Ryongnam-Kyonggi massif".

The author proposes that Ogcheon geosynclinal zone is divided geologically and geochronologically into five segments, namely the Preca-

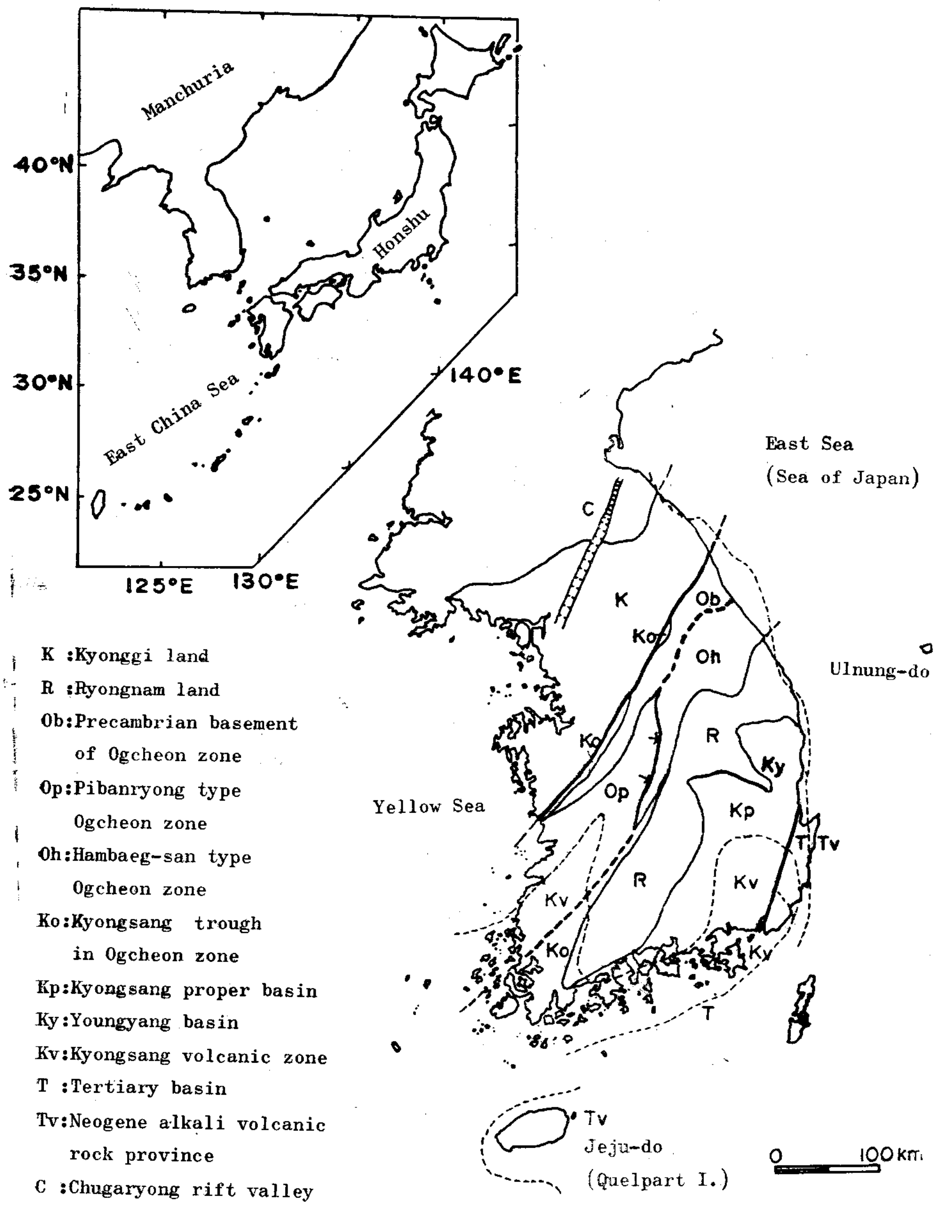

Fig.1. Geologic provinces of S. Korea (Modified from Kim, O.J.,

mbrian metasediments, the Hambaegsan-type Ogcheon subzone of Cambrian and post Cambrian, the Pibanryong-type Ogcheon subzone of the same geological age, the Kyongsang troughs of middle of late Cretaceous and the Kyongsang volcanic rock area of the same geological age.

Kyongsang basin is also subdivided stratigraphically into three parts; the Cretaceous sedimentary, the Cretaceous volcanic, and the Tertiary sedimentary.

Alkali rock Province along the eastern coast borders the western part of, so called, "Circum-

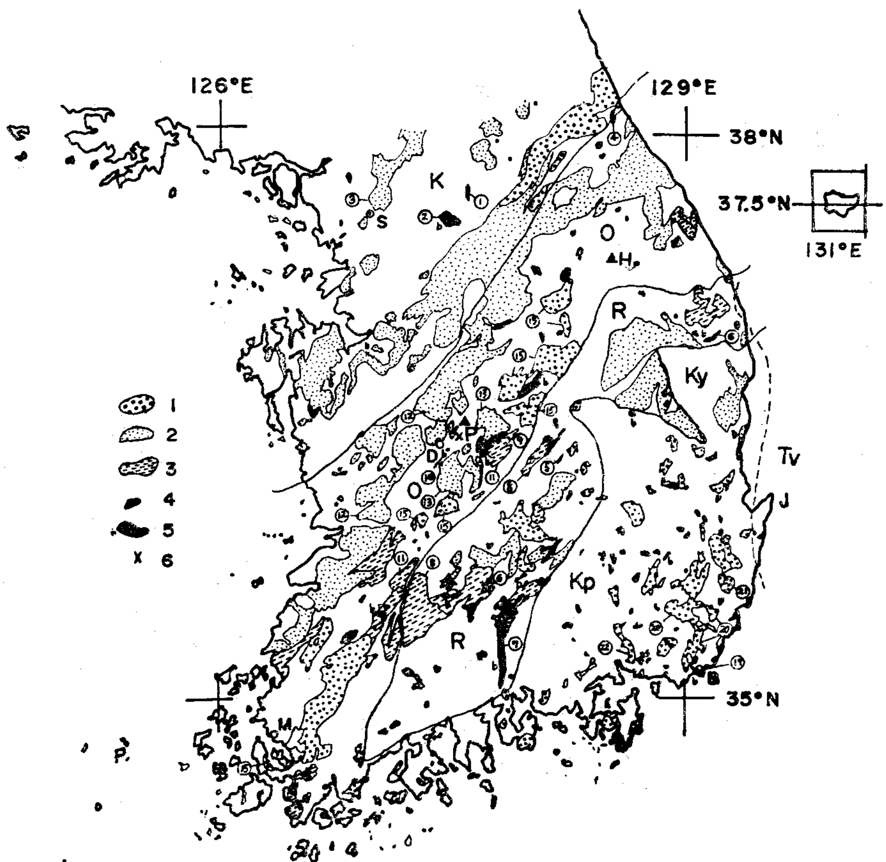

Fig.2. Distribution of plutonic rocks with major petrographic provinces in S. Korea. K: Kyonggi land, R: Ryongnam land, O: Ogcheon zone, Kp: Kyongsan proper basin, Tv: Neogene alkali volcanic province, H: Hambaegsan area , P: Pibanryong area ,S: Seoul, D: Daejon, B: Busan, M: Mogpo, J: Janggi cape, 1: Cretaceous granite, 2: Jurassic granite, 3: Jurassic schistosed granite 4: Intermediate rock, 5: Mafic and meta-mafic rocks, 6: Peridotite

Japan Sea Alkali rock Province" of plio-pleistocene age (Aoki, 1958). Jeju and Ulnung volcanic islands and Janggi basalt flow are included in this province. The Chugaryong rift valley which given rise an olivine basalt flow in Quaternary is also included in this province, because of its similarity of petrology and its age, even though its location is at a distance from the proper area of the province.

