A Study on the Antimony and Gold Contents in Antimony Ores from Kayin State and Kayah State

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Abstract

Antimony ore (Stibnite, Sb_2S_3) samples were collected from Khotkwa Mine, Kyarinn-seikkyi Township, Kayin State and Hanphyu Mine, Loikaw Township, Kayah State. The representative ore samples were collected from four different sites in each sampling area. The specific gravity of the collected Antimony ore samples were determined by Pycnometer method. Antimony ore samples from Kayin State and Kayah State were characterized and analyzed by XRD, AAS and conventional chemical analysis methods. It was observed that the antimony content in Antimony ore sample from Khotkwa Mine, Kyarinnseikkyi Township, Kayin State was 19.49%. The antimony content in Antimony ore sample from Hanphyu Mine, Loikaw Township, Kayah State was 21.87%. Antimony ores also consist of trace amount of gold. It was observed that the gold contents were 0.22 ppm (Kayin State) and 0.92 ppm (Kayah State) respectively.

Keywords: Antimony, Gold, Antimony ores, Kayin State, Kayah State

Introduction

Antimony is in the nitrogen group (group 15) and has an electronegativity of 2.05. As expected from periodic trends, it is more electronegative than tin or bismuth, and less electronegative than tellurium or arsenic. Antimony is stable in air at room temperature, but reacts with oxygen if heated to form antimony trioxide, Sb_2O_3 (Greenwood, 1997).

Antimony is a silvery, lustrous gray metal that has a Mohs scale hardness of 3. Thus pure antimony is too soft to make hard objects. Coins made of antimony were issued in China's Guizhou province in 1931, but because of their rapid wear, their mining was discontinued. Antimony is resistant to attack by acids (Gonser, 1982).

Four allotropes of antimony are known, a stable metallic form and three metastable forms (explosive, black and yellow). Metallic antimony is a brittle, silver-white shiny metal. When slowly cooled, molten antimony crystallizes in a trigonal cell, isomorphic with the gray allotrope of arsenic. A rare explosive form of antimony can be formed from the electrolysis of antimony trichloride. When scratched with a sharp implement, an exothermic reaction occurs and white fumes are given off as metallic antimony is formed. When rubbed with a pestle in a mortar, a strong detonation occurs. Black antimony is formed upon rapid cooling of vapor derived from metallic antimony. It has the same crystal structure as red phosphorus and black arsenic, it oxidizes in the air and may ignite spontaneously. At 100˚C, it gradually transforms into the stable form. The yellow allotrope of antimony is the most unstable. It has only been generated by oxidation of stibine (SbH_3) at - 90˚C. Above this temperature and in ambient light, this metastable allotrope transforms into the more stable black allotrope. The Antimony Ores were shown in Fig. (1).

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Fig. (1) Antimony Ores (Stibnite, Sb_2S_3)

Occurrence and mineralogy

The abundance of antimony in the Earth's crust is approximately 0.2 mg/kg. Antimony is a chalcopyrite, occurring with sulfur and the heavy metals copper, lead and silver. More than 100 minerals of antimony are found in nature. Industrially, stibnite (Sb_2S_3) is the predominant ore of interest and importance. Stibnite deposits are usually found in quartz veins. The deposits frequently contain minor amounts of gold, silver, and mercury sulfides (Clegg, 1974).

Antimony has been produced from ores in over 15 countries. Annual world mine production and reserves are estimated to about 1.8 million metric tons. As China, the leading producer accounts for about 90% of the world's mine production and the vast majority of the reserve base. Other minor producing countries are Bolivia, the Republic of South Africa, Tajikistan, Russia, Mexico, Peru, Yugoslavia and Algeria.

