Jour. Petrol. Soc. Korea
Vol. 1, No. 1, p. 25~33, 1992

A study on the metamorphism in the southwestern part of Gyeonggi Massif

Ki Chang Na

Department of Earth Sciences, Chungbuk National University
Cheongju 360-763, Korea

ABSTRACT : The southwestern part of Gyeonggi Massif consists mainly of Archean Seosan and Daesan Groups, and Paleoproterozic Bucheon Group with Bucheon and Seosan gneiss complexes which are members of Gyeonggi gneiss complex. In the eastern part of Dangjin fault, Mesoproterozoic Anyang Group and Anyang granite gneiss occur, and in the western part of the fault Taean Group uncomformably overlies Archean and Paleoproterozoic Groups. Metamorphic facies of Archean Groups is mainly upper amphibolite facies which was overprinted by the second amphibolite facies metamorphism and the third greenschist facies metamorphism. Bucheon and Anyang Groups belong to amphibolite and greenschist facies and are partly overprinted by greenschist facies metamorphism which is characteristic for Taean and Daedong Groups.

Key Words : Gyeonggi gneiss complex, polymetamorphism, amphibolite facies

INTRODUCTION

The southwestern part of Gyeonggi Massif consists mainly of Archean metamorphic rocks and migmatites. They form the Archean basement overlain by the Bucheon, Anyang, and Taean Groups of Proterozoic paraplatform metasediments (Fig. 1). The Daedong Group overlies unconformably these Precambrian Groups. Most parts of the studied area have been known as Archean Groups, so-called Yeoncheon or Seosan Groups and Grey granite gneiss, in 1/1,000,000 and 1/250,000 scale geologic maps of Korea.

Na (1972) concluded that the metamorphic facies series of Anyang-Namyang area (Fig. 1) belongs to the intermediate facies series and the peak metamorphic P-T condition is about 700°C and 6-8 kb. Na (1978, 1979) also correlated the upper part of Anyang-Namyang area with Jangrak Group overlying unconformably the Gyeonggi gneiss complex in central part of Gyeonggi Massif.

In the Seosan area, Na *et al.* (1982a) defined the Seosan Group consisting of Archean high grade Seosan and age-unknown Daesan formations. This Group was intruded by Seosan granite gneiss and partly migmatized at 2,572 Ma (Na *et al.*, 1982a). This age corresponds to Kenoran orogeny of Canadian shield and is correlated with metamorphic age of Qianxi and Fuping Groups of China (Sun, 1985).

Taean Group (Na *et al.*, 1982a) is composed of low grade metamorphic rock overlying unconformably Seosan Group and Gyeonggi Gneiss Complex. This Group is either Neoproterozoic strata correlated with Yeoncheon Group defined by Na (1978) of Gyeonggi Massif or Sangwon Group or Paleozoic strata like Ogcheon Group in Ogcheon folded belt.

Song (1988) studied the metamorphic P-T conditions of Seosan and Daesan formations, using geothermobarometries based on analysis of plagioclase, garnet and biotite. Metamorphism in Daedong Group near the Nampo Area was investigated by Jun (1989), who remarked the metamorphic condition of the Group belongs to the greenschist facies except for some contact aureoles near Mesozoic granites. In this paper, all of results of these studies will be recompiled and supplemented with the new results of present research in the southwestern Gyeonggi Massif.

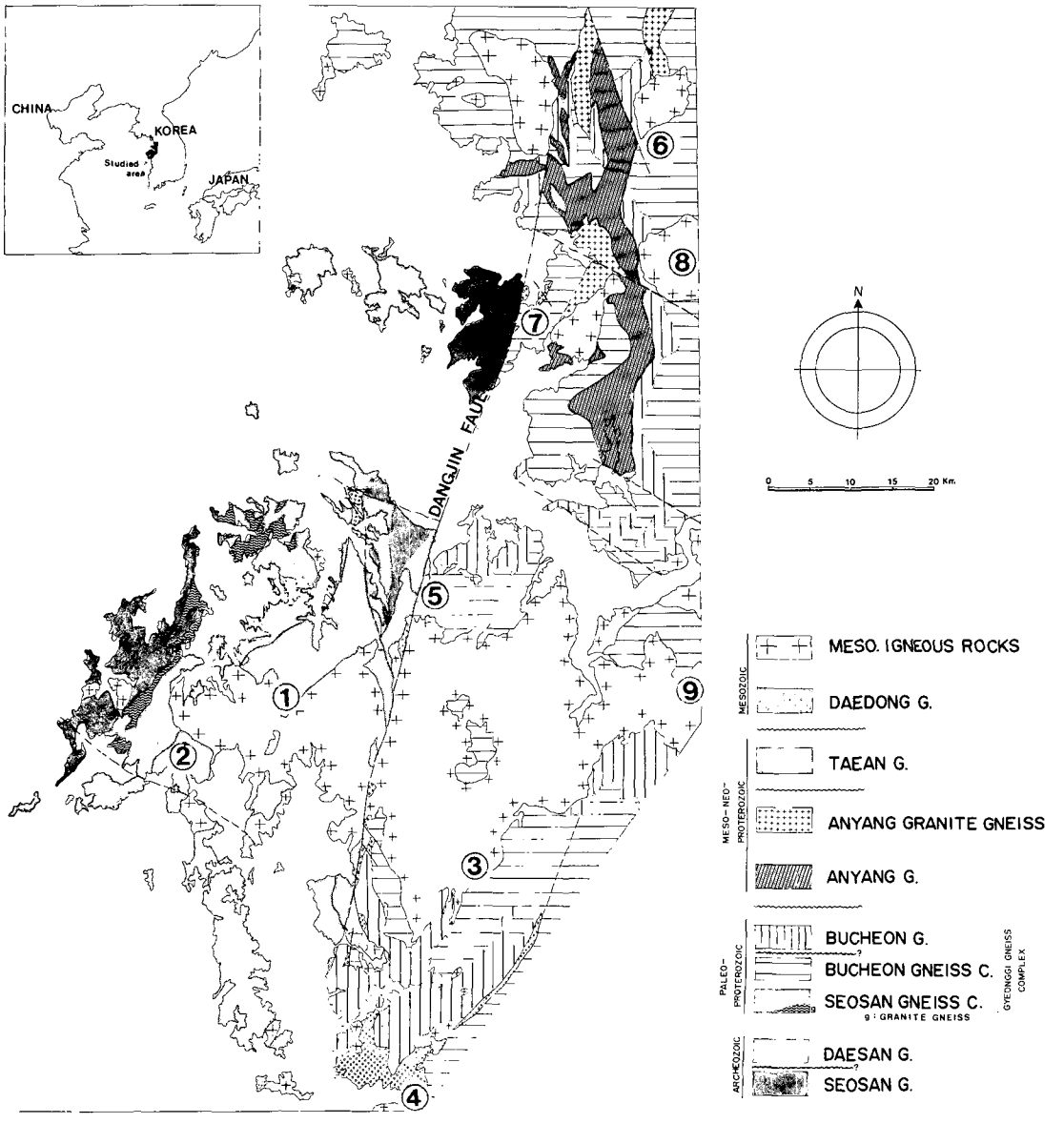

Fig. 1. Geologic Map of the studied area. G: Group, C: Complex, Cities: 1; Seosan, 2; Taean, 3; Hongseong, 4; Daecheon, 5; Dangjin, 6; Anyang, 7; Namyang, 8; Suwon, and 9; Onyang.

GENERAL GEOLOGY AND PETROGRAPHY

Archeozoic rocks

Seosan and Daesan Groups are equivalent to Seosan and Daesan Formations defined by Na *et al.* (1982a). Chang and Lee (1982) subdivided these Groups into five formations such as Euihangri, Sogeunri, Daegiri, Suryongri, and Jeonmagsan formations in Seasan area.

Euihangri formation is chiefly composed of biotite schist, sillimanite-biotite schist and quartzite, whereas Sogeunri formation is composed of iron-bearing quarzite, biotite schist and calc schist. These two formations belong to Seosan Group and

the other three formations to Daesan Group. Daegiri formation consists of quartzite, calc schist, and biotite schist. In particular, pure milky white quartzite of 10-50 m thickness accompanies the overlying calc-schist. Biotite, garnet and sillimanite are commonly altered to muscovite and chlorite. Suryongri and Jeonmagsan formations are composed of quartz schist, mica schist, calc schist and amphibolite.

The sedimentary facies of Seosan and Daesan Groups suggests a shallow marine environment. Depositional basin of Seosan Group is shallower than that of Daesan Group because many cross-beddings and detrital iron formations occur in Seosan Group, in contrast to many intercalated limestone formations of Daesan Group.

Paleoproterozoic rocks

In the Gyeonggi Gneiss Complex of studied area, migmatitic gneiss, banded gneiss and granite gneiss occur showing gradational contact relations. But in some areas, granite gneiss cuts the foliation of migmatite or banded gneiss.

Rb/Sr whole rock isochron ages of migmatitic gneiss and granite gneiss are 2,572 Ma and 2,370 Ma, respectively (Na *et al.*, 1982a; Choo *et al.*, 1982). The difference between these two ages may suggest that regional migmatitization of Archean rocks is followed by granitic magmatism. But there is no reason to preclude the possibility of resetting in the Rb-Sr system of these old rocks.

Seosan Gneiss Complex occurs mainly in the western marginal part of Taean Peninsula. It is composed of banded gneiss, migmatitic gneiss interbedded with small volume of biotite schist and thin quartzite. Bucheon Gneiss Complex is widely exposed in the eastern part of studied area enclosing Anyang, Namyang, Asan, Dangjin, and Hongseong quardrangles. Banded gneiss, migmatitic gneiss, porphyroblastic gneiss and augen gneiss are intercalated with small volume of biotite schist, graphite schist, calc schist, and amphibolite. Bucheon Group consists mainly of biotite schist and sillimanite schist, gradationally changing to Bucheon gneiss complex. In the southern part of studied area, near Hongseong, many ultramafic dikes intruded this Group (Lee and Kim, 1963). They are hydrothermally metamorphosed, forming many talc and serpentine asbestos deposits.

Meso-Neoproterozoic rocks

Mesoproterozoic rocks, Anyang Group, occur in northern part of the studied area, showing the N-S trend. They consist mainly of quartzite, muscovite-quartz schist and calc-schist. Anyang Group unconformably overlies the Bucheon gneiss complex and Bucheon Group. The age of Anyang granite gneiss intruding Bucheon and Anyang Groups has not been known, but because there are some granite gneisses of 1,350 Ma which show same petrological features with Anyang granite gneiss, intruding Bucheon Group near Suwon in western part of Gyeonggi Massif (Choo, 1983). Intruding age of Anyang granite gneiss may discriminate Meso and Neoproterozoic period in this area.

Taean Group overlying unconformably Seosan, Bucheon and Anyang Groups occurs mainly in the western part of the studied area including Anmyeon island. The Group is composed mainly of low-grade metamorphic rocks such as chlorite slate and phyllite, biotite phyllite, sericite-quartz phyllite and meta-sandstone. These rocks are similar to Daedong Group, but their structures such as foliation, folding style, and trend are different from those of Daedong Group. Furthermore, Taean Group shows regionally homogeneous metamorphic facies, but Daedong Group shows local variations in metamorphic facies.

Mesozoic rocks

Daedong Group is mainly distributed in the southern part of the studied area near Daecheon, and partly along the Dangjin fault running from Daecheon to Seoul. Pale reddish sandstone, conglomerate and shale are predominent. These rocks are partly metamorphosed into greenschist

facies rocks consisting of white mica, chlorite and biotite. Quartz shows wavy extinction, sutured texture and mortar texture resulting from the recrystallization and cataclastic deformation.

Igneous rocks are mostly biotite granite. Porphyritic syenite, gneissose granite and granite porphyry occasionally occur. The age of granite is Jurrassic (Lee, 1987). Taean and Daedong Groups near granite uncommonly show contact metamorphic effect. Recently the Cheonsuman Formation of late Mesozoic was reported in the northern coast of Cheonsu Bay (Song and Woo, 1992). The Formation is composed of conglomerate, tuff, basalt, tuff breccia, and shale.

METAMORPHISM AND METAMORPHIC FACIES

The Precambrian metamorphic belt commonly shows low pressure type metamorphism (Zwart, 1967; Miyashiro, 1971). In Gyeonggi metamorphic belt, this principle is generally accepted in central and western part of the Massif (Na, 1979; Na et al., 1982b; Kim, 1989).

Three metamorphic events have been generally recognized in the Precambrian rocks of Gyeonggi Massif (Na, 1979; Na *et al.*, 1982a; Choo, 1983; Kim, 1989). From mesoscopic and microscopic textural relations, Kim (1989) established metamorphic sequence and path in the central part of Gyeonggi Massif without age-dating data and concluded that maximum five times of metamorphic episodes including retrograde events were discernible and the third represents the highest grade of metamorphism. But these five times of episodes can be reduced to two episodes, such as progressive and retrogressive ones.

Times and types of metamorphism

Among three stages of regional metamorphism, the oldest one occurred around 2,572 Ma and 2,370 Ma, the former is the age of migmatitization of Seosan and Daesan Groups and the latter is the age of intrusion of granite gneiss. Migmatitization is the remarkable character of metamorphism at early Paleoproterozoic Era in Gyeonggi Massif (Na *et al.*, 1982a; Choo, 1983). Garnet, biotite, sillimanite and hornblende form mafic parts in migmatite, wheras quartz, plagioclase and orthoclase form leucocratic parts. In pelitic rocks, chlorite + muscovite + quartz → garnet + biotite + sillimanite + H_2O or biotite + sillimanite + quartz → orthoclase + garnet + H_2O reactions occur. The maximum P-T conditions of metamorphism were estimated to be 3.2-4.4 kb and 540-681℃ (Song, 1988). These P-T conditions represent low-pressure type metamorphism. From the garnet rim-core data, however, Song (1988) remarked that metamorphic temperature of Seosan and Daesan Groups first decrease and then increase with time, respectively.

The second metamorphism occurred around 1,350-1,420 Ma which is the intrusion age of younger granite gneisses including Anyang granite gneiss in the western part of Geonggi Massif. Migmatitization also occurred around this granite gneiss but not so regionally as in the first metamorphic event. Tables 1 and 2 show chemical compositions of garnet and biotite of pelitic migmatites in Anyang and Bucheon gneiss complexes of which mineral assemblages are quartz, biotite, garnet, hornblende, chloritoid or staurolite, sillimanite or kyanite with plagioclase. Sillimanite and chloritoid were respectively replaced by kyanite and staurolite (Fig. 3B and C). The peak temperature condition of second metamorphism estimated from coexisting garnet and biotite (Kretz, 1990) is 470-678℃ (Table 3). These conditions and mineral assemblages show higher pressure and lower temperature conditions than those of the first metamorphism. The third regional metamorphism occurred mainly in Taean Group during Triassic and Jurassic period. It shows low temperature metamorphism similar to metamorphic condition of Ogcheon, Yeoncheon and Sangwon Groups.

Some parts of Seosan, Daesan and Bucheon Groups show three metamorphic episodes, whereas in Taean and Daedong Groups only one regional episode is recorded. Chlorite, muscovite and albite are common in Taean Group. Compared

Table 1. Electron microprobe analyses and structural formulae of garnet from Bucheon gneiss complex near Anyang and Hongseong (on the basis of 24 oxygens)

	N9168	N9169	N9508	N82404	N82405	N82508	N92404
SiO_2	37.37	37.83	37.99	37.40	36.36	37.28	37.84
TiO_2	0.02	0.01	tr	tr	tr	tr	0.01
Al_2O_3	21.13	21.31	21.73	21.28	21.29	21.43	21.40
FeO*	34.06	32.09	34.14	35.15	34.47	35.24	33.62
MnO	0.14	3.90	1.21	1.28	1.97	1.21	1.84
MgO	3.13	2.16	3.87	4.31	3.93	4.01	3.92
CaO	3.76	4.08	1.03	1.56	1.67	1.06	1.85
Na_2O	tr	tr	0.01	tr	0.01	tr	tr
K_2O	0.01	0.01	tr	tr	tr	tr	tr
Total	99.62	101.39	99.98	100.98	99.70	100.23	100.48
Si	6.158	6.068	6.043	5.944	5.898	5.962	6.013
Aliv	0.000	0.000	0.000	0.056	0.102	0.038	0.000
Alvi	4.098	3.824	4.075	3.931	3.938	4.002	4.008
Ti	0.000	0.000	0.000	0.000	0.001	0.000	0.001
Fe	4.749	4.293	4.542	4.672	4.640	4.714	4.468
Mn	0.020	0.527	0.163	0.172	0.268	0.164	0.247
Mg	0.768	0.517	0.919	1.021	0.944	0.957	0.929
Ca	0.739	0.790	0.176	0.266	0.287	0.181	0.314
Na	0.000	0.000	0.001	0.000	0.004	0.000	0.000
K	0.001	0.001	0.000	0.000	0.000	0.000	0.000
Total	16.533	16.020	15.920	16.062	16.083	16.018	15.982

*Total Fe as FeO.