3. Distribution and rock assemblages of igneous and related rocks.

The granitic rocks which occupied about 40 percent of the south Korea are distributed in

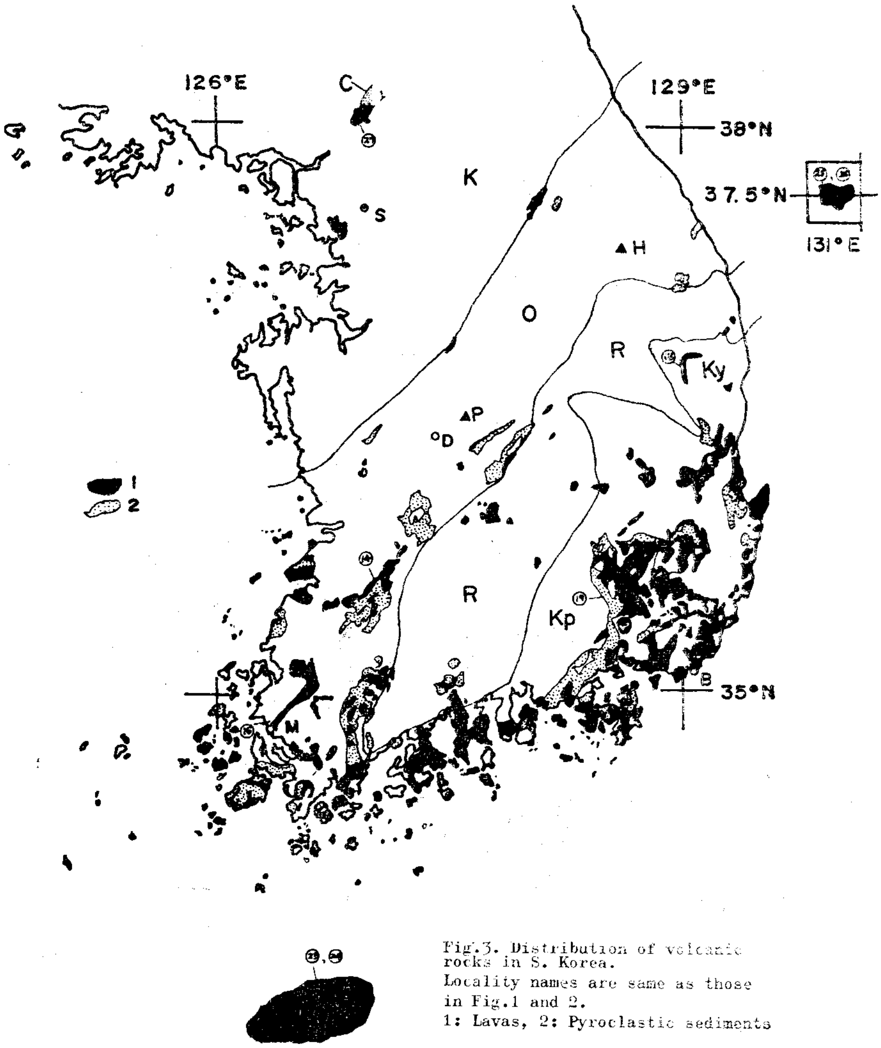

Fig.3. Distribution of volcanic rocks in S. Korea.
Locality names are same as those in Fig.1 and 2.
1: Lavas, 2: Pyroclastic sediments

two types as seen in Fig 2; the one is mainly in batholithic plutons in the major part of the area trending a diagonal lineaments northeasterly parallel with the regional structure of this part of Asia, and the other in stock-formed plutons which are irregularly scattered predominantly in the Kyongsang basin. The plutons of the former type are strongly related with the orogenic movement occured in Jurassic age, whereas the plutons of the later type are related with the block movements which took place in middle to late Cretaceous age.

Intermediate and mafic rocks are mostly diorites and hornblende gabbros and some of ano-

Table 1. Rock associations in major petrographic provinces of South Korea

		Kyong-gi land (Areal)	%	Ryong-nam land	%
Igneous Rocks	Quater,	Basalt*	0. 2		
	Tertiary				
	Late Mesozoic	Pink feldspar granite, Diorite, Porphyries, Rhyolite	9	Biotite granite, Anorthosite, Diorite Acidic lava, Welded tuff, Rhyolite	7 2
	Ear. Midd. Mesozoic (Jurassic)	Biotite granodiorite	33	Schistosed granodiorite, Adamellitic migmatite, Porphyroblastic granodioritic gneiss	25
	Late Paleozoic				
	Early Paleozoic				
	Pre-Jura. & Unknown age	Igneous Complex: hornblende gabbro, diorite, monzonite, syenite**, Amphibolite	1. 4	Amphibolite (mainly ortho-)	0. 0
Sedimentary Rocks	Tertiary				
	Late Mesozoic	Kyong-sang system: conglomerate sandstone, shale	0. 2		
	Middle Mesozoic	Dae-dong system: conglomerate, sandstone, shale, coaly shale	4		
	Late Paleozoic				
	(Hiatus)				
	Early Paleozoic				
Meta. R.	Precambrian	Gneissic Complex: granite gneiss, granitic gneiss, augen gneiss, marble, migmatite, quartzite, schists	52. 5	Banded gneiss, Migmatitic gneiss, Porphyroblastic gneiss, granitic gneiss, Schists, Augen gneiss, Graphite gneiss, Amphibolite (mainly para-)	66
	Total		100		100

* Olivine basalt in Chugaryong rift valley
** Metasomatic origin of Amphibolite

Table 1. (continued)

		Og-cheon zone	%	Kyong-sang basin	%
Igneous and related rocks	Quaternary			Basalt*	0. 5
	Tertiary	Pitchstone	0. 0	Granite(?), Volcanic rocks.	0. 7
	Late-Middle Mesozoic	Pink feldspar perthite granite, Adamellites, Biotite granite, Diorite, Acidic dikes. Acidic tuff, andesite, rhyolite.	8 7	Andesite, Basalt, Acidic volcanic rocks. Biotite granite, Masanite, Diorite, Gabbro.	27 15. 5
	Early Mesozoic (Jurassic)	Schistose granodiorite, Biotite granodiorite, Adamellite.	35		
	Late Paleozoic				
	Early Paleozoic				
	Pre Jurassic & Unknown age	Amphibolites: meta-andesite(?), meta-basalt, meta-tuff, hornblendite. Gabbro, monzonite.	1. 5 0. 09		
related rocks	Tertiary			Yon-il formation: conglomerate, mudstone, siltstone.	6
	Late Mesozoic	Kyong-sang system: shale, conglomerate, sandstone, welded tuff	6	Sil-la group: conglomerate, sandstone, shale, mudstone, tuff. Nag-dong group: sandstone, shale	50

Sedimentary and				mudstone, conglomerate, coaly shale, tuffaceous sandstone.	
	Middle Mesozoic	Ban-song formation: conglomerate, sandstone, shale, anthracite.	1.4		
	Late Paleozoic	Upper Og-cheon group: slate, limestone, chert.	7		
		Pyong-an system: sandstone, conglomerate, shale, anthracite.			
	—(Hiatus)—				
	Early Paleozoic	Jo-sun system: quartzite, schist. Limestone. Middle Og-cheon group: dolomite, quartzite, phyllite	15		
Meta. R.	Precambrian	Lower Og-cheon group: schist, gneiss, migmatite. Granitic gneiss, Schists, Granite gneiss, Porphyroblastic gneiss, Migmatitic gneiss.	19		
			/100		/100

*It belongs to Alkali rock provines.

rthosite in the forms of stocks and dikes.

Metamorphosed intermediate and mafic rocks in the middle part of Ogcheon zone are found mainly as elongated amphibolite to green schist bodies which was used to be called "green rock". Recently Kim, O.J. and his coworker (1976) suggested that these metamorphosed basic rocks may be a part of ophiolites that occur along ancient geosuture line.

Volcanic rocks which occupied about 13 percent of the South Korea consist mainly of andesitic and subordinately of basaltic and rhyolitic lavas and tuffs of Cretaceous to Quaternary. They are distributed dominantly along the southern coastal and off shore areas as shown Fig. 3. Of the volcanics, Cretaceous andesitic, rhyolitic lavas and pyroclastics are also extended to the southern part of Ogcheon zone through faults and trough zones. The area of neogene volcanic rocks are limited along the southeast coastal area including Jeju and Ulnung volcanic islands and their compositions indicate alkalic Chugaryong rift valley which erupted basalts and trachytic tuff runs diagonally NNS to SSW (from Wonsan to Seoul) in the middle of Korean peninsula.

The igneous and related rocks could be classified into five groups according to the geotectonic provinces regardless of their age. The gr oup may here be called "rock assemblage". which equivalents to "Spatial rock association". The rock assemblages in the southern part of Korea were summerized and listed in Table 1 except that of the alkali rock province.

4. Chemical composition

The chemical analyses of Korean igneous rocks has not compiled yet in summerized publication. So that, the author collected the data from individual papers. From 35 papers 359 chemical analyses were selected. The analyses were made mainly by Geological Survey of Korea and subordinately by Japanese institutes. In this study no attempt was made to collect all the data systematically. The collected chemical analyses of igneous rocks were grouped according to the each geotectonic province and arranged the rock masses in the order of geologic age in each province as in Table 2.

In the table, amphibolites and meta-volcanics can hardly be called as "igneous", but the other data are mostly felsic and seldom of typical intermediate to mafic igneous rocks. Whereas these metamorphic rocks were determined as "igneous origin" through field and laboratory workrs, so that they are used in this paper as

Table 2. Chemically analyzed ignecus and related rock masses in S. Korea

No.*	Province	Age	Name of mass	Name of rock	No. of anal-ysis	Symbol**	
						rock body. CaO	$Na_2O + K_2O$
1	Kyonggi land	Pre-Jura.?	Chuncheon	Amphibolite	4	✚	+
2		"	Yangpyong	Hb-gabbro	5	■	▣
3		Tri.-Jura.	Seoul	Granodiorite	2	◆	◇
4		Pre-Jura.?	Yangyang	Syenite	2	⬢	⬡
5	Ryongnam land	Pre-Jura.?	Gumnung	Amphibolite	1	✱	⁜
6		"	Ogbang-	Meta-mafic	19	■	□
7		Cret.	Hadong	Anorthosite	13	■	▣
8		Tri.-Jura.	Cheongsan-Namwon	Schistose grano-diorite	16	⧫	⧫
9	Ogcheon zone	Pre-Jura.	Kimcheon & cheongsan	Amphibolite (meta-volcanics)	30	✖	×
10		Jura.	Seachon	Hb-Gabbro	1	✚	✧
11		"	Cheongsan-Jeonju	Schistose grano-diorite	14	⧫	⧫
12		"	Chungju-Nonsan	granodiorite	22	●	◉
13		"	Yongdam-Yongdong	"	13	●	◉
14		Ear.-Cret.	Yongdam-Sunchang	Tuff, Rhy., And.	21	▲	△
15		Mid.-Cret.	Whanggangri-Suheori	Adamellite-granite	28	●	○
16		Tert.(?)	Mogpo	Pitchstone	3	▼	▽
17	Kyongsang basin	Cret.	Busan & Gimhae	Hb-gabbro	3	▪	▪
18		"	Yongyang	Basalt(Th.***)	8	▲	▲
19		"	Kyongsang basin	Tuff, andesite, rhyolite	9	▲	▲
20		"	"	Granite	51	●	◉
21		"	Yongsan	Granodiorite	5	●	◇
22		"	Masan	Masanite	2	●	○
23	Jeju v. Island	Neogene	Jeju I.	Olivine basalt	31	▲	△
24		"	"	Intermediate v.	19	▲	△
25	Ulnung v. Island	"	Ulnung I.	Olivine basalt	6	▲	▲
26		"	Ulnung I.	Intermediate v.	17	▲	▲
27	Chugaryong valley	"	Chugaryong	Olivine basalt	14	▲	▲
					359		

* : These numbers correspond to those in Fig. 2 and Fig. 3 and Table. 4
** : These symbols were used in Fig. 4, Fig. 5 and Fig. 7
*** : Th. means thoreiitic

some references to see the general trends of the rock assemblages as a whole. The CIPW weight norms are recalculated for the all analyses.

Following diagrams are used for the determining the chemical properties of individual rock assemblages and overall rocks of south Korea. They are as follows:

1) SiO_2 versus total alkali and CaO (Fig. 4)
2) AFM triangle (Fig. 5 and Fig. 6)
3) AKF triangle (Fig. 7)
4) D. I. versus major oxides (Fig. 8)
5) Normative An-Ab-Or triangle (Fig. 9), and
6) normative Q-Or-Ab triangle (Fig. 10).

