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K/Ar Ages of Micas from Precambrian and Phanerozoic Rocks in the Northeastern Part of the Republic of Korea

by *Hyun-Soo Yun*[1]

Abstract

The age relations of several intrusive bodies in the Precambrian and Cambro-Ordovician terrains in the NE of the Republic of Korea were investigated using the K/Ar age determination method: muscovite ages of between 1642 and 1802 Ma were measured for the Naedeogri and Nonggeori granites intruded into Precambrian rocks. For pegmatites occurring in the Precambrian terrain similar ages were found, except for two samples from the southern part of the area which gave younger mica ages of 305±4 and 467±10 Ma. A biotite schist sample from just south of Sangdong gave a biotite age of 998±10 Ma. The Precambrian basement is overlain unconformably by the Cambrian Jangsan quartzite: in the western part of the study area, these 2 units are separated by a 10 m. thick sericite quartz schist. Enriched sericite concentrates yielded ages of 235±5 and 266±5 Ma; data on the quartz concentrate indicate a high content of excess argon. Cretaceous K/Ar biotite ages were obtained for the Geodo (107–110 Ma) and Imog (92 Ma) granites, intruded into Precambrian and Cambro-Ordovician terrain.

Keywords: precambrian granites, cretaceous granites, K/Ar ages, cambrian quartzites, intrusions, Korea

INTRODUCTION

The study area, located at Sangdong, Gangweondo, in the northeast part of South Korea, is composed of Precambrian polymetamorphic rocks to the south, Cambrian quartzite followed by Cambro-Ordovician limestones in the north and Upper Carboniferous-Triassic coal bearing sediments in the northeast and northwest (Lee and Kim, 1965; Lee, 1966; Um and Reedman, 1975; see Figure 1). From the Precambrian terrain the following rocks have been studied: the Naedeogri and Nonggeori granites (denoted Gc and Gn in Fig. 1) and three pegmatites from the northern area, and one pegmatite (sample SR-4) and one biotite schist (sample SR-7) from a few km. further south. In addition quartz and sericite concentrates have been studied from the basal Cambrian sericite

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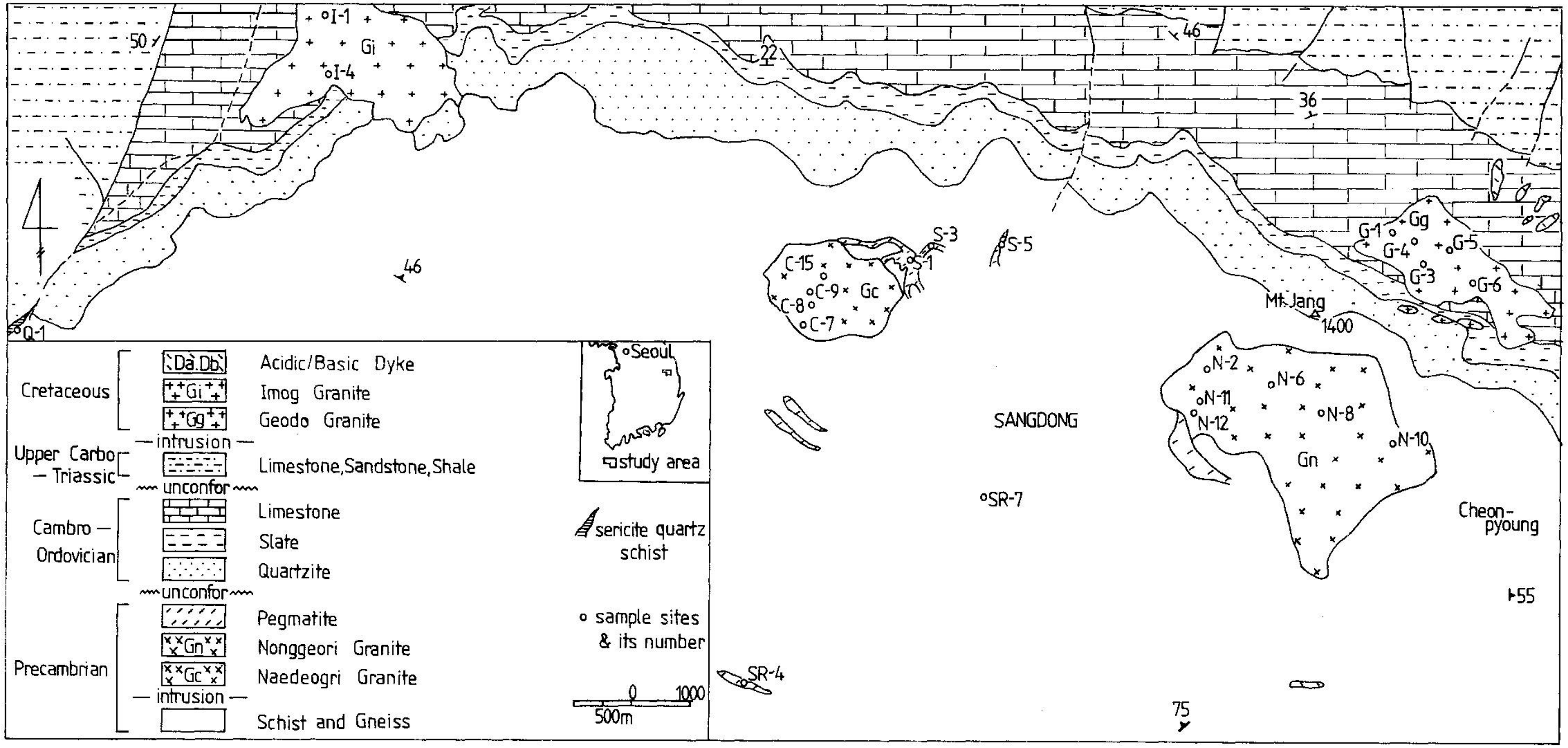

