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Variation of Gold Content in Rocks and Minerals from the Seongsan and Ogmaesan Clay Deposits in the Haenam Area, Korea

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ABSTRACT: Several acid-sulfate clay deposits associated with silicic magmas occur in the Haenam area of the southwestern part of Korea. Geology of the studied area consists of tuffs, granitic rocks, quartz porphyry, rhyolite, andesite and sedimentary rocks. The granitic rocks and quartz porphyry intruded tuffs and sedimentary rocks. The rhyolite and tuffs around the mines have undergone hydrothermally weak or strong alteration. Gold contents with major and trace elements have been determined for a total of sixty-seven specimens of fresh igneous rocks, wall rocks and minerals such as dickite and alunite by graphite furnace atomic absorption spectrometer and inductively coupled plasma. Gold is enriched in the alunite vein and the silicified zone, but is depleted in dickites and hydrothermally altered rocks with dickite of the Seongsan deposit. Gold is especially concentrated near the faults or conjunction area of two faults. High content of gold is shown in the mineral assemblages of alunite-quartz-pyrite in the alunite vein and silicic zone of the Seongsan deposit compared with that of minerals and rocks from another deposits distributed in the studied area. Gold content in tuffs and dickites with pyrite is generally low. Gold content in silicified tuff tends to show positive correlations with content of As, Hg and Sb. Variation trends of Cd, Hg and Sb are similar to those of gold content. From the result of gold content variations, gold may be transported and concentrated by mineralizing solutions ascending along the cracks like fault. Therefore, it is important to survey alunite vein and silicified zone at the conjunction of faults, and to analyze pathfinder elements such as As, Hg and Sb for geological and geochemical exploration of gold in the studied deposits.

INTRODUCTION

Many workers have concerned gold mineralization associated with acid alteration and acid leached residual silica of volcanic rocks distributed in the Circum Pacific Belt (e.g., Izawa, 1990; Hedenquist, 1987; Kwak, 1990; White, 1990; Rye, 1990; Rytuba and Miller, 1990). Gold deposits occurring in the acid-sulfate alteration zone have attracted economic geologists' attention in respect of economic as well as scientific concerns because of their reserves more than 1.5 million tons of gold. The deposits are called as Nansatsu type, acid-sulfate type, kaolinite-alunite type or low/high sulfidation type according to their local name or characteristic geological processes. They are characterized by their occurrence with kaolinite, alunite, diaspore or pyrophyllite within alteration zone. The deposits were formed mainly in Tertiary or Quarternary, but Temora deposit in Australia was formed in late Paleozoic or early Mesozoic age (Thompson *et al.*, 1986). Kim *et al.* (1990) suggested that Ogmaesan deposit was formed by acid-sulfate solution based on the occurrence and assemblages of minerals, and results of geochemical studies. White(1990) has also classified clay deposits distributed in the Gyeongsang basin as Temora type.

Geochemical analysis for gold and other trace elements have been carried out for fresh igneous rocks, altered wall rocks and minerals in the studied area. The purpose of this study is to make basic data for applying geochemical exploration of gold deposits in the acid-sulfate alteration zone of the studied area.

GEOLOGIC SETTING

The geology of the studied area consists mainly of Precambrian metamorphic rocks, Jurassic granitic rocks, Cretaceous granitic and volcanic rocks, and sedimentary rocks (Fig. 1).

Precambrian metamorphic rocks are distributed in the northwestern and eastern part of the Haenam Eup. The metamorphic rocks are unconformably covered by the Cretaceous volcanic rocks in the eastern part, and are contacted with fault developed in the Hwawon peninsula. They are composed of quartz, plagioclase, biotite, muscovite, microcline and accessory minerals such as chlorite and opaque minerals. Jurassic granitic rocks are distributed mainly in the Sani peninsula. Outcrops cannot be found because