Summary of chemical properties of each rock

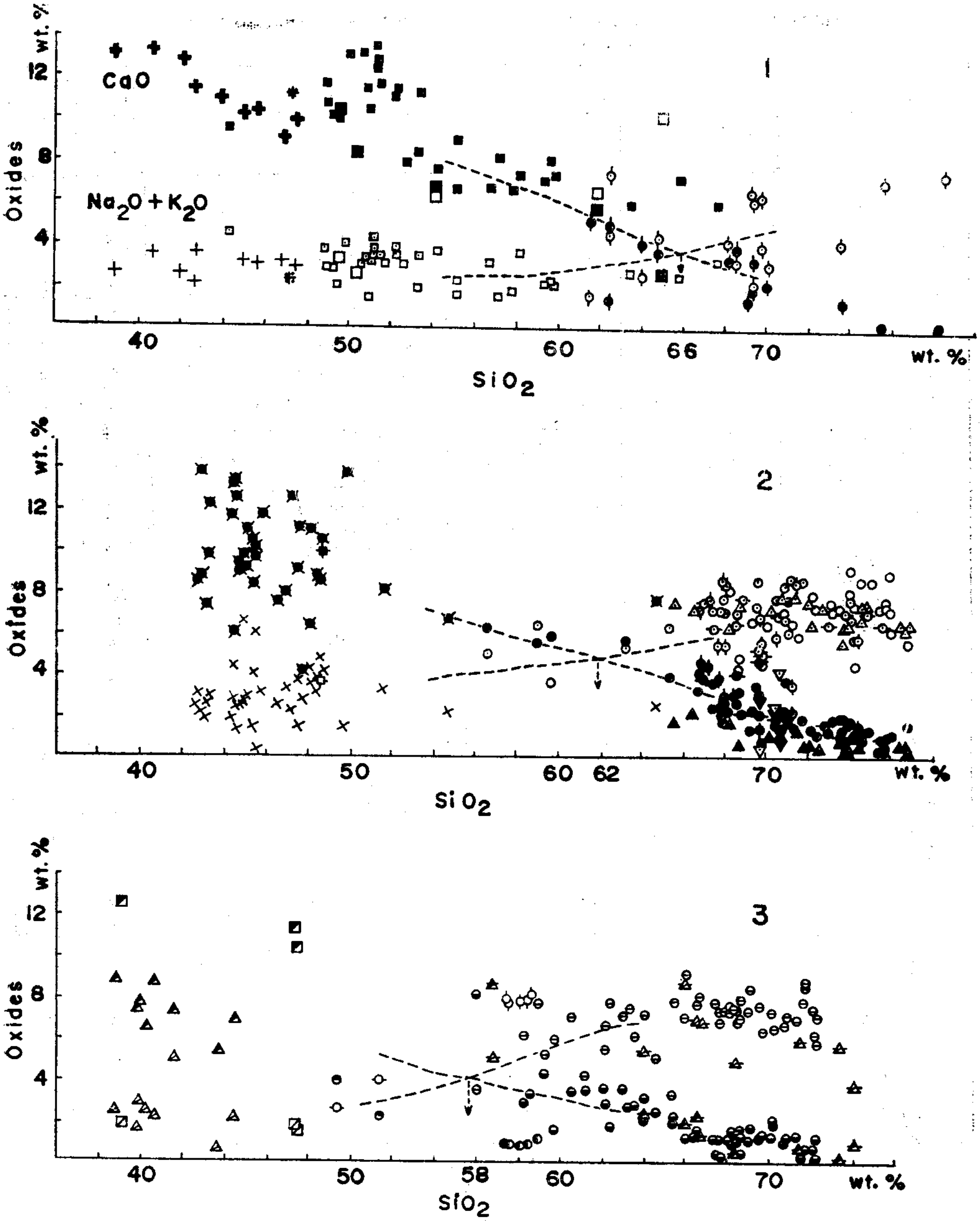

Fig. 4. Variation diagrams for 359 analyses of igneous rocks of S. Korea from major petrographic provinces Na_2O+K_2O and CaO versus SiO_2. 1: Kyonggi-Ryongnam massif, 2: Ogcheon zone, 3: Kyongsang basin, (refer to the symbols in Table 2)

assemblages are as follows:

Kyonggi-Ryongnam massif: It belongs to calcic rock series having 66% SiO_2; alkali-lime index of Peacock's classification. Alkali increment is slower than the others, but the decrement of lime content is normal (refer of Fig. 4-1). Differentiation trend is equivalent to that of the world calc-alkali rock series having wide ranges (refer to Fig. 5-1 and 6). The igneous rocks of it are rather highly contaminated with pelitic rocks except some of gabbroic rocks (refer to Fig. 7-1). Generally, the rocks of it are

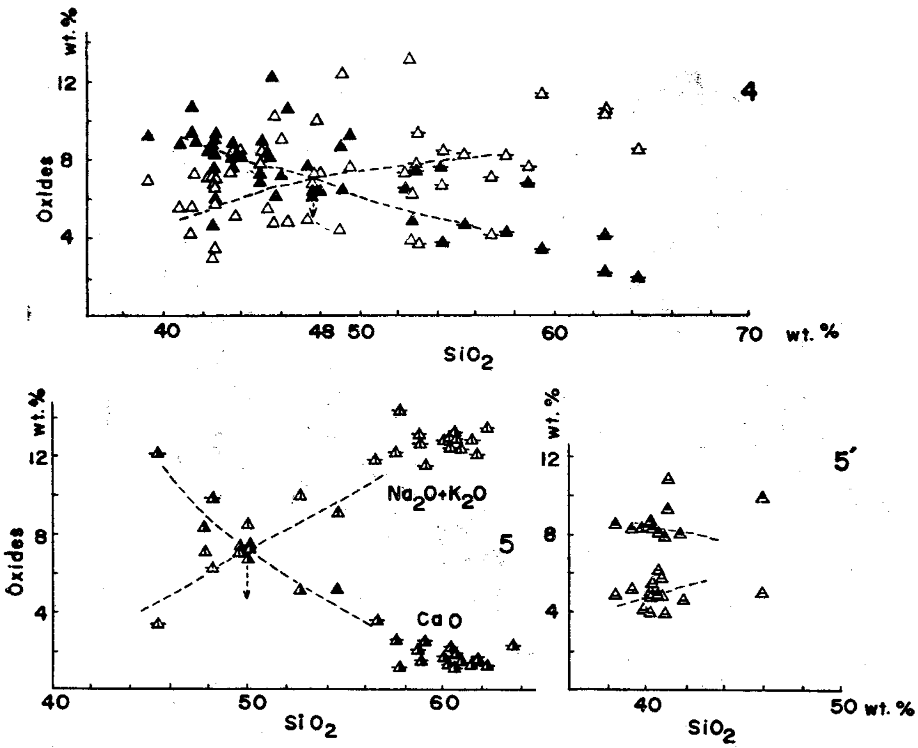

Fig.4. (continued) 4:Jeju Island, 5: Ulnung Island, 5': Chugaryong valley. (refer to the symbols in Table 2)

higher in Na_2O than K_2O.

Ogcheon zone: It belongs to calcic rock series having 62% SiO_2; alkali-lime index. Alkali increment is normal, and lime decrement is also normal (refer to Fig. 4-2). Differentiation trend is equivalent to that of the world calc-alkali rock series having relatively wider range (refer to Figs. 5-2 and 6). The igneous rocks of it are strongly contaminated with pelitic rocks (refer to Fig. 7-2). Generally, the igneous rocks of this zone have nearly same contents in Na_2O and K_2O.

Kyongsang basin: It belongs to calc-alkali rock series having 58% SiO_2; alkali-lime index. Alkali increment is normal and lime decrement normal (refer to Fig. 4-3). Differentiation trend is equivalent to that of Karroo dolerite, but alkali is lower in mafic stage than that of Karroo's and higher in intermediate to felsic stage (refer to Figs. 5-3 and 6). The granitic and andesitic rocks are rather highly contaminated with pelitic rocks (refer to Fig. 7-3). Generally, the rocks are higher in K_2O than Na_2O.

Alkali rock province:

1) Jeju island: It belongs to alkali rock series having 48% SiO_2; alkali-lime index (refer to Fig. 4-4). Alkali increment is normal and lime decrement normal. Differentiation trend is equivalent to that of Mull volcano of Scotland (refer to Figs. 5-4 and 6). The basalt and intermediate rocks are partly contaminated with pelitic rocks (refer to Fig. 7-4). The rocks are higher in Na_2O than K_2O.