Fig. 1 Geologic Map and Sampling Sites at Sangdong Area.

quartz schist (sample Q-1) in the west of the area. From the Phanerozoic terrain in the north, the Imog and Geodo granite bodies have been dated. These younger granites intrude in close proximity to the Precambrian rocks and thus one purpose of this study was to investigate the preservation of mica ages at the edge of an old continent.

K/Ar AGE DETERMINATIONS

Extremely pure mica mineral concentrates were obtained from the sampled rocks using conventional magnetic separation techniques. Sericite from the sericite quartz schist was substantially enriched using heavy liquid and similar magnetic separation techniques. Potassium concentrations were determined in duplicate using a Beckmann flame photometer (PURDY and JÄGER, 1976). Argon content and isotopic composition were measured using a MM1200 static vacuum mass spectrometer (FLISCH, 1982) employing an enriched ^{38}Ar spike. K/Ar ages were calculated using the IUGS agreed constants (STEIGER and JÄGER, 1977).

RESULTS

Both granites and 3 pegmatites from the Precambrian terrain yield similar K/Ar muscovite ages ranging between 1736 and 1802 Ma, with the single exception of granite sample C-15 which contains abundant tourmaline, possibly

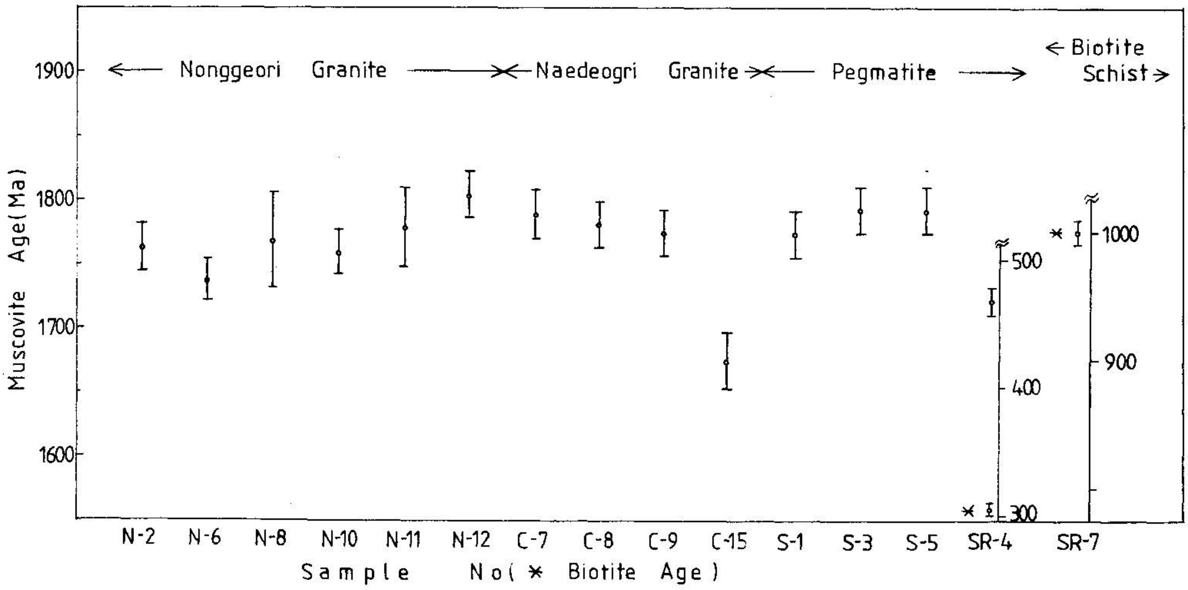

Fig. 2 Ages of Intrusives in the Precambrian Terrain.