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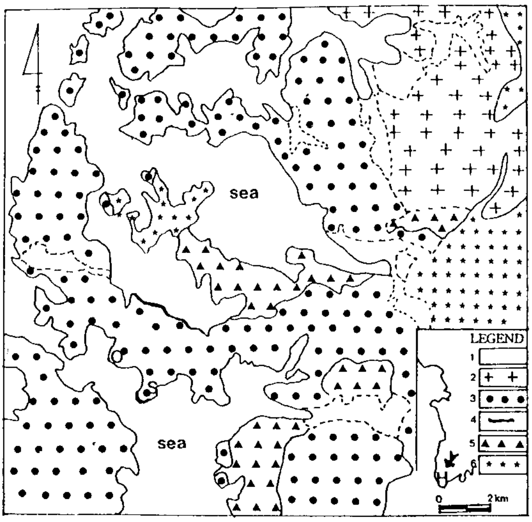

Fig. 1. Generalized geologic map of the studied area modified from Kim *et al.* (1990) and Kim (1992). 1; Alluvium, 2; Cretaceous granitic rocks, 3; Cretaceous volcanic rocks, 4; Sedimentary rocks, 5; Jurassic granitic rocks, 6; Metamorphic rocks, H; Haenam, O; Ogmaesan mine, S; Seongsan mine.

they are deeply weathered. They are unconformably covered by the Haenam and the Hwawon formations which consist of Cretaceous volcanic rocks, and are intruded by Cretaceous granitic rocks (Kim *et al.*, 1994). They are composed of plagioclase, quartz, microcline, hornblende, biotite and accessory minerals such as zircon, chlorite, epidote and allanite (Kim *et al.*, 1994). K-Ar data from biotite separated from the Weolgagsan granite yield an age of 140.9 to 144.8 Ma through K-Ar method (Kim, 1991). Cretaceous granitic rocks which occur as small stocks or dikes are divided into Jiyoungsan granite, Weolchulsan granite, Weolgangdu quartz porphyry and Jangseong porphyry (Kim and Kusakabe, 1993). Jiyoungsan granite mass which is composed of hornblende-biotite and biotite granite intrudes the Hwawon Formation. The rock has been dated at 67 Ma (Lee and Lee, 1976) and 81.5 Ma (Kim, 1991) through K-Ar method. Weolchulsan granite which is composed mainly of pink feldspar and quartz intrudes metamorphic rocks, Jurassic granite and Hwangsan Formation (Kim *et al.*, 1994). The rock is coarse grained with porphyrytic texture and druse. They are composed of quartz, orthoclase, perthite, plagioclase, biotite and accessory minerals such as hornblende, sericite, apatite and opaque minerals. K-Ar data from K-feldspar and whole rock yields age of 77-81.2 Ma (Kim, 1991). Quartz porphyry which is composed of quartz and feldspar is mainly distributed at Weolgangdu in the northern part of the Ogmaesan and Seongsan mines as a small stock, and intrudes Hwangsan Formation. The rock has been dated at 63 Ma (Lee and Lee, 1976), 79.6 Ma (Moon *et al.*, 1990) and 75 to 77.9 Ma (Kim, 1991) through K-Ar method. Cretaceous volcanic rocks are widely distributed in the studied area. Several workers (e.g., Lee and Lee, 1976; Kim *et al.*, 1990; Moon *et al.*, 1990) studied about sequence and age of the rocks, but they have still been in a controversy. Moon *et al.* (1990) divided the rocks into three groups according to K-Ar data: intermediate volcanic rocks (Hwawon formation), acidic volcanic rocks and tuffs (Haenam formation), and andesite. Sedimentary rocks are distributed along the Uhangri shore line, and are covered by Cretaceous volcanic rocks. The rocks consist of black shale, sandstone and tuffaceous sandstone (Yoon, 1975; Yoo and Yoon, 1977).