2) Ulnung island: It belongs to alkali rock series having 50% SiO_2, alkali-lime index. The alkali increment is abnormally steeper than the

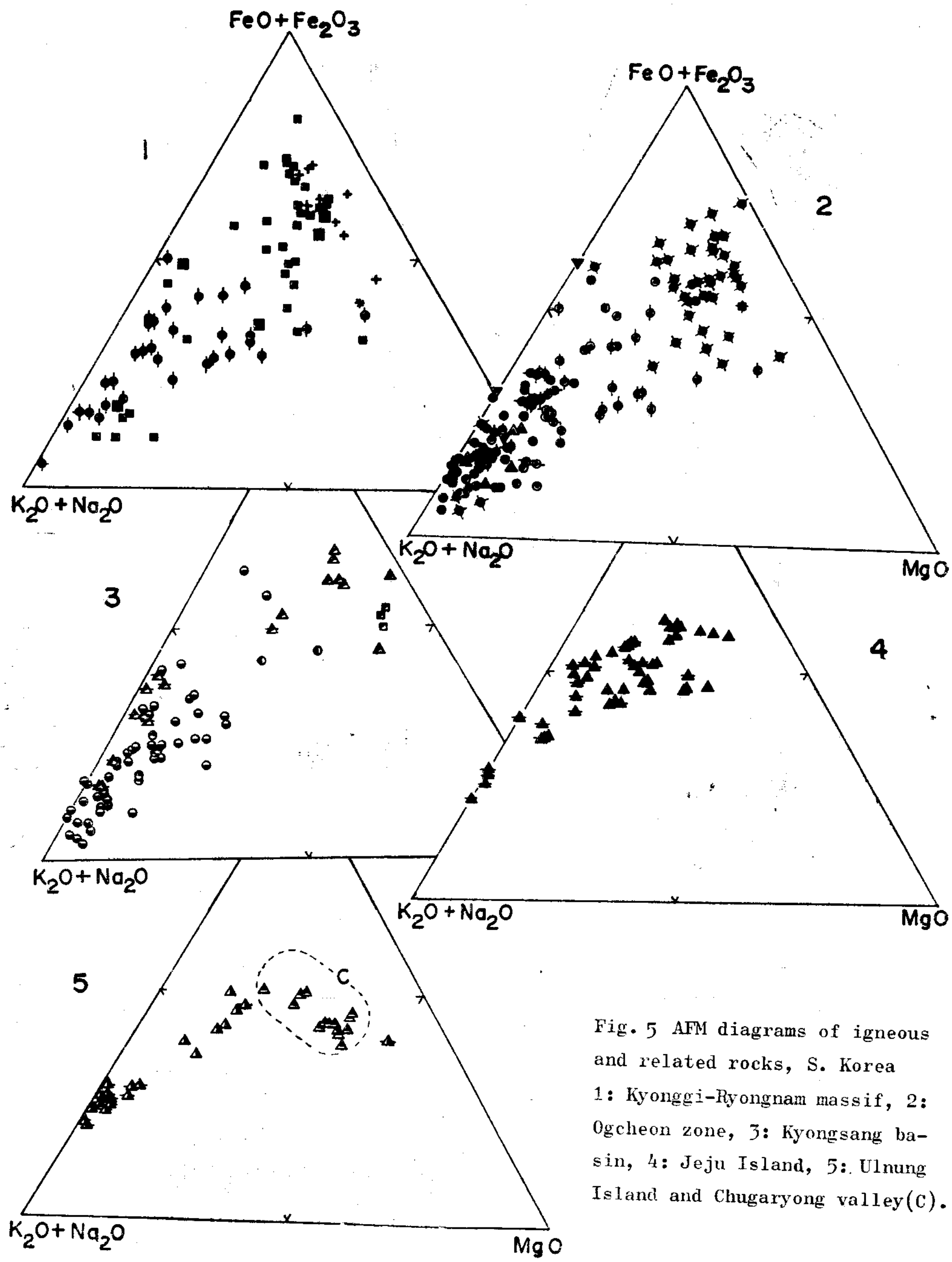

Fig. 5 AFM diagrams of igneous and related rocks, S. Korea 1: Kyonggi-Ryongnam massif, 2: Ogcheon zone, 3: Kyongsang basin, 4: Jeju Island, 5: Ulnung Island and Chugaryong valley(C).

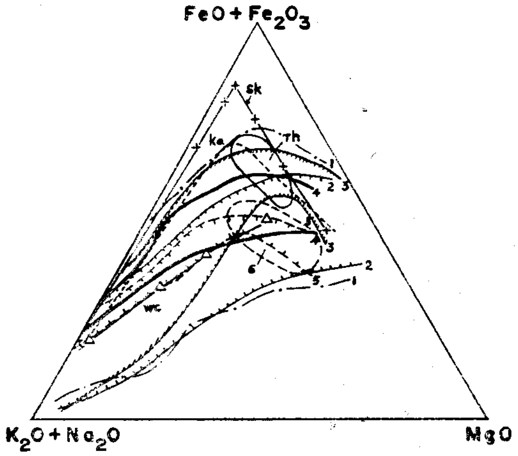

Fig. 6. AFM diagram for summery of Fig5 comparing with the trends of Skaergaard (Sk), Karroo dolerite (Ka), Thoreiite basalt plateau (Th) and world average calc alkali rock series (Wc) (from Kuno. 1965) 1:Kyonggi-Ryongnam massif, 2: Ogcheon zone, 3:Kyongsang basin, 4:Jeju I., 5:Ulnung I., 6: Chugaryong rift valley

others, and the lime decrement steep (refer to Fig. 4–5). Differentiation trend is nearly identical to that of Jeju island (refer to Figs. 5–5 and 6). The rocks of it do not show distinctive contamination effect (refer to Fig. 7–5). The rocks are higher in Na_2O than K_2O.

3) Chugaryong rift valley: No intersection point between total alkali-line and lime-trend line has been taken from the diagram, because of lack of intermediate and felsic rock points in the data. However, the trends were estimated on the diagram to be intersected at the area around 50% SiO_2 (refer to Fig4–5′). Therefor, it may belong to alkali rock series. The data points of it are biased to an area (6 in Fig. 6 and Cin Fig. 7–5). The points indicate that the rocks of it are slightly contaminated with the pelitic rocks.

The petrochemical characteristics of the igneous rock assemblage are summerized in Table 3.

The distribution of points in the D. I. versus oxide weight percent variation diagrams for all rocks of the south Korea (Fig. 8) can be approximated by straight lines for all major oxides except the variation of SiO_2. In the diagrams, the areas of data points of alkali rocks and anorthosites are delineated by dashed lines. Of the diagrams, variations of K_2O, Na_2O, FeO, and Al_2O_3 of alkali rocks are sitted in higher position than those of other oxides, and the variation of SiO_2 of the rocks in lower position than those of other oxides.

Normative An-Or-Ab plottings for 359 igneous rocks are shown in Fig. 9, and the representative trend of the plottings is quite similar to that of plotting of normative feldspars of 1189 Japanese granitic and related rocks.

The normative Ab-Or-Q plottings of 97 felsic plutonic rocks having 80 percent or more

Table 3. Petrochemical properties of igneous rock assemblages in S. Korea.

Province	alkali-lime index	type of differentiation trend	degree of contam. with pelitic rocks	$K_2O:Na_2O$
Kyonggi-Ryongnam	(% SiO_2) 66	World calc alkali rock series	very high	$K_2O<Na_2O$
Ogcheon	62	World calc alkali rock series	very high	$K_2O \approx Na_2O$
Kyongsang	58	Karroo dolerite	high	$K_2O<Na_2O$
Alk. rock: Jeju	48	Mull volcano	rather high	$K_2O<Na_2O$
Alk. rock: Ulnung	50	Mull Volcano	very low	$K_2O<Na_2O$
Alk. rock: Chugaryong	50	Alkali olivine basalt plateau	low	$K_2O<Na_2O$