Table 1 Analytical Data and K/Ar Ages from the Sangdong Area, Korea.

Sample and Reference		Mineral and Mesh Size		K%	ccm40Arrad STP/g (x10-6)	%40Arrad	Age in Ma
Geodo Granite	G-1	biotite	60/80	7.23	32.08	96.16	111±1
	G-3	biotite	60/80	7.17	30.93	96.28	108±1
	G-4	biotite	60/80	7.66	33.22	96.32	108±1
	G-5	biotite	60/80	7.21	31.41	96.58	109±1
	G-6	biotite	60/80	7.58	32.76	97.67	107±1
Imog Granite	I-1	biotite	60/80	7.21	26.58	96.16	92±1
	I-4	biotite	60/80	7.43	27.54	95.21	93±1
Naedeogri Granite	C-7	muscovite	40/60	8.70	1032.64	99.06	1787±19
	C-8	muscovite	60/80	8.60	1014.21	99.10	1780±18
	C-9	muscovite	40/60	8.69	1018.65	99.13	1773±18
	C-15	muscovite	40/60	8.56	917.10	98.70	1673±22
	C-15 (repeat)	muscovite	40/60	8.56	891.58	98.20	1642±23
Nonggeori Granite	N-2	muscovite	40/60	8.78	1018.74	98.52	1761±18
	N-6	muscovite	40/60	8.68	984.85	98.79	1736±16
	N-8	muscovite	40/60	8.61	1004.10	97.70	1767±37
	N-10	muscovite	40/60	8.70	1005.59	98.88	1757±17
	N-11	muscovite	40/60	8.65	1017.37	98.59	1777±31
	N-12	muscovite	40/60	8.64	1039.59	99.11	1802±18
Pegmatite	S-1	muscovite	40/60	8.57	1004.53	99.17	1773±18
	S-3	muscovite	40/60	8.63	1029.23	99.13	1792±18
	S-5	muscovite	40/60	8.30	989.75	99.20	1792±18
	SR-4	biotite	40/100	6.30	130.55	89.43	467±10
		muscovite	40/100	8.69	112.18	92.63	305±4
Biotite Schist	SR-7	biotite	60/80	7.29	377.88	98.67	998±10
Sericite Quartz Schist	Q-1	sericite	150/200	1.44	14.08	81.07	235±5
		sericite + quartz	100/200	0.73	8.14	78.10	266±5
		quartz	60/100	0.23	5.90	92.94	562±5

representing a later stage in the granite evolution (see Fig. 2 and Table 1). A few kilometers to the south, a biotite schist (sample SR-7) gave a K/Ar biotite age of 998±10 Ma, whilst a pegmatite (sample SR-4) yielded a K/Ar biotite age of 467±10 Ma and a surprisingly lower muscovite age of 305±4 Ma. This discordant age pattern may be interpreted as resulting from partial resetting.

The northern granites intruding the Precambrian and Cambro-Ordovician yield two sets of K/Ar biotite ages, with means of 109±1 Ma for Geodo and 93±1 Ma for Imog granites (see Fig. 3 and Table 1). Although K/Ar biotite ages must be regarded as cooling ages, this difference may indicate a real difference