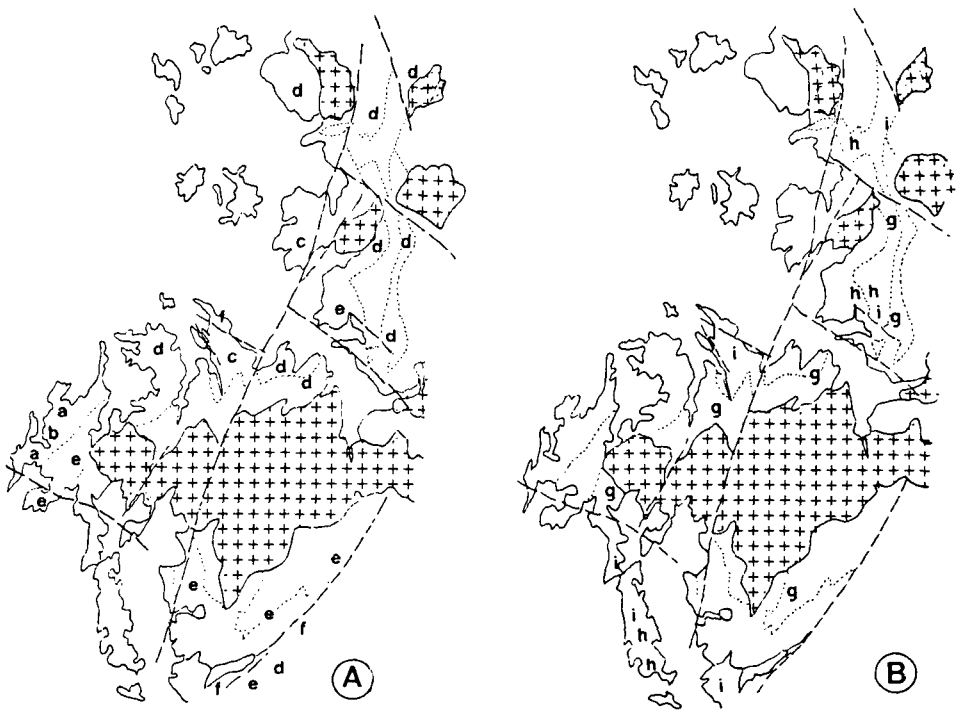

Fig. 2. Distribution of mineral assemblages of the studied area.

Table 2. Electron microprobe analyses and structural formlae of biotite from Bucheon gneiss complex near Anyang and Hongseong (on the basis of 22 oxygens)

	N9168	N9169	N9508	N82404	N82405	N82508	N92404
SiO_2	35.80	36.28	36.63	35.71	36.13	35.61	35.05
TiO_2	1.61	1.92	1.32	1.49	1.46	1.50	1.57
Al_2O_3	19.43	18.76	15.84	18.92	19.24	18.85	18.61
FeO*	18.01	19.31	14.53	19.59	19.79	17.67	18.91
MnO	0.10	0.19	0.15	0.20	0.19	tr	0.17
MgO	9.73	9.45	15.48	9.85	10.19	9.93	9.96
CaO	0.12	0.08	0.04	0.05	0.11	0.07	0.02
Na_2O	0.29	0.20	0.86	0.27	0.29	0.27	0.18
K_2O	8.49	8.21	8.75	8.73	8.96	9.22	9.03
Total	93.68	94.40	93.60	94.81	96.46	93.13	93.52
Si	5.476	5.526	5.555	5.446	5.423	5.494	5.426
Aliv	2.524	2.474	2.445	2.554	2.577	2.506	2.574
Alvi	0.966	0.888	0.386	0.848	0.828	0.921	0.821
Ti	0.189	0.216	0.151	0.171	0.165	0.174	0.182
Fe	2.295	2.448	1.844	2.499	2.484	2.279	2.450
Mn	0.009	0.026	0.020	0.025	0.024	0.000	0.022
Mg	2.235	2.155	3.499	2.240	2.280	2.284	2.299
Ca	0.026	0.017	0.006	0.009	0.018	0.011	0.003
Na	0.086	0.052	0.254	0.081	0.084	0.081	0.054
K	1.651	1.604	1.693	1.698	1.717	1.814	1.782
Total	15.457	15.406	15.852	15.571	15.606	15.566	15.612

*Total Fe as FeO.