OUTLINE OF MINERAL DEPOSITS

There are several clay mineral deposits in the studied area. Representative clay mineral deposits are the Seongsan, Ogmaesan, Haenam and Dogcheon mines. The Seongsan and Ogmaesan deposits were developed from the 1920s. These deposits were formed by hydrothermal alteration of Cretaceous acidic volcanic rocks and tuffs, and are considered to be genetically related to Cretaceous felsic magmatisms (e.g., Moon *et al.*, 1990; Kim and Kusakabe, 1993). These deposits are classified into two types as pyrophyllite and koalinite type (Kim, 1991, 1992) based on the mineral assemblages. The Seongsan and Ogmaesan deposits are classified as kaolinite type. The deposits occur as massive or vein type which cut the massive type. Alunites also occur as massive or vein type. The alunites from the Seongsan and Ogmaesan deposits have been dated at 71 Ma to 76 Ma through K-Ar method (Moon *et al.*, 1990). Moon *et al.* (1990) suggested that alteration of the deposits be related with volcanism rather than hydrothermal effect based on the isotopic age dating of minerals and rocks. The alteration zones are recognized from the center to the margin of the Seongsan deposit: kaolin, quartz-kaolin, quartz, sericite and chlorite zone (Kim, 1992), and those of the Ogmaesan deposit; quartz, alunite, kaoline, sericite and chlorite zone (Kim, 1992; Kim *et al.*, 1990).

Table 1. Average and range of trace element contents of the samples from the studied area.

	Alunite-quartz-dickite(n=4)			Dickite(n=10)			Quartz zone(n=6)			Silicified tuff(n=4)			Alunite(n=5)			Tuff(n=8)			Quartz porphyry(n=6)		
	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.
Ag	36	6	27.5	816	6	110.6	708	18	175	226	13	58.81	66	13	33	251	29	101.3	129	17	71.33
Au	29.4	1.4	9.3	22.8	2.3	5.89	35.5	7.6	18.3	9.7	0.5	2.95	6	0.2	2.76	5	0.3	1.73	17.9	0.7	4.45
As	34.5	2	9.9	76.6	0.2	10.48	45.2	1	14.55	6	0.3	2.15	1.5	0.2	0.58	31.2	0.3	6.08	1.6	0.8	1.25
Bi	0.14	0.08	0.12	0.77	0.05	0.23	0.66	0.11	0.30	0.33	0.05	0.14	0.06	0.05	0.05	0.4	0.06	0.18	0.1	0.1	0.1
Cd	0.06	0.02	0.03	0.06	0.02	0.025	0.08	0.02	0.04	0.3	0.02	0.02	0.02	0.02	0.02	0.3	0.02	0.12	0.16	0.02	0.1
Cl	0.02	0.01	0.013	0.12	0.01	0.041	0.01	0.01	0.01	0.03	0.01	0.02	0.12	0.01	0.01	0.02	0.01	0.01	0.2	0.01	0.08
Co	3	1	2.0	5	2	3.4	5	1	2	3	1	1.81	2	2	2	10	1	4.6	6	2	2.83
Cu	3	2	2.5	5	1	22	10	1	4.33	4	1	2.63	4	0	1.6	23	3	10.5	16	2	8.67
Ga	1.4	0.1	0.55	1.2	0.1	0.52	0.5	0.1	0.3	1	0.1	0.32	0.3	0.1	0.14	7.6	0.5	2.2	7.5	3	4.82
F	1530	830	1310	1980	990	1354	1440	150	878.33	1620	560	1016.2	1080	470	788	540	170	307.5	200	40	125
Hg	1.23	0.02	0.34	0.57	0.02	0.19	0.5	0.03	0.14	0.58	0.02	0.11	0.22	0.02	0.11	0.07	0.02	0.03	0.03	0.02	0.02
Mo	6.82	0.25	3.91	15	0.03	2.22	35.1	0.42	9.64	3.18	0.7	2.02	0.23	0.03	0.12	3.4	0.02	0.57	3.84	0.34	0.96
Pb	3.87	1.2	2.30	19.2	0.37	6.02	25.2	1.37	8.36	40.2	1.08	5.33	2.9	0.41	1.21	37.7	2.45	17.71	20.5	8.02	14.47
Sb	3.81	0.2	1.56	4.96	0.11	1.53	5.4	0.65	2.26	2.1	0.07	0.80	0.27	0.07	0.13	0.63	0.05	0.14	0.05	0.05	0.05
Se	0.28	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.23	0.2	0.2	0.2
Te	0.07	0.07	0.07	0.07	0.05	0.06	0.14	0.05	0.09	0.09	0.05	0.07	0.15	0.05	0.08	0.07	0.05	0.05	0.05	0.05	0.05
Tl	0.05	0.05	0.05	0.7	0.5	0.54	0.6	0.5	0.52	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.5	0.53	0.5	0.5	0.5
Zn	26	13	16.25	38	9	14.3	37	10	16.67	75	10	22.4	275	7	62	160	14.9	62.3	68.1	27.5	52.05

Unit in ppm. Unit of Au and Ag; ppb. Number of analyzed specimens in parenthesis (after Yoon, 1993).