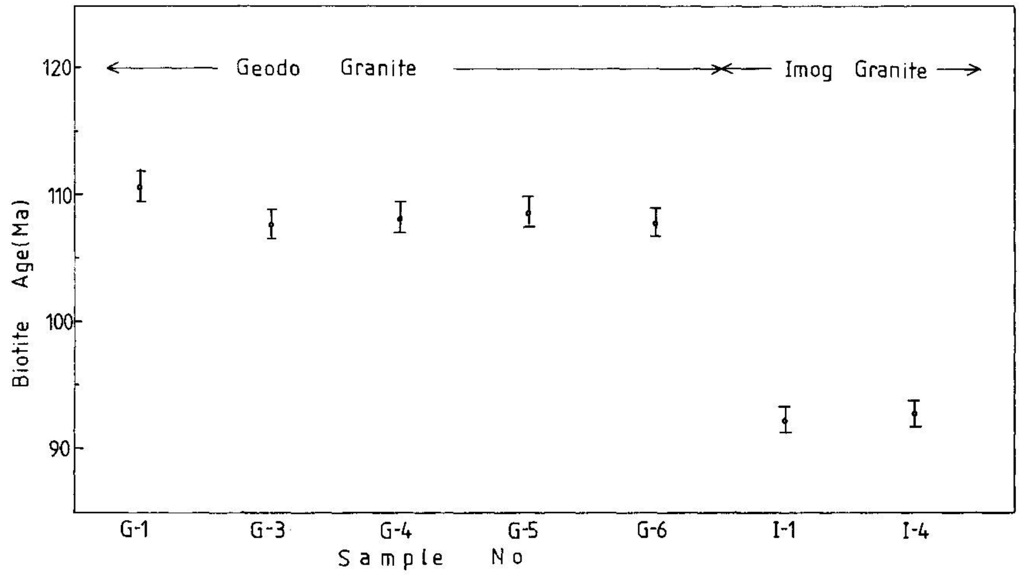

Fig. 3 Ages of Intrusives in the Cambro-Ordovician Terrain.

in the intrusion ages of the two granites. Both the presence of a thermal aureole around the Geodo granite (Chang and Park, 1982) together with the observation that the Cretaceous intrusion has not rejuvenated the older mica ages in the adjacent Nonggeori granite (the two granites are separated by a distance of only 3 km.) indicate intrusion of the Geodo granite at a shallow level.

The data on the sericite quartz schist are of particular interest: the low K/Ar ages for the sericite concentrates of 235±5 and 266±5 Ma, when compared with the Cambrian age of the formation (Lee, 1966), may be interpreted either as the age of a late period of sericite formation or as rejuvenated ages. The higher age of 562±5 Ma obtained from the quartz concentrate is indicative of excess argon. Accordingly, since both sericite concentrates contain quartz, their ages must be interpreted as maximum ages. Figure 4 demonstrates the relation between $^{40}Ar_{rad}$ and potassium content in the three sericite, sericite-quartz and quartz concentrates, indicating an excess argon content of approximately 4×10^{-6} ccm STP/g.

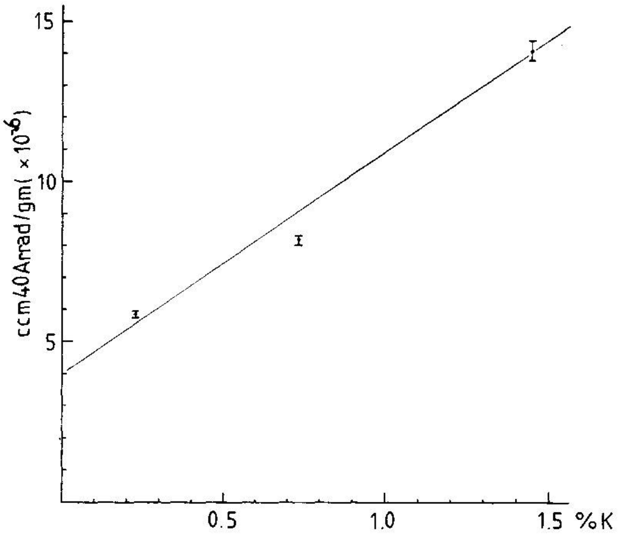

Fig. 4 Relation of 40Ar rad and Potassium content of three Quartz, Quartz Sericite Mixture and Sericite from the Sericite Quartz Schist.

Summarising these results demonstrates the wealth of geological information to be gained from application of the K/Ar method in a well selected geological situation.

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References

CHANG, H. W. and PARK, K. H. (1982): Petrogenesis of Fe-Cu bearing skarns at Geodo. Report on Geoscience and Mineral Resources, 14, 129-130.

FLISCH, M. (1982): Potassium-argon analysis. In: G. S. ODIN (Editor), Numerical Dating in Stratigraphy. John Wiley, Chichester, 151-158.

LEE, D. S. (1966): Geological Map of Ogdong Sheet, Geological Survey of Korea, 18.

LEE, D. W. and KIM, S. W. (1965): Geological Map of Seobyeogni Sheet, Geological Survey of Korea, 3-8.

PURDY, J. W. and JÄGER, E. (1976): K/Ar ages on rock-forming minerals from the Central Alps. Mem. Inst. Geol. Min. Univ. Padova, 30, 31.

STEIGER, R. H. and JÄGER, E. (1977): Subcommission on geochronology: convention on the use of decay constants in geo- and cosmochronology. Earth Planet. Sci. Letts., 36, 359-362.

UM, S. H. and REEDMAN, A. J. (1975): Geology of Korea. 34.

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