Table 3. Temperatures calculated using garnet-biotite geothermometer

		N9168	N9169	N9508	N82404	N82405	N82508	N92404
Grt	Fe	4.75	4.29	4.54	4.67	4.64	4.71	4.47
	Mg	0.77	0.77	0.92	1.02	0.94	0.96	0.93
	X_{Fe}	0.86	0.85	0.83	0.82	0.83	0.83	0.83
Bt	Fe	2.30	2.45	1.84	2.50	2.48	2.28	2.45
	Mg	2.24	2.16	3.50	2.24	2.28	2.28	2.30
	X_{Fe}	0.51	0.53	0.35	0.53	0.52	0.50	0.52
	K_d	6.02	4.92	9.38	4.10	4.51	4.94	4.51
	T(℃)	567.90	622.62	468.50	678.45	648.40	621.70	648.30
Location		Anyang	Anyang	Anyang	Hongseong	Hongseong	Hongseong	Hongseong
Nat'l Grid		4308-1889	4287-1890	4267-1965	3342-1649	3367-1674	3340-1766	3378-1767

*Total Fe as FeO.

to Yeoncheon and Ogcheon Groups, Taean Group seems to have undergone lower grade metamorphism, judging from their mineral assemblages.

Contact aureoles around the Mesozoic granites are especially well developed in Taean and Daedong Groups overprinting on the last regional metamorphism. Near Mt. Dobi in Taean Group, andalusite-cordierite-muscovite-biotite assemblages occur well in metapelites of Taean Group.

Typical mineralogical variation was not found along the contact with Archean and Paleoproterozoic Groups. Along the contact zone only,