Antimony Ore in Myanmar

Over 31 occurrences of stibnite and other Sb-bearing minerals are known in Myanmar. All are located within the Eastern Highland Belt. The northernmost known antimony occurrence is Bawdwin (latitude: 23˚ 07ˈN where the antimony is contained in boulangerite, bournonite, pyrargyrite and tetrahedrite.) The southernmost occurrence is Thabyu (latitude: 15˚ 31ˈ N). Among the known antimony ore occurrences in Myanmar, 18 are found in the upper Palaeozoic Plateau Limestones, seven in the upper Palaeozoic clastics of the Mergui series and its equivalents, one in the Jurassic Kalaw Red Beds and one (Bawdwin) in the Lower Paleozoic Volcanics. At least two are known to be associated with wolfram ores. According to their distribution, these occurrences do not seem to be only associated with granitic intrusion but rather with sediments deposited within a certain and very limited time span (Upper Palaeozoic) in both carbonate and clastic facies (ESCAP, 1996). The distribution of antimony deposits in Myanmar was shown in Fig. (2).

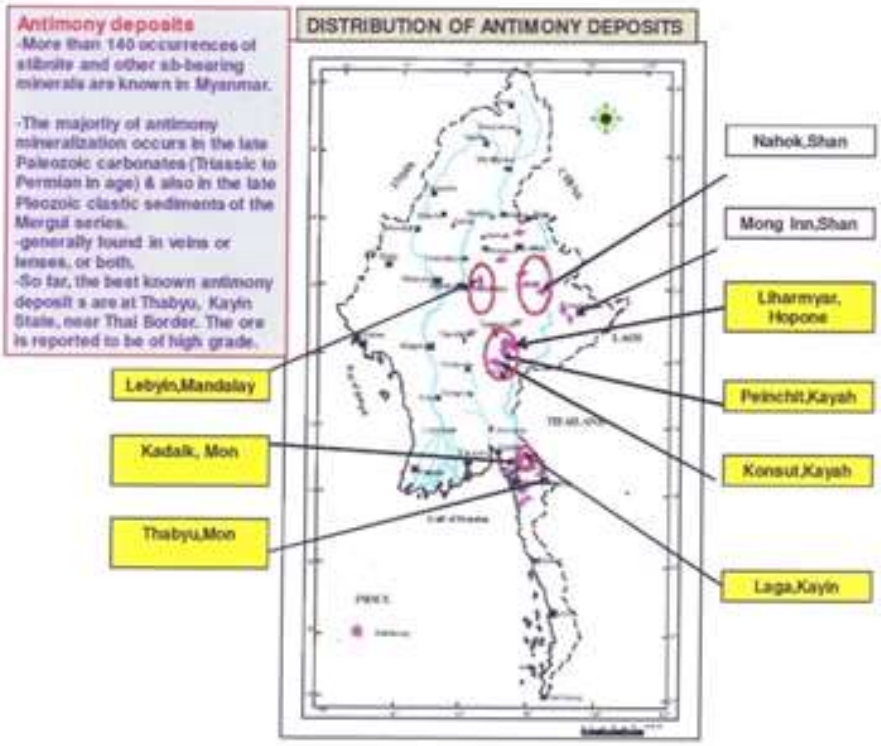

Fig. (2) Distribution of Antimony deposits in Myanmar

Materials and Methods

Sample collection

Antimony ore samples were collected from Khotkwa area, Kyarinn-seikkyi Township, Kayin State and Hanphyu area, Loikaw Township, Kayah State. The representative antimony ore samples were collected from four different sites in each sampling area.

The collected samples were ground and sieved with a 100 mesh sieve. The representative samples were taken to determine the some physicochemical analysis.

Determination of antimony contents in antimony ores

Antimony ore powder sample (0.2 g) was added in 10 mL of concentrated sulphuric acid. The solution was heated to dryness. The solid mass was cooled. Then 100 mL of deionized water and 15 mL of hydrochloric acid were added to the solid mass. The mixture solution was boiled for 5 minutes. Then 100 mL of distilled water was added. The solution was cooled. The solution was titrated with 0.1 N potassium permanganate solution.