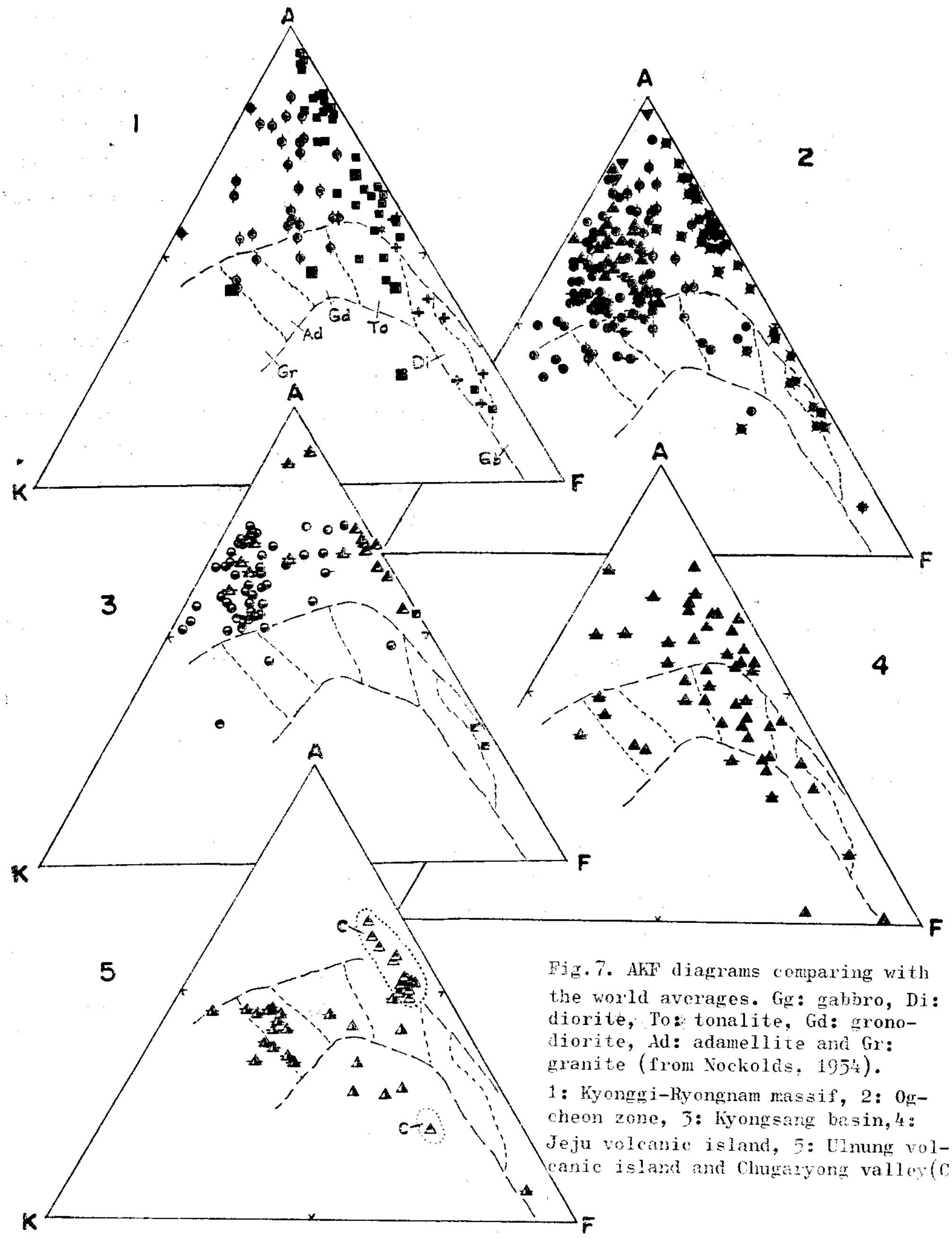

Fig. 7. AKF diagrams comparing with the world averages. Gg: gabbro, Di: diorite, To: tonalite, Gd: gronodiorite, Ad: adamellite and Gr: granite (from Nockolds, 1954).
1: Kyonggi-Ryongnam massif, 2: Ogcheon zone, 3: Kyongsang basin, 4: Jeju volcanic island, 5: Ulnung volcanic island and Chugaryong valley (C)

normative Ab+Or+Q are shown in Fig. 10 for the comparison with the distributions of plots of the analyzed plutonic rocks in Washington's Table's and of Japanese granites with ratio of An/Q+Or+Ab+An less than 20%. The area of more than 4% in a 0.25% counter is located at the same area of more than 6% in a 0.25% counter of Japanese granites.

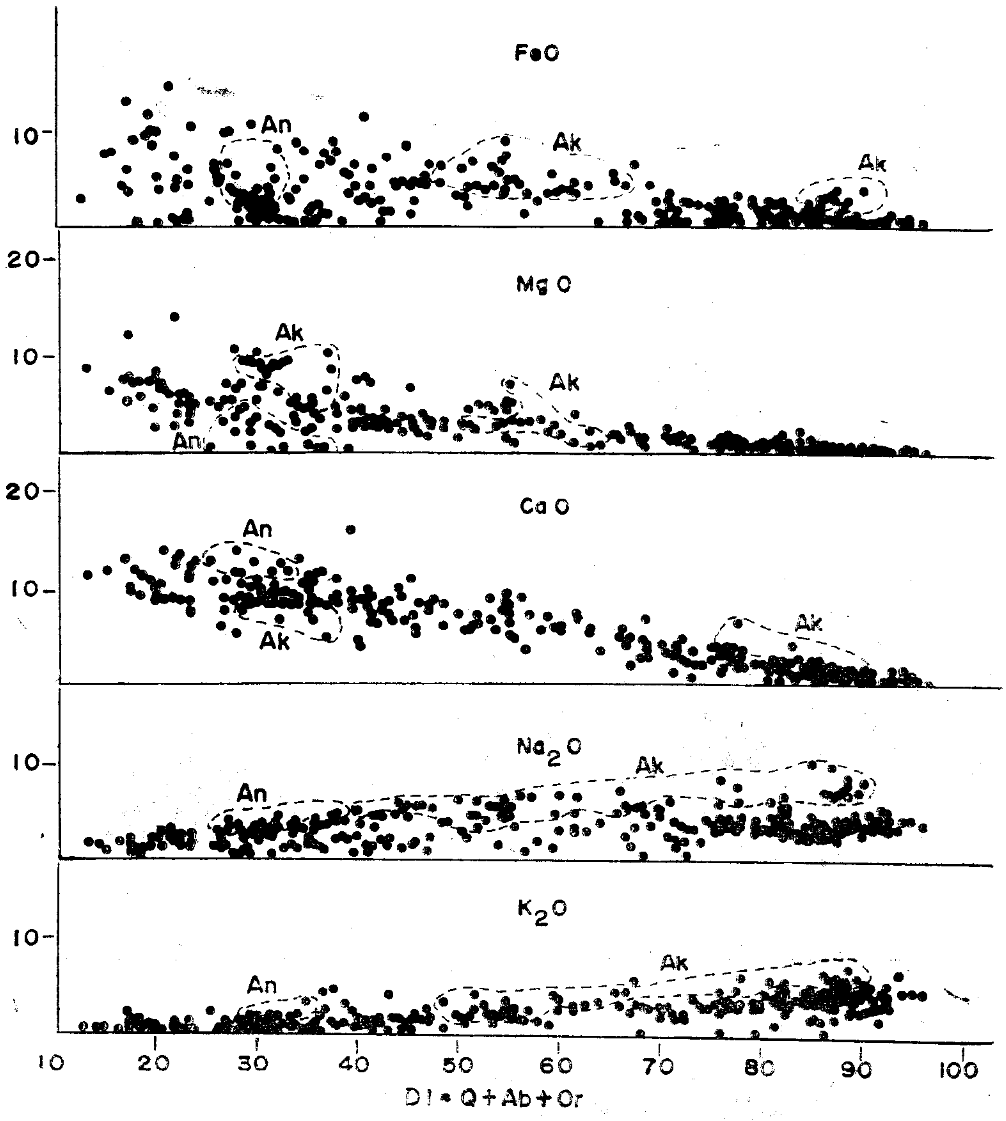

Fig. 8. Variation diagrams for 359 analyses of igneous rocks of S. Korea. Oxides contents (weight percent) versus Differentiation Index (D. I.) of Thornton and Tuttle (1960). Ak: Alkali rock area, An: Anorthosite area

5. Average composition of igneous and related rocks

The average chemical compositions (hydrous) and CIPW norms of igneous and related rocks are calculated and shown Table 4. In this table the 27 rock groups are arranged in the same order of the table. 2.

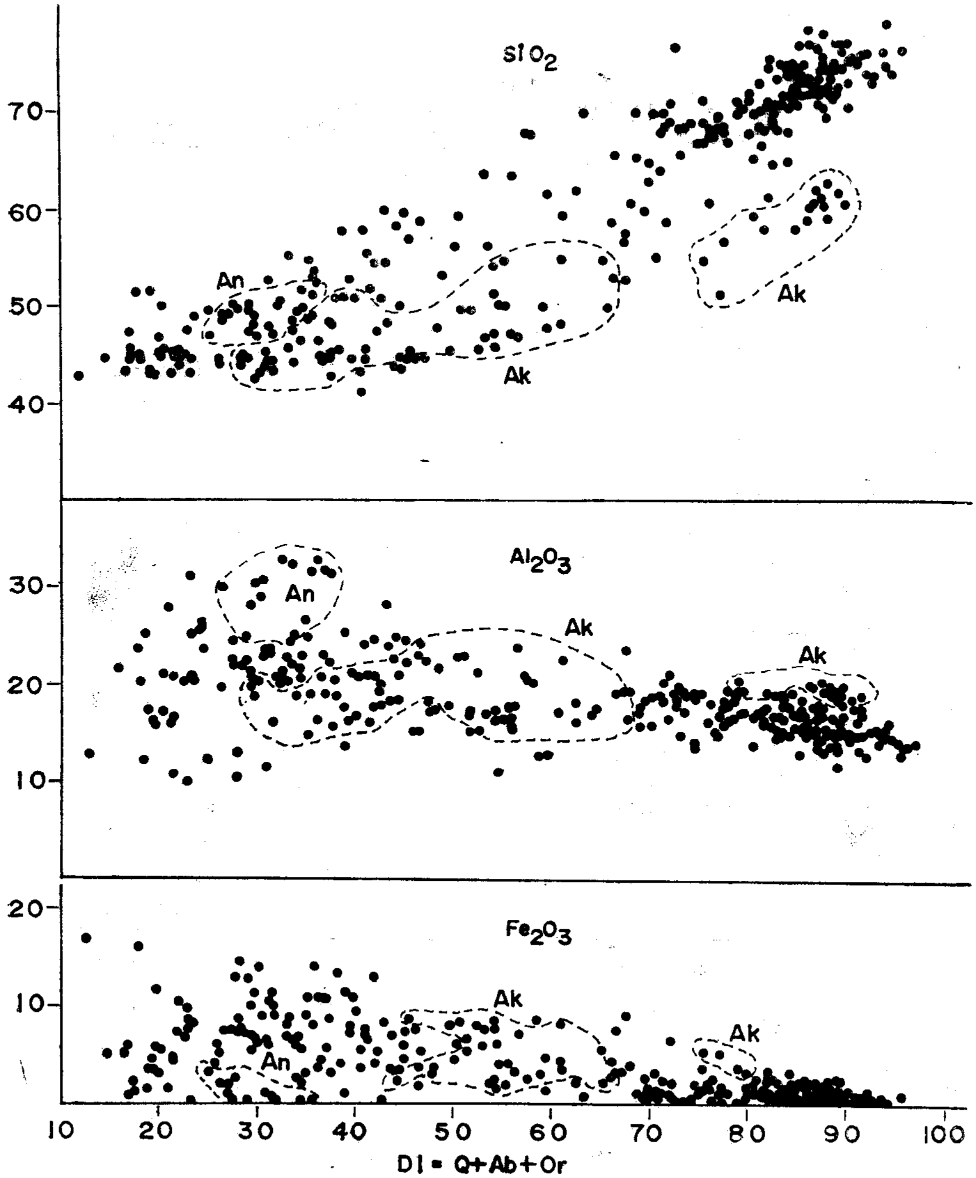

Fig.8. (continued)

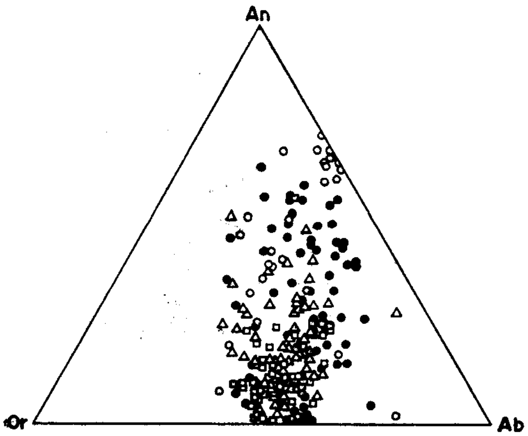

Fig.9. Plotting of normative An, Or and Ab for 359 igneous and related rocks of S. Korea. Data point of ○:Kyonggi-Ryongnam massif, △: Ogcheon zone □:Kyongsang basin ●:Alkali rock province

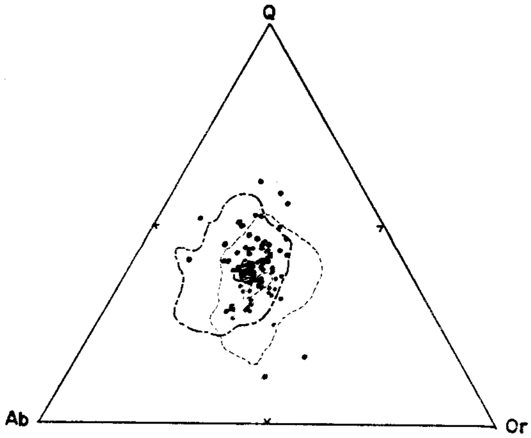

Fig. 10. Normative Ab-Or-Q diagram for 97 S. Korean felsic plutonic rocks which have 80 percent or more normative Ab+Or+Q. The area more than 4% is stippled. Dashed lines and chain lines are the reproductions of Fig.42 in the Tuttle and Bowen's paper (1958) and paper of Aramaki et al. (1972) respectively.

Table 4. Average chemical compositions and their CIPW norms of igneous and related rocks, S. Korea.