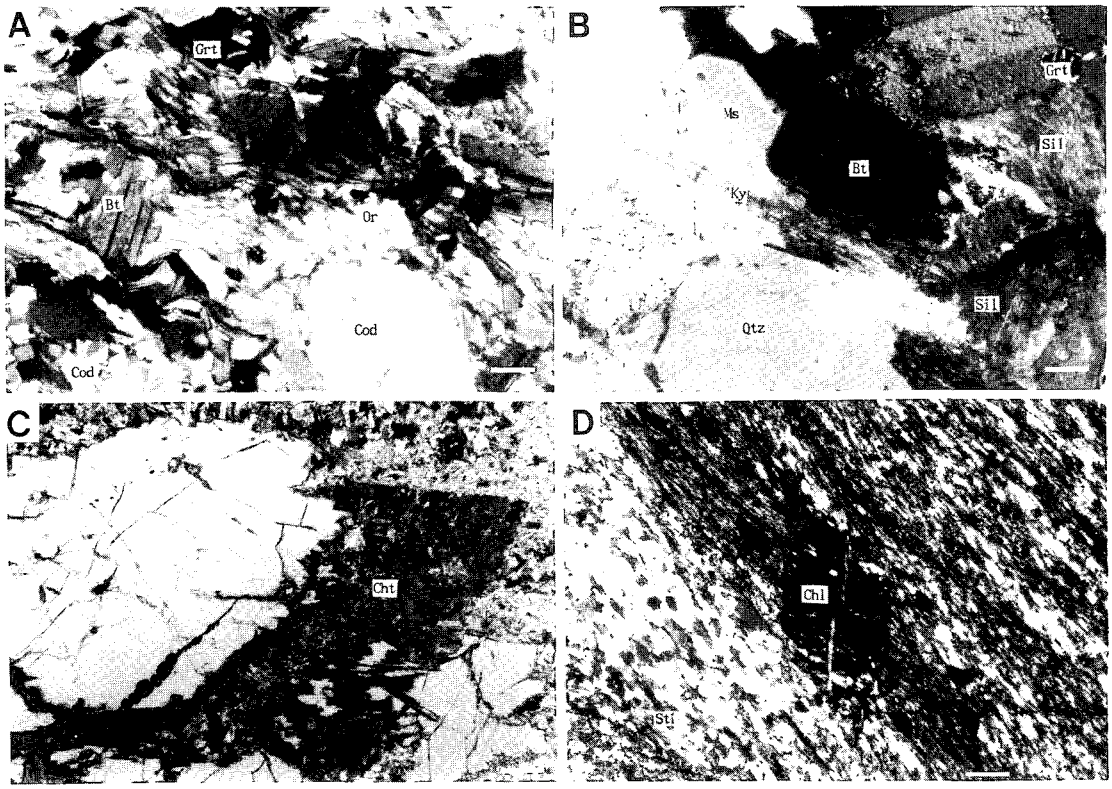

Fig. 3. Photomicrographs of important mineral assemblages of the studied area. Abbreviations are Bt: biotite, Chl: chlorite, Cht: chloritoid, Cod: cordierite, Grt: garnet, Or: orthoclase, Ky: kyanite, Ms: muscovite, Pl: plagioclase, Qtz: quartz, Sil: sillimanite, St: staurolite, and Sti: stilpnomelene. A. quartz-biotite-garnet-cordierite-orthoclase assemblage (N9123, Manripo 3691-1252), B. quartz-biotite-garnet-sillimanite-kyanite-muscovite assemblage. Sillimaniteis replaced by kyanite (N9111, Cheongyang 3312-1999), C. quartz-biotite-staurolite-chloritoid-muscovite (N91616, Hongseong 3401-1773), D. quartz-chlorite-stilpnomelane-muscovite assemblage (N 91606, Sinon 3501-1397). All scales represent 0.5 mm. Crossed nicols.

biotite is sporadically concentrated and minor lit-par-lit injections of aplitic or granitic material are common.

Hydrothermal alteration occurs along the shear zone or fractures in the whole studied area. These features are well observed in calc schist where much scapolitization and chloritization occur. Serpentinization is very common in Mg-rich calc schists and ultramafic rocks which are widely distributed as small bodies in the southern part of the studied area.

Metamorphic facies of regional metamorphism

Mineral assemblages of metapelites of the studied area are as follows. All following asemblages contain quartz.

(A) Metapelites produced by the first stage regional metamorphism.

a. biotite-garnet-cordierite-orthoclase.

b. biotite-garnet-sillimanite-oligoclase.

c. biotite-garnet-andesine-muscovite.

These assemblages show that the first stage metamorphic rocks belong to the upper amphibolite facies.

(B) Metapelites produced by the second stage regional metamorphism.

d. biotite-garnet-hornblende-oligoclase.

e. biotite-staurolite-chloritoid-muscovite.

f. biotite-garnet-sillimanite-kyanite-muscovite.

These assemblages suggest that the second stage metamorphic rocks belong to the amphibolite facies.

(C) Metapelites produced by the third stage regional metamorphism.

g. chlorite-biotite-muscovite.

h. biotite-albite-muscovite.

i. chlorite-stilpnomelane-muscovite.

These assemblages indicate that the third stage metamorphic rocks belong to greenschist facies. In the second stage metamorphic rocks, the overprinting of the third metamorphic stage can rarely be identified.

Fig. 2 shows the distribution of these mineral assemblages. The letters in figure refer to mineral assemblages given above. Fig. 3 shows photomicrographs of these assemblages.

Metamophic facies of contact metamorphism

Mineral assemblages formed by Mesozoic granites in pelitic and calcareous rocks are as follws and represent the greenschist to amphibolite facies.

(A) Metapelites in Taean Group.

a. quartz-biotite-cordierite-andalusite-plagioclase-muscovite.

b. quartz-biotite-chlorite-plagioclase-sericite.

(B) Calcareous metamorphic rocks in Taean Group

a. quartz-diopside-hornblende-idoclase-calcite.

b. quartz-tremolite-epidote-garnet-plagioclase.

CONCLUSION

1. The studied area consists mainly of Archean Seosan and Paleoproterozoic Bucheon Groups which have undergone low pressure type metamorphism up to amphibolite facies at about 2,370 to 2,572 Ma, forming Seosan and Bucheon gneiss complex.

2. Anyang Group was metamorphosed up to amphibolite facies of intermediate pressure type metamorphism which overprinted also on Bucheon, Daesan and Seosan Groups. The peak metamorphic temperature conditions and age of this second metamorphism is 470 to 678℃ and 1,350 to 1,420 Ma. Anyang Group has been intruded by Anyang granite gneiss in Mesoproterozoic Era.

3. Taean and Daedong Groups were metamorphosed up to greenschist facies at Triassic to Jurassic Period.

ACKNOWLEDGEMENTS

This study was financially supported by Korea Research Foundation in accordance with its program (1990-1991). The auther wishes to thank Prof. M. Cho who reviewed this paper and graduate students of Chungbuk University who assisted the auther for field works and arrangement of manuscripts.

REFERENCES

Chang, T.W. and S.Y. Lee, 1982, Geologic map of Korea, Seosan-Mohang sheet. Korea Inst. of Energy and Resources. 30p.