Determination of gold contents in antimony ores

The sample (25 g) was placed into the 400 mL conical flask (or) beaker. Aqua regia (100 mL) was added to the conical flask. The mixture solution was stirred and was covered with a watch glass. The mixture solution was stand for overnight. The mixture solution was heated for $1^1/_2$ hour just at boiling point. The mixture solution was cooled. The final volume should be about 60 mL. The mixture solution was filtered and the residue was discarded. The filtrate was transferred to a 100 mL volumetric flask and was made up to the mark with

distilled water. The filtrate was stand for overnight. Then 20 mL of aliquot was taken into an extraction tube. The remaining volume was made up to 60 mL with aqua regia. Sorenson salt solution (18 mL) was added to the solution. Then 5mL of 1% Aliquot (336) in diisobutyl ketone was added. The mixture solution was extracted by shaking for 2 minutes. The phases was allowed to separate. The gold content in the disobutyl ketone was measured by Atomic Absorption Spectrophotometer.

Results and Discussion

Antimony ore samples were collected from Khotkwa area, Kyarinn-seikkyi Township, Kayin State and Hanphyu area, Loikaw Township, Kayah State. There are four sampling sites in each mine in Kayin State and Kayah State. The sampling site and location map of Khotkwa area, Kyarinnseikkyi Township, Kayin State are shown in Figs. (3) and (4). The sampling site and location map of Hanphyu area, Loikaw Township, Kayah State are shown in Figs. (5) and (6).

The collected antimony ore samples are shown in Figs. (7) and (8). The specific gravities of antimony ore samples were determined. The specific gravities of antimony ore samples were presented in Table (1). It was characterized by XRD technique and was analyzed by AAS method. The XRD diffractograms of antimony ore samples were presented in Figs. (9) and (10). The contents of antimony and gold in the antimony ore samples were presented in Table (2), (3), (4) and (5).

Fig. (3) Khotkwa area, Kyarinnseikkyi Township, Kayin State

Fig. (4) Location map of Khotkwa area, Kyarinnseikkyi Township, Kayin State, Kayin State

Fig. (5) Hanphyu area, Loikaw Township, Kayah State

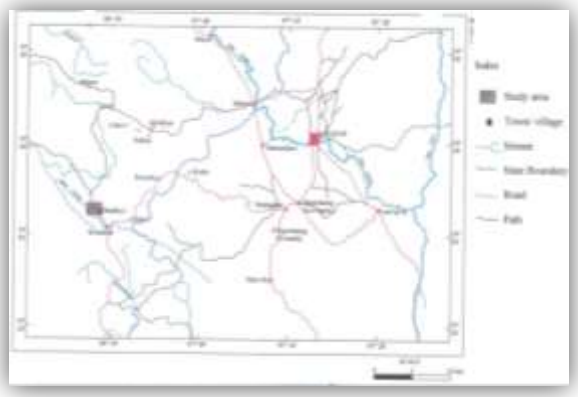

Fig. (6) Location map of Hanphyu area, Loikaw Township, Kayah State

Fig. (7) Antimony ore sample from Khotkwa area, Kyainseikkyi Township, Kayin State

Fig. (8) Antimony ore sample from Hanphyu area, Loikaw Township, Kayah State

Table (1) Specific Gravity of Antimony Ore Samples

No	Sample	Specific Gravity
1.	Sample 1	2.60
2.	Sample 2	2.45

Sample (1) = Sample from Khotkwa area, Kyarinnseikkyi Township, Kayin State

Sample (2) = Sample from Hanphyu area, Loikaw Township, Kayah State

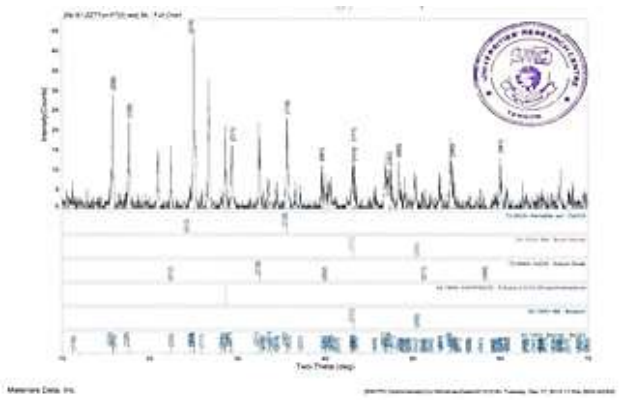

Fig. (9) XRD diffractogram of antimony ore sample from Kayin State

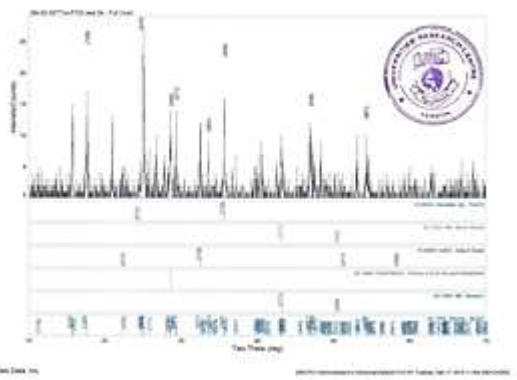

Fig. (10) XRD diffractogram of antimony ore sample from Kayah State

Antimony Contents of Antimony Ores

The antimony contents of Antimony ore from four different sampling sites in Kayin State were shown in Table (2). The average content of antimony was 19.49%. The antimony contents of Antimony ore from four different sampling sites in Kayah State were shown in Table (3). The average content of antimony was 21.87%. The antimony content of Antimony ore sample from Kayah State is higher than that of Antimony ore sample from Kayin State.

Table (2) Antimony Content of Antimony Ore Samples from Kyarinnseikkyi Township, Kayin State

No.	Sample	Sb Content (%)
1.	Sample 1	24.16
2.	Sample 2	39.65
3.	Sample 3	10.86
4.	Sample 4	3.29
	Average	19.49

Table (3) Antimony Content of Antimony Ore Samples from Loikaw Township, Kayah State

No.	Sample	Sb Content (%)
1.	Sample 1	5.00
2.	Sample 2	41.11
3.	Sample 3	30.50
4.	Sample 4	10.86
	Average	21.87

Gold Contents of Antimony Ores

The gold contents of antimony ore from four different sampling sites in Kayin State were shown in Table (4). The average content of gold was 0.22 ppm. The gold contents of antimony ore from four different smapling sites in Kayah State were shown in Table (5). The average content of gold was 0.92 ppm. The gold content of antimony ore sample from Kayah State is higher than that of antimony ore sample from Kayin State.

Table (4) Gold Content of Antimony Ore Samples from Kyarinnseikkyi Township, Kayin State by AAS

No.	Sample	Au Content (ppm)
1.	Sample 1	0.72
2.	Sample 2	0.03
3.	Sample 3	0.02
4.	Sample 4	0.10
	Average	0.22

Table (5) Gold Content of Antimony Ore Samples from Loikaw Township, Kayah State by AAS

No.	Sample	Au Content (ppm)
1.	Sample 1	0.58
2.	Sample 2	2.06
3.	Sample 3	0.30
4.	Sample 4	0.75
	Average	0.92

Conclusion

The antimony ores from Kyarinnseikkyi Township, Kayin State and Loikaw Township, Kayah State were characterized and analyzed by modern instrumental techniques and conventional chemical methods. The specific gravity of antimoy ore samples from Kayin State and Kayah State were found to be 2.60 and 2.45. From the XRD analysis of antimony ores, it was found that the fine resolution diffraction peaks confirmed that it contained the antimony sulphide (Sb_2S_3) and hematite, boron nitride and indium oxide. From chemical analysis method, it was found that the antimony contents of antimony ores from Kayin State and Kayah State were 19.49% and 21.87% respectively. From AAS determination of antimony ores, the gold contents of antimony ores from Kayin State and Kayah State were 0.22 ppm and 0.92 ppm respectively. The antimony ore sample from Kayah State contains a little higher content of antimony and gold than the antimony ore sample from Kayin State. The contents of antimony and gold from the antimony ore sample of Khotkwa area, Kyarinnseikkyi Township, Kayin State is not appreciably different from the antimony ore sample of Hanphyu area, Loikaw Township, Kayah State.

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