	Average, hydrous													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SiO_2	45.53	56.22	77.04	55.51	47.30	56.07	49.15	67.45	46.44	48.80	69.11	68.85	70.55	71.41
TiO_2	0.93	0.15	0.02	1.08	0.32	0.92	n.d.	0.15	1.46	0.14	0.22	0.22	0.13	0.19
Al_2O_3	14.35	18.16	14.04	15.17	25.02	18.83	25.69	19.14	22.64	11.33	15.99	16.44	16.09	16.10
Fe_2O_3	10.56	3.76	0.94	7.18	2.46	6.68	1.58	1.69	7.05	4.46	1.29	1.23	0.88	0.71
FeO	5.42	4.19	0.03	1.61	3.51	3.22	2.43	1.00	4.06	10.34	2.18	1.76	1.31	1.18
MnO	0.07	0.02	n.d.	0.41	0.09	0.27	n.d.	0.02	0.21	0.03	0.05	0.06	0.06	0.05
MgO	8.91	3.73	0.11	2.31	6.36	3.24	2.06	1.76	4.74	10.18	0.88	1.01	0.69	0.50
CaO	10.01	6.73	0.17	4.95	11.05	7.88	11.63	3.18	9.32	9.72	2.75	2.83	2.61	1.51
Na_2O	1.75	2.27	4.10	3.35	0.81	1.32	3.37	2.04	2.08	2.61	2.90	3.41	2.91	3.57
K_2O	1.04	3.44	3.13	5.70	1.43	1.18	0.38	2.29	0.71	0.94	3.60	3.49	3.72	3.07
P_2O_5	0.25	tr.	n.d.	1.49	0.04	0.09	n.d.	tr.	0.15	0.05	0.08	0.04	0.04	tr.
Total	98.82	98.67	99.58	98.76	98.39	99.70	96.29	98.72	98.86	98.60	99.05	99.34	98.99	98.29
	CIPW norm													
Q	1.56	8.80	40.68	5.51	2.17	22.36	—	37.27	4.81	—	30.29	27.37	32.18	34.30
C	—	—	3.67	—	2.11	1.22	—	7.50	1.83	—	2.51	2.00	2.61	4.13
Or	6.17	20.35	18.34	33.69	8.45	7.01	2.22	13.60	4.17	5.65	21.29	20.63	22.02	18.18
Ab	14.78	19.18	34.58	28.30	6.92	11.16	28.30	17.24	17.55	23.75	24.52	28.82	24.57	30.18
Ne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
An	28.19	29.13	0.83	9.48	54.57	38.56	53.93	15.79	45.34	16.65	13.09	13.76	12.68	7.51
Di	15.44	3.46	—	4.25	—	—	3.15	—	—	25.60	—	—	—	—
Hy	15.20	11.98	0.69	3.81	19.95	8.10	3.09	4.62	11.85	6.24	4.85	4.43	3.30	2.61
Ol	—	—	—	—	—	—	2.72	—	—	—	—	—	—	—
Mt	15.01	5.45	—	3.41	3.57	8.58	2.32	2.46	9.56	4.73	1.88	1.79	1.28	1.02
Hm	0.21	—	1.60	4.83	—	0.77	—	—	0.46	—	—	—	—	—
Il	1.76	0.29	—	2.05	0.61	1.75	—	0.29	2.77	0.20	0.43	0.43	0.24	0.36
Ap	0.60	—	—	3.84	0.10	0.20	—	—	0.34	0.11	0.20	0.10	0.10	—

Table 4. (continued)

	Average, hydrous												
	15	16	17	18	19	20	21	22	23	24	25	26	27
SiO_2	72.66	70.34	48.70	45.19	70.49	72.13	64.42	72.16	47.59	54.29	50.83	58.31	44.71
TiO_2	0.17	n.d.	0.26	0.90	0.12	0.13	0.15	0.13	1.39	0.96	2.45	0.82	1.14
Al_2O_3	15.05	16.83	19.15	21.34	16.58	16.39	19.66	13.96	18.68	19.48	17.48	18.62	20.94
Fe_2O_3	1.70	1.03	2.78	6.67	2.05	1.53	3.43	2.07	7.36	4.37	3.54	2.19	7.64
FeO	0.86	tr.	7.26	3.54	1.06	0.94	1.34	0.74	4.49	3.65	4.88	2.99	3.23
MnO	0.12	n.d.	0.11	0.36	0.06	0.07	n.d.	0.07	0.18	0.15	0.20	0.11	0.01
MgO	0.64	0.13	7.35	5.18	0.57	0.43	2.68	1.07	4.25	1.79	2.82	1.46	8.16
CaO	1.55	1.95	11.34	7.23	1.93	1.71	3.04	0.84	7.61	6.04	6.59	2.91	8.08
Na_2O	3.14	0.90	1.24	1.77	2.92	3.26	1.08	3.15	4.82	4.80	4.40	6.65	2.64
K_2O	3.75	1.41	0.41	0.54	2.80	3.57	2.19	4.60	2.28	3.14	3.82	5.12	2.15
P_2O_5	0.04	n.d.	0.05	0.00	0.03	0.03	tr.	0.06	0.22	0.38	0.73	0.20	0.41
Total	99.68	92.59	98.65	92.72	98.61	100.19	97.99	98.85	98.87	99.05	97.74	99.38	99.11
	CIPW norm												
Q	35.86	55.35	2.13	9.66	37.82	35.18	39.23	33.20	—	0.42	—	—	—
C	3.09	10.27	—	4.69	5.28	4.11	9.97	2.40	—	—	—	—	0.61
Or	22.18	8.34	2.45	3.34	16.57	21.13	12.95	27.19	13.34	18.35	22.80	30.02	12.79
Ab	26.51	7.60	10.48	16.67	24.68	27.56	9.12	26.62	35.63	40.35	36.16	47.68	19.91
Ne	—	—	—	—	—	—	—	—	2.84	—	0.57	4.54	1.14
An	7.42	9.67	45.40	35.86	9.40	8.28	15.10	3.81	19.13	22.52	16.40	3.06	37.25
Di	—	—	8.56	—	—	—	—	—	—	3.80	—	—	—
Hy	1.72	0.32	24.98	1.43	1.59	1.33	6.70	2.68	—	4.52	—	—	—
Ol	—	—	—	—	—	—	—	—	12.68	—	10.42	7.83	14.28
Mt	2.46	—	4.04	9.98	2.97	2.23	3.87	2.25	10.67	6.26	5.10	3.25	7.19
Hm	—	1.03	—	—	—	—	0.75	0.51	—	—	—	—	2.72
Il	0.32	—	0.50	1.67	0.23	0.24	0.29	0.24	2.58	1.82	4.71	1.52	2.13
Ap	0.10	—	0.13	—	0.07	0.07	—	0.13	0.67	1.00	1.68	0.34	1.00

岩石區로 본 南韓火成岩組合의 化學成分에 關하여

要　　約

李　大　聲

南韓에 分布하는 火成岩類의 化學成分과 그 岩石化學的性質을 概略的으로 알기 위해서 35個 文獻에서 359個 火成岩類 및 火成起源으로 認定되는 岩石類의 化學分析値를 引用하였다. 分析値들은 27個岩石組合으로 區分하고 이들은 다음의 5個岩石區로 갈라서 處理하였다. (1) 京畿地塊, (2) 嶺南地塊(圖表에서는 이들을 合쳐서 하나의 地塊로 묶 음), (3) 沃川帶, (4) 慶尙盆地, 및 (5) 알카리岩區, 分析値는 SiO_2對 K_2O+Na_2O 및 CaO, D.I. 對 酸化物類, AFM 三角圖, AKF 三角圖, An—Ab—Or 노름三角圖, 및 Q—Or—Ab 노름三角圖로 處理하였다. 이에 依하면 (1) (2) (3) (4)는 모두 칼식岩系列에 (5)는 알카리岩系列에 屬한다. 또한 (1)-(2)와 (3)의 分化經路는 世界칼크알카리岩系列에 (4)는 Karoo dolerite에, (5)는 Mull 火山 및 알카리橄欖石玄武岩台地에서의 分化經들과 類似하다. 地殼內 粘土質岩과의 同化程度는 (1)-(2) 및 (3)에서는 매우 높고 (4)에서도 높으며 (5)에서는 낮다. $K_2O:Na_2O$는 大體로 $K_2O<Na_2O$이고 (3)에서만 $K_2O\approx Na_2O$를 보이고 있다. 노름値에 의한 圖表에 의하면 地質時代의 差異는 있으나 南韓의 火成岩類는 日本의 火成岩類와 類近似하다.

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