Choo, S.H., D.H. Kim, M.S. Kim and H.S. Yoo, 1982, Rb/Sr age determination on granite gneiss and granite in Seosan, Onjeongri Granite, and Mesozoic Granites along the East coast, Korean Peninsula. Report on Geoscience and Mineral Resources 13, 193-208.

Choo, S.H., 1983, A study on age determinations of Gyeonggi Massif, Korea Peninsula by Rb-Sr method. Ph.D thesis, Hanyang Univ., 139p.

Jun, J.H., 1989, Low grade meyamorphism of the Nampo Group in the southeastern part of the Taecheon area. M.Sc. Thesis, Korea Univ., 48p.

Kim, D.H. and J.H. Hwang, 1982, Geologic map of Korea, Daesan-Igog sheet. Korea Inst. of Energy and Resources, 30p.

Kim, J.Y., 1989, A study on metamorphism of the metamorphic rocks in the central part of Gyeonggi Massif. Ph. D. thesis, Seoul National Univ., 277p.

Kertz, R., 1990, Biotite and garnet compositional variation and mineral equilibrium in Grenville gneisses of the Otter Lake area, Quebec. Jour. Metamorphic Geol., 8. 493-506.

Lee, J.H. and S.S. Kim, 1963, Geological map of Korea, Hongsong sheet. Geological Survey of Korea, 33p.

Miyashiro, A., 1971, Metamorphism and metamorphic belts. George Allen and Unwin, 339-415.

Na, K.C., 1972, Regional metamorphism of the so-called Yeoncheon system in the western Gyeonggi area. Memoirs for Prof. Son's 60th Birthday, 140p.

Na, K.C., 1978, Regional metamorphism in the Gyeonggi Massif with comparative studies in the Yeoncheon and Ogcheon metamorphic belts (I). Jour. Geol. Soc. Korea. 14, 195-211.

Na, K.C., 1979, Regional metamorphism in the Gyeonggi Massif with comparative studies in the Yeoncheon and Ogcheon metamorphic belts (III). Jour. Geol. Soc. Korea. 15, 145-151.

Na, K.C., H.S. Kim and S.H. Lee, 1982a, Stratigraphy and metamorphism of Seosan Group. Jour. Korea Inst. Min. Geol., 15, 33-39.

Na, K.C., H.S. Kim, D.J. Lee and S.H. Lee, 1982b, Comparative studies between Chungju and Seosan Groups. Jour. Korea Inst. Min. Geol., 15, 177-188.

Song, M.Y. and Y.K. Woo, 1992, Structure and physical properties of Earth crust material in the middle of Korea peninsula (I): Geology in the vicinity of Cheonsu Bay. Jour. Korean Earth Science Soc., 13, 42-53.

Song, Y.K., 1988, Petrochemistry and mineral chemistry on the metasediments and the igneous rocks in Seosan area. M,Sc. thesis, Yonsei Univ., 79p.

Sun, D. and S. Lu, 1985, A subdivision of the Precambrian of China, Precambrian Research, 28, 137-162.

Zwart, H.J., 1967, The dualitity of orogenic belts. Geologic en Mijinbouw, 46, 283-309.

(책임편집 : 조문섭)

경기육괴 서남부 일대의 변성작용에 관한 연구

나 기 창

Department of Earth Sciences, Chungbuk National University
Cheongju 360-763, Korea

요 약 : 경기육괴 서남부는 주로 시생대에 속하는 서산층군 및 대산층군과 고기원생대에 속하는 부천층군 및 경기편마암복합체에 속하는 부천-서산 편마암복합체로 구성된다. 당진단층 동편에는 중기원생대에 속하는 안양층군과 안양화강편마암이 분포되며 당진단층 서편에는 태안층군이 이들 시생대 및 고기원생대층군들을 부정합으로 덮고있다. 시생대층군은 주로 고압피볼라이트 변성상을 보여주며 암피볼라이트상 및 녹색편암상인 제2, 제3의 변성작용들이 중복되어 나타난다. 부천 및 안양층군은 암피볼라이트상과 녹색편암상을 보여주며 곳에 따라 중생대 변성작용으로 사료되는 녹색편암상이 중복되어 있다. 태안층군과 중생대의 대동층군은 녹색편암상을 보여준다.

핵심어 : 경기 편마암 복합체, 다변성작용, 암피볼라이트상