Table 2. Contents of gold and trace elements of alunite vein from the Seongsan mine.

Sample No.	Ag	Au	As	Bi	Cd	Cl	Cu	Ga	F	Hg	Mo	Pb	Sb	Se	Te	Tl	Zn
Y9268	7359	259	240	0.13	0.34	0.01	3.69	0.1	1170	0.90	9.28	24.4	47.2	0.3	0.08	8.0	9.01
Y9269	262	55	161	0.12	0.04	0.01	5.34	0.1	790	0.21	3.89	10.5	3.96	0.3	0.06	0.5	12.6
Y9270	276	58	115	0.19	0.27	0.01	3.72	0.1	660	0.13	2.53	43.7	2.81	0.2	0.08	0.5	34.7
Y9271	70	41.4	92	0.11	0.03	0.05	1.65	0.1	840	0.13	2.77	7.68	2.71	0.2	0.07	0.5	17.1
Y9272	185	67.9	42	0.10	0.03	0.01	2.06	0.1	880	0.08	2.39	6.76	2.27	0.2	0.05	0.5	6.80

Unit; ppm except Ag and Au(ppb).

SAMPLING AND EXPERIMENTAL

Ten fresh plutonic rocks, four volcanic rocks and fourty-three wall rocks and minerals were collected from the Seongsan and the Ogmaesan mine area. These specimens include samples taken near the fault and at 36 m under the sea level in the Seongsan mine.

Several thin sections and polished sections were made for microscopic study and electron probe microanalysis. The samples were ground under two hundred mesh (−74 μm) by disc mill made by tungsten carbide or agate mortar in order to protect contamination possible during powdering the samples. Trace elements except Au were analyzed by inductively coupled argon plasma in London University and ACTLABS of Canada.

GOLD CONTENT VARIATIONS

Gold contents of rhyolite, tuff, granitic rocks and quartz porphyry distributed in the studied area are less than 5 ppb with the exception of 11.6 ppb of biotite granite and 17.9 ppb of quartz porphyry (Table 1). However, gold content of alunite vein which has mineral assemblages of alunite-quartz-pyrite shows anomalous values of 41~259 ppb, and those of quartz zone also show high values of 7.6 ppb to 35.5 ppb. The gold content of dickites is less than 5 ppb except one sample. One dickite sample showing the highest gold content as 22.8 ppb was collected from the intersection part of two faults which are located at 36 m under sea level. A strongly silicified specimen taken from the same place also shows high gold content as 23.2 ppb. From the above results, it is suggested that the gold may be concentrated and transported by mineralizing solutions ascending along the cracks like fault.

Several workers (e.g., White, 1990) suggested that gold be associated with sulfides in the acid-sulfate alteration zone. The observed sulfide mineral occurring in the studied deposits is only pyrite. The pyrites in the studied area present in alunite veins, black

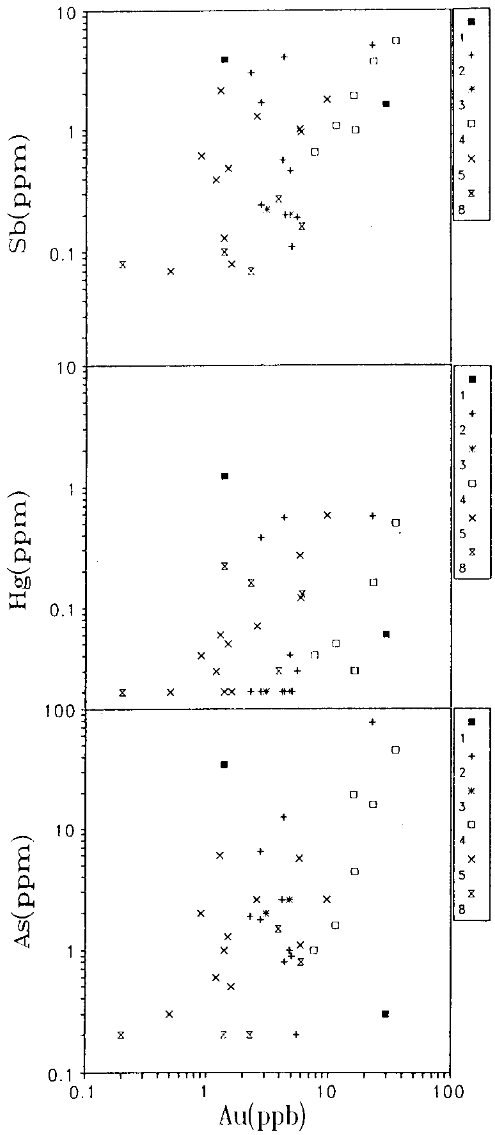

Fig. 2. Scatter diagrams of Au and As, Au and Hg, Au and Sb of silicified tuff in the studied area.

high aluminous dickites and tuffs of 91 m under sea level in the Haenam deposit. Gold content in the

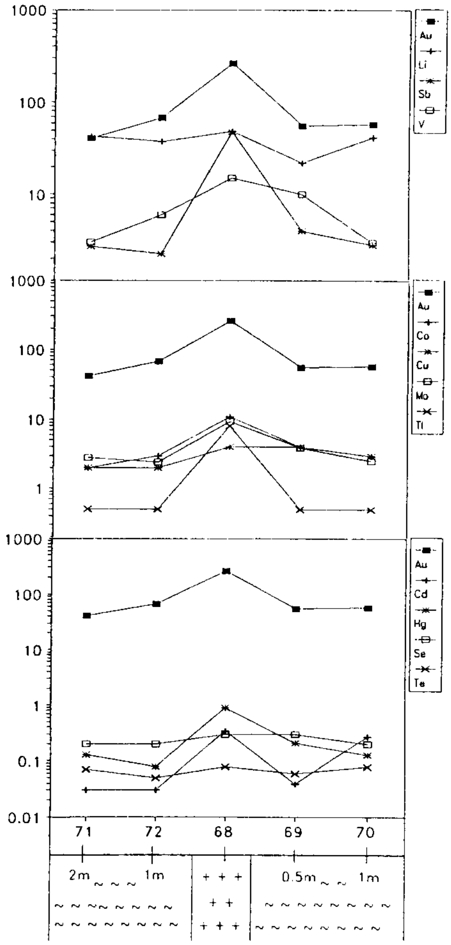

Fig. 3. Gold content variations with trace elements in the alunite vein of the Seongsan mine. Cross; alunite vein, Symbols around alunite vein; altered rhyolite, Numbers; sampling point and sampling distance.

pyrites is the highest in the alunite vein from the Seongsan deposit, whereas gold contents of others are less than 5 ppb. This result of gold content suggests that all pyrites are not associated with gold. Gold content of alunites shows the highest from the Seongsan deposit, medium from the Ogmaesan deposit and the lowest from the Dogcheon deposit located at the eastwestern part of the studied area. Gold contents in minerals and wall rocks from the deposits generally have a tendency to show higher in the Seongsan deposits than in the Ogmaesan deposit.

Arsenic, Hg and Sb contents of the silicified tuffs tend to show positive correlations with Au (Fig. 2). This result is in accord with that of samples from silicified zone (Yoon, 1993). It is well known that elements such as As, Bi, Hg, Sb and Te are important to explore geochemically gold deposits, because they have a good geochemical affinity with gold (Boyle and Jonanson, 1973; Boyle, 1974; Rose *et al.*, 1979). Gold content of the alunite vein in the Seongsan mine shows very interesting variations. The mineral assemblage of the alunite vein is alunite-quartz-pyrite. Contents of gold and some trace elements of the vein are shown in Table 2. Contents of trace elements such as Cd, Co, Cu, Hg, Li, Mo, Sb, Se, Te and Tl have a tendency to increase with gold contents (Fig. 3). Especially, variation trends of Cd, Hg, Mo and Sb are similar to those of gold content (Fig. 3). The host rock of alunite vein is rhyolite. The gold contents of the altered rhyolite distributed around the vein are high as 41 ppb to 67.9 ppb, whereas those of the fresh rhyolite distributed in the studied area are low as 0.6 ppb to 1.7 ppb. This fact also implies that gold might be enriched by hydrothermal solution which formed the alunite vein.

CONCLUSIONS

Major features about the variations of the gold content in minerals and rocks from the studied area can be summarized as follows:

1. Gold is enriched in the silicified zone and alunite vein in which mineral assemblage is alunite-quartz-pyrite, while gold is depleted in dickite and alteration zone with dickite.
2. Gold is concentrated and transported by hydrothermal solution ascending along the cracks like fault based on the facts that gold content is high in the fault or intersection of faults, regardless of minerals or rocks.
3. Gold contents are higher in the mineral and rock from the Seongsan deposit than those from other deposits in the studied area. Gold content is also higher in the alunite from the Seongsan deposits than in the alunite from the other deposits.
4. The pyrites in the studied area present in alunite vein, black high aluminous dickites and tuffs. The highest gold content is from alunite vein, while gold contents from other pyrites are less than 5 ppb.
5. Content of As, Hg and Sb in the silicified tuffs shows positive correlation with gold. Contents of trace elements such as Cd, Co, Cu, Hg, Li, Mo, Sb, Se, Te and Tl in the alunite vein have a tendency to increase with gold contents. Especially, variation trends of Cd, Hg, Mo and Sb are similar to those of gold content.
6. It is recommended that alunite vein and silicified zone at the conjunction of faults should be surveyed in detail and that pathfinder elements such

as As, Hg and Sb be analyzed for geological and geochemical exploration of gold in the studied area.

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REFERENCES

Boyle, R. W. and Jonasson, I. K. (1973) The Geochemistry of arsenic and its use as indicator element in geochemical prospecting. Jour. Geochem. Explor., v. 2, p. 251-296.

Boyle, R. W. (1974) Elemental associations in mineral deposits and indicator elements of interest in geochemical prospecting (revised). Geol. Surv. Canada paper, p. 74-75.

Hedenquist, J. W. (1987) Mineralization associated with volcanic-related hydrothermal systems in the Circum-Pacific basin; In Transactions of the Fourth Circum-Pacific Energy and Mineral Resources Conference. Singapore. Horn, M.K., Ed., Am. Assoc. Pet. Geol., p. 513-524.

Izawa, E. (1990) Hydrothermal alteration associated with Nansatsu-type gold mineralization. Syposium on high temperature acid fluids and associated alteration and mineralization. Geol. Survey of Japan, p. 39-44.

Kim, Y. H., Moon, H. S., Kim, J. H., You, J. H. and Kim, I. J. (1990) Hydrothermal alteration and mineralogy of alunite and kaolinite in the Ogmaesan deposit, Southwest Jeonnam., Jour. Korean Inst. Mining Geol., v. 23(3), p. 287-308 (in Korean with English abstract).

Kim, I. J. (1991) Geochemistry of hydrothermal alteration and clay deposits in the Haenam area, Southwestern Korea. D. S. Thesis of University of Tokyo.

Kim, I. J. (1992) Alteration zoning, Mineral assemblage and Geochemistry of the hydrothermal clay deposits related to Cretaceous felsic magmatism in the Haenam area, Southwest Korea. Jour. Korean Inst. Mining Geol., v. 25(4), p. 397-416.

Kim, I. J. and Kusakabe, M. (1993) Oxygen and hydrogen isotope studies of the hydrothermal clay deposits and surrounded rocks in the Haenam area, Southwestern part of the Korean peninsula. Jour. Korean Inst. Mining Geol., v. 26(1), p. 11-20.

Kim, J. B., Yoon, C. H., Kim, J. T., Park, J. B., Kang, S. W. and Kim, D. J. (1994) Petrochemistry of Mesozoic granites in Wolchulsan area. Econ. Environ, Geol., v. 27(4), p. 375-385.

Kwak, T. A. P. (1990) Geochemical and temperature controls on ore mineralization at the Emplor. v. 36, p. 297-337.

Lee, D. S. and Lee, H. Y. (1976), Geological and geochemical study on the rock sequences containing oily materials in southern coast area of Korea., Jour. Korean Inst. Min. Geol., v. 9, p. 45-74 (in Korean with English abstract).

Moon, H. S., Kim, Y. H., Kim, J. H. and You, J. H. (1990) K-Ar ages of alunite and sericite in altered rocks, and volcanic rocks around the Haenam area, southwest Korea. Jour. Korean Inst. Mining Geol., v. 23(2), p. 135-141 (in Korean with English abstract).

Rose, A. W., Hawkes, H. E. and Webb, J. S. (1979) Geochemistry in mineral exploration (2nd ed.). Academic press, London, 657p.

Rye, R. O. (1990) Acid-Sulfate alteration and vein alunite formation in volcanic terrains; Stable isotope systematics. Symposium on high temperature acid fluids and associated alteration and mineralization. Geol. Survey of Japan, p. 14.

Rytuba, J. J. and Miller, W. P. (1990) Geology and geochemistry of epithermal precious metel vein systems in the intraoceanic arcs of Palau and Yap, western Pacific. Jour. Geochem. Explor. v. 81, p. 732-738.

Thompson, J. F. H., Lessman, J. and Thompson, A. J. R. (1986) The Temora gold-silver deposit; A newly recognized style of high sulfur mineralization in the lower Paleozoic of Australia. Econ. Geol., v. 81, p. 732-738.

White, N. C. (1990), High sulfidation epithermal gold deposit; Characteristics and a model for thdir origin. Symposium on high temperature acid fluids and associated alteration and mineralization. Geological survey of Japan. p. 5-15.

Yoon, C. H. (1975) Study on the petroleum hydrocarbon bearing sedinentary rocks (Woo Hwang Ri, Hwangsan Myeon, Haenam, Chonnam). M. E. Thesis of Chonnam National University), 46.

You, H. S. and Yoon, C. H. (1977) A study on the petroleum hydrocarbon bearing shale in Haenam and Jindo. Tech. Review, Engineering Research Inst. Chonnam Naitonal University., v. 14, p. 67-84 (in Korean with English abstract).

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해남지역 성산 및 옥매산 점토광산에서의 금함량 변화

윤 정 환

요 약: 한국 남서부에 위치한 해남지역에는 산성마그마 활동에 수반된 acid-sulfate 점토광상들이 산출되고 있다. 연구지역의 지질은 응회암, 화강암질암, 석영반암, 유문암, 안산암 및 퇴적암으로 구성되어 있으며 화강암질암과 석영반암은 응회암과 퇴적암을 관입하며 광산주변의 유문암과 응회암은 열수변질을 받았다. 채취된 시료중 67개의 시료를 GFAAS와 ICP로 주성분 원소함량과 금을 비롯한 미량원소함량을 분석한 결과 금은 성산광산에서 산출되는 명반석맥과 규화작용을 심하게 받은 변질대에서 부화된 반면 dickite와 dickite가 함유된 암석이나 광석이 열수변질을 받은 경우에는 결핍된 경향을 보여주며, 특히 단층주변과 단층들이 교차하는 지점에서 금함량이 높은 경향을 나타낸다. 명반석-석영-황철석이 공생하는 명반석이나 명반석맥에서는 금함량이 높으나 황철석을 포함하는 응회암과 dickite에서는 일반적으로 금함량이 낮은 경향을 보여준다. 규화작용을 받은 응회암에서 금함량은 As, Hg 및 Hg와 정의 상관관계를 보여 주며 대부분의 시료에서 Cd, Hg 및 Sb함량변화는 금함량변화와 유사한 경향을 나타낸다. 따라서 이 연구지역에서 지질학적 및 지구화학적으로 금광상을 탐사하기 위해서는 단층이 교차하는 지점의 silicified zone 또는 황철석을 함유하는 명반석맥을 찾아서 As, Hg 및 Sb 등과 같은 지시원소를 분석하는 것이 중요할 것으로 판단된다.