

PART III CONCLUSIONS

CHAPTER 1 CONCLUSIONS

Initially, the existence of a promising ore deposit was expected due to the 1976 Kyrghyz survey estimated potential ore reserves (C2+P1 ore reserves) of 33 tons Au with an average grade of 3.85 g/t Au in the central and the northern mineralization zones in the Kichi-Sandyk district. However, it was revealed that the extension of the ore body is very limited both laterally and vertically, and the ore gold grade suddenly decreases underground. Therefore the existence of a promising ore deposit is hardly expected in both mineralization zones.

In the Turpac-Tushty district, the result of the survey confirms an existence of high-grade ores at the Turpac-Tushty and the Ak-Kamou ore manifestations and suggests a possibility that the high-grade ore bodies, even though of a small scale, exist in both the manifestations.

The other hand, possible ore reserve (P1) of 695 thousand tons and gold quantity of 2.9 tons (average Au-grade: 4.22g/t) were estimated by the Kyrghyz side. But the results of the survey obtain an ore reserves of only 0.7 tons of gold (5.0 g/t Au).

1-1 The Kichi-Sandyk District

1-1-1 Characteristics of geological structure and mineralization

1) Geology

The geology of the Kichi-Sandyk district mainly consists of crystalline limestone of Late Cambrian to Early Carboniferous (Visean) age and Permian granodiorite porphyry (Chalmansay complex) intruding into the limestone. Conglomerate of Miocene covers all of the above rocks.

2) Geological structure

The limestone is intruded by the granodiorite porphyry. The contact plane between the limestone and granodiorite porphyry gently dips north or west and layered skarns often occur near the contact.

Conglomerates of Miocene are tectonically overlain by the granodiorite porphyry and limestone with a thrust fault that gently dips SW in the eastern part of the district. Topographic features indicate the presence of parallel faults trending NW-SE.

3) Mineralization

(1) Types of mineralization

Two types of mineralization described below are recognized in the survey district.

① Endoskarn: A number of fissures and joints striking NW-SE and steeply dipping SW were formed within the granodiorite porphyry. Along these fractures near the boundary of limestone, vein-like skarns containing copper and gold, closely associated with calcite-quartz veinlets were often formed. These endoskarns occur in the central mineralization zone and below the layered skarns in the northern mineralization zone.

② Exoskarns: Layered skarns were formed in limestone at the contact with intrusives. This type of skarn occurs in the northern mineralization zone. In addition, pale green or pale brown limestone containing minor skarn minerals such as wollastonite, (weakly skarnized limestone) is widely distributed in the survey district, although they are barren.

(2) Minerals

Garnet, clinopyroxene and wollastonite are the main skarn minerals, which are accompanied with minor amounts of prehnite. Chrysocolla, malachite and minor amounts of chalcopyrite, bornite, chalcocite, covellite and electrum are identified as ore minerals. Also iron minerals of goethite, hematite and minor amount of pyrite are observed.

(3) Size of ore body

Width of individual vein-like skarns is on the order of 10-40 cm, and in the aggregate, they form several copper gold ore bodies with a width of a few meters to a maximum of 25 m. Deep ore bodies have a width on the order of 10-40 m. Ore bodies appear to be stockwork type as a whole, trending NW-SE, parallel to the major fracture system. The extent of the central mineralization zone as the aggregate of the above described ore bodies is presumed to be 300 m by 300 m. The downward extension of the mineralization zone is inferred to be on the order of 10-20 m and a maximum of 30 m. Mineralized part of 1.29 g/t Au was detected in the 7.0 m drill core from 90m depth of MJKK-2, although it is not expected to extend to the surface.

Outcrop of the layered skarns extends intermittently for 2 km in the NE-SW direction along the contact of limestone and granodiorite porphyry. The layered skarns are presumed to extend to a considerable depth and their width is on the order of 10-40 m.

(4) Ore grade

In the northern mineralization zone, the highest assay results in the survey are detected as 0.62 g/t Au in sample K904 of drill hole MJKK-9, and 0.34% Cu in sample K032 of drill hole MJKK-10. Assay result was generally low grade.

On the surface in the central mineralization zone, three ore bodies total 4,944 m², 1.94 g/t Au on average were calculated. However these ore bodies is inferred not to

continue to a sufficient depth.

(5) Model of mineralization

From the above-described facts, the following model of mineralization of this district is proposed.

- ① As a result of intrusion of the granodiorite porphyry into the limestone, the layered skarns of 5-40 m thick were formed in the limestone along the contact plane. On the other hand, the vein-like skarns were formed along the fractures of the NW-SE system in the granodiorite porphyry, mