Mineralization Ages of Some Epithermal Gold-Silver Vein-type Deposits in the Central Kitami Mining District of the Kitami Metallogenic Province, Hokkaido, Japan

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Abstract: The mineralization ages of some epithermal gold-silver vein-type deposits in the Kitami metallogenic province, Hokkaido, Japan have been studied based on the K-Ar dating on the vein adularia and quartz mixtures. The Kohnomai mineralization took place in Middle Miocene time (12.9±0.4 Ma). On the other hand, the gold-silver mineralization in the Iikutahara-Rubeshibe area occurred in Late Miocene to Early Pliocene time (Ryuo mine: 7.7±0.2 Ma; Shakinzawa mine: 7.4±0.2 Ma; Muka mine: 6.6±0.2 Ma; Saroma mine: 5.3±0.5 Ma).

Introduction

It is very important to reveal the mineralization ages in studying the ore genesis and in prospecting the ore deposits.

Recently, the times of some kuroko- and vein-type mineralizations in so-called "Green Tuff" region of southwestern Hokkaido have been discussed based on the radiometric ages (MITI, 1979; Marumo, 1985; Sugaki and Isobe, 1985; Marumo and Sawai, 1986; Maeda, 1988; Sawai and Itaya, 1988; Sawai and Ganzawa, 1988). According to their data, the kuroko mineralizations (Minamishiraoi and Tohya-Takarada mines) in the region took place in Middle Miocene time (14.0-13.6 Ma) and the vein mineralizations of Au-Ag-Cu-Pb-Zn (Hakuryu and Date mines) in Late Miocene to Early Pliocene time (6.5-5.2 Ma), Cu-Pb-Zn-Mn (Inakuraishi, Ohe and Toyoha) in Pliocene to Pleistocene time (4.9-0.5 Ma), and Au-Ag (Chitose and Kohryu) in Pliocene to Pleistocene time (4.7-1.0 Ma). While only one determination of the Sanru gold-silver mineralization (12.4 Ma) in the Kitami metallogenic province, Hokkaido has been reported by Sugaki and Isobe (1985) on the basis of a K-Ar age for vein adularia. In this paper the K-Ar dating for five vein adularia and quartz mixtures from five epithermal gold-silver vein-type deposits in the province was made to compare the ages with those mentioned above.

Geologic Setting

Geology in so-called "Central Kitami mining district" (Urashima, 1957, 1961) is made principally of the Cretaceous, Neogene, and Quaternary systems, and Neogene intrusive rocks.

The basement rocks of Cretaceous age are the Hidaka Super-group comprising chiefly sandstone and shale, intercalated with conglomerate, acidic tuff, green rocks, chert, and limestone (e.g., Nochi et al., 1967; Yahata et al., 1988) or the Yubetsu Group consisting mainly of sandstone and shale (e.g., Yamada et al., 1963; Kiminami et al., 1983).

According to Yahata et al. (1988), the Kohnomai Formation is marine sediments,
and is divided into the following two Members; the Lower and Upper ones. The Lower Member consists chiefly of shale with basal conglomerate and sandstone. The Upper Member is composed mainly of alternation of mudstone, sandstone, and tuff, intercalated with andesite lava, homogeneous hyaloclastite, and dacitic pumice tuff. The Mobetsu Formation unconformably covers the Hidaka Super-group and Kohnomai Formation, and is characterized by terrestrial rhyolitic and dacitic rocks. The Tomeoka Formation is sediments equivalent to or younger than the Mobetsu Formation, and consists chiefly of basaltic hyaloclastite and lava, intercalated with mudstone and sandstone. The Shanafuchi Formation unconformably overlies the older formations, and is characterized by lacustrine sediments and terrestrial volcanic rocks. The Formation is divided into following three Members; the Lower, Middle, and Upper ones. The Lower Member is made up mainly of conglomerate and sandstone, intercalated with mudstone. The Middle Member is composed principally of acidic pyroclastic rocks, intercalated with andesitic and basaltic pyroclastic rocks, including hyaloclastite. The Upper Member consists chiefly of dacitic pyroclastic rocks including welded tuff, basalt lava, and andesite lava.

The Yahagi (or Komatsuzawa) Formation unconformably covers the older formations, and is lacustrine sediments (YAMADA et al., 1963; SAWAMURA and HATA, 1965; SUZUKI, 1967). The Formation is composed mainly of conglomerate, sandstone, tuffaceous mudstone, tuff, and tuff breccia. The intrusive rocks consist chiefly of Miocene dikes of rhyolite, dacite, andesite, and basalt.

The Kitami metallogenic province located at northeastern Hokkaido (Fig. 1) is a Tertiary metallogenic province in Hokkaido, and is divided into seven sub-provinces: the Western Kitami, Daisetsu Basement, Spinal Kitami, Kitami-Tokachi, Central Kitami, Abashiri, and Shiretoko mining districts (URASHIMA, 1961). The province had produced gold, silver, copper, lead, zinc, and mercury etc., and especially is known as a gold field. The representative mineralizations in the province are the Itomuka mercury, Kohnomai gold-silver, and Kitami (Inaushi) copper-lead-zinc vein-type and Nemuro kuroko-type ones. Particularly the gold-silver deposits are the Chukoh, Tokusei, and Takinoue etc. in the Daisetsu Basement mining district, the Esashi, Utanobori (Hokkaido), Ohmu, Hokuryu, Ohmui, and Sanru etc. in the Western Kitami one, the Harutomi and Fujimi etc. in the Kitami-Tokachi one, the Akan, Taihoh, and Tohbeta (Nissho) etc. in the Shiretoko one, and the Kohnomai, Numanoue, Kamishokotsu, Yasoshi, Otowa, Yahagi, Ryuo, Shakinawa, Kitanooh, Showa, Ikutahara (Kyoie), Hokushin, Akebono, Saroma, Chitose, Taihoh (Kitami), Taihoku, Tenryu, Fusei, Tokoro, Rubeshibe, Muka, Kunihana, Onne, Hyakuhoh, Sohryu, and Jindai etc. in the Central Kitami one (e.g., TAKEUCHI, 1942; SAITO and WATANABE, 1956; URASHIMA, 1962; SAKOH et al., 1964; MITI, 1969).

Fig. 1 Location map of the studied epithermal gold-silver vein-type deposits in the Kitami metallogenic province, Hokkaido, Japan.

The gold-silver deposits in the Central Kitami mining district belong to an epithermal quartz-adularia fissure-filling vein-type and are divided into the following two types: the Kohnomai-, and Showa-Kitanooh-type ones (WATANABE, 1940; FUKUTOMI, 1949). The former includes the Kohnomai and Otowa mines.
etc. and occurs mainly in the Kohnomai and Mobetsu Formations and dikes. It is quartz-adularia veins and is closely related to the andesitic activities (e.g., Fukutomi, 1949; Kondoh et al., 1967). The veins are 1.0–30.0 m wide and are characterized by a banded structure. The latter includes most of the veins in the Ikutahara-Rubeshibe area and occurs in the Yubetsu Group at the Saroma, Chitose, and Taihoh mines, but at the other mines in the Shakinzawa (or Shanafuchi) Formation and rhyolite dikes. It consists of quartz-adularia veins, clayey veins, and residual (so-called “Doshakoho”) deposits (Watanabe, 1940; Yamada et al., 1964). The veins are made up of numerous veinlets and are as much as 1.0 m wide, but they pinch and swell irregularly. The related rock is rhyolite (e.g., Takahashi and Matsuda, 1936).

Description of Studied Deposits and Samples

Brief descriptions of studied deposits and samples are as follows.

Kohnomai mine: The veins occur mainly in the Kohnomai and Mobetsu Formations, andesite, dacite and rhyolite dikes, and the Hidaka Super-group. According to Kondoh et al. (1967), the fractures in the northern part of the mine area are divided into N30°-35°E and N80°E systems. The former is shearing fractures and hosts the No. 8 and Toyoshima veins etc. The latter is the fractures of second order standing at 45° with the master shearing ones and hosts the No. 5 and Sannoh veins etc. The latter is the fractures of second order standing at 45° with the master shearing ones and hosts the No. 5 and Sannoh veins etc. The radial fractures in the central and southern parts were caused by doming up and host the Sumiyoshi, Motoyama, and Fujishima veins etc. The Motoyama No. 2 veins strike N70°W and dip 55°SW. Their strike- and dip-elongations are more than 700 and 340 m, respectively, and their average width is 5.0 m. The ore usually has a banded structure with so-called “Ginguro” bands in quartz and/or adularia. A dated sample consists of large amounts of quartz and small amounts of adularia and calcite in the “Ginguro” ore. It was collected from 100 m level of the Motoyama No. 2 veins by Mr. I. Abe of the Sumitomo Metal Mining Co., Ltd.

Ryuo mine: The veins are in adularia-bearing strongly or intermediately silicified rhyolite dike, and clastic and pyroclastic rocks of the Shakinzawa Formation. The main veins, Jinja and Shoiei ones, are parallel to each other, strike N60°E and dip 60°SE, and their widths range from 0.7 to 1.0 m (Takahashi and Matsuda, 1936; Fukutomi, 1949; Bamba and Saito, 1959). They have brecciated and banded structures.

The analyzed sample is a milky banded vein consisting of large amounts of adularia and quartz, and small amounts of pyrite. The sample is a rolling stone.

Shakinzawa mine: The veinlets occur in clastic and pyroclastic rocks of the Shakinzawa Formation and rhyolite dikes, strike N80°E, and dip 70°SE.

The dated sample is adularia crystals separated from a drusy adularia-quartz veinlet, about 5 cm in width, occurring in adularia-bearing intensively silicified brecciated mudstone. The veinlet contains a small amount of pyrite, marcasite, and chalcopyrite. The sample was collected from an outcrop in the middle reach of the Shakinzawagawa River.

Saroma mine: The veins are in strongly silicified shale and sandstone of the Yubetsu Group. They are parallel to each other, strike N50°-70°E, dip 70°-80°SE, and are as much as 1.0 m wide. The ore is a banded, milky quartz with the “Ginguro” bands.

The analyzed sample is a vein quartz and adularia mixture having a fine-grained pyrite-sphalerite veinlets, less than 7 mm in width, that are called so-called “Pseudo-ginguro” band. The sample is a rolling stone.

Muka mine: The veins occur mainly in rhyolite dike and pyroclastic rock of the Shakinzawa Formation. The principal veins, Tsudoh and Motoyama ones, are parallel to each other, strike N35°-45°E, dip 90°, and are 0.2–1.2 m wide. They extend for about 100 m along the strike. Numerous veinlets striking N10°E and dipping 60°-80°W accompany the main veins.

The dated sample is a quartz-adularia vein occurring in adularia-bearing intermediately silicified white rhyolite. It was taken from an
outcrop. The vein strikes N55°E, dips 80°SE, and is composed chiefly of fine-grained gray quartz and drusy milky quartz-adularia. The K–Ar age determination on the adularia and quartz mixtures was carried out in Central Research Institute, Mitsubishi Metal Co. The constants used in the age calculation are \( \lambda_0 = 4.962 \times 10^{-10}/\text{year} \), \( \lambda_c = 0.581 \times 10^{-10}/\text{year} \) and \( \frac{^{40}\text{K}}{^{40}\text{Ar}} = 0.01167 \text{atom\%} \) (STEIGER and JÄGER, 1977). The error was calculated after the method by COX and DALRYMPL (1967) or NAGAO et al. (1984). The results are given in Table 1.

### Discussion

The K–Ar ages for the vein adularia and quartz mixtures from the gold-silver deposits at the Kohnomai, Ryuo, Shakinzawa, Muka, and Saroma mines in the Central Kitami mining district of the Kitami metallogenic province are 12.9±0.4, 7.7±0.2, 7.4±0.2, 6.6±0.2, and 5.3±0.5 Ma, respectively. It is therefore suggested that most of the gold-silver mineralizations in the Ikutahara-Rubeshibe area of the Central Kitami mining district took place in Late Miocene to Early Pliocene time which is distinctly later than the Middle Miocene Kohnomai mineralization in the Monbetsu area of the same district and the Middle Miocene Sanru one (a K–Ar age of 12.4±0.6 Ma was obtained for vein adularia from the Juhji vein: SUGAKI and ISOBE, 1985) in the Western Kitami mining district of the Kitami metallogenic province. Besides, the Akan gold-silver mineralization age (a K–Ar age of 3.2±1.2 Ma for vein adularia and quartz from the No. 1 vein: MAEDA, 1989) in the Shiretoko mining district of the province was Pliocene time as well as the Chitose one (a K–Ar age of 3.6±0.3 Ma for sericite-bearing clay juxtaposed with the Daikoku No. 3 vein: MARUMO and SAWA, 1986) in southwestern Hokkaido.

### Acknowledgements

The author is much indebted to Mr. I. ABE of the Sumitomo Metal Mining Co., Ltd. for his kind preparation of a sample from the Kohnomai mine. Thanks are also due to Mr. H. HIRATA of the Kitami Institute of Technology for his help during the laboratory work.

### References


北海道北見中部鉱床区の浅熱水金銀鉱脈鉱床の鉱化期

前田 寛之

要旨：北海道北見中部鉱床区の浅熱水金銀鉱脈鉱床の脈
氷長石・石英混合物のK-Ar年代から鉱化作用の時期を
検討した。この鉱床区の鉱脈鉱化作用は中期中世（鴨
之舞鉱床：12.9±0.4 Ma）と後期中世〜前期鮮新世（隆
尾鉱床：7.7±0.2 Ma；砂金沢鉱床：7.4±0.2 Ma；武華
鉱床：6.6±0.2 Ma；佐呂間鉱床：5.3±0.5 Ma）に行わ
れた。

日本語表記
Abashiri 網走, Akan 阿寒, Akebono 岩井, Chitose 千歳,
Chukoh 中角, Daikoku 大黒, Daisetsu 大雪, Date
伊達, Esashi 東香, Fujimi 富士見, Fujishima 藤島,
Fusci 富盛, Hakuryu 白竜, Harutomi 春富, Hidaka 日高,
Hokuryu 北竜, Hokushin 北信, Hyakuoh 百宝,
Ikutahara 生田原, Inakuraiishi 稲倉石, Inaushi 伊奈牛,
Itonuka イトムカ, Jindai 神代, Jinja 神社, Juhji 十字,
Kamishokotsu 上沼戸, Kitami 北見, Kitanooh 北ノ王,
Kohnomai 鴨之舞, Kohryu 光竜, Komatsuzawa 小松沢,
Kunihana 亀華, Kyoei 共栄, Minamishirao 南白老,
Mobetsu 蒼別, Monbetsu 蒼別, Motoyama 元山,
Muka 武華, Nemuro 根室, Nisho 日置, Numanoue 沼ノ上,
Ohe 大江, Ohmu 雄武, Ohmui 雄武威, Onne 奥根,
Otowa 音羽, Pifue-Honpi 美富本郷, Rubeshibe 留
辺帯, Ryuuo 隆尾, Sannoh 三王, Sanru 景朝, Saroma
佐呂間, Shakinzawa 砂金沢, Shanafuchi 社名淵,
Shiretoko 知床, Shoei 昭栄, Showa 昭和, Sohryu 多竜,
Sumiyoshi 畑吉, Taihoh 太平, Taihoku 塚北,
Takinoue 湯ノ上, Tenryu 天竜, Tohetsu 当別,
Tohya-Takarada 洞爺財田, Tokachi 十勝, Tokoro 常呂,
Tokusei 徳星, Tomeoka 留岡, Toyoha 豊羽, Toyo-
shima 豊島, Tsudoh 湯沢, Utanobori 歌登, Yahagi 矢
別, Yasoshi 八十士, Yubetsu 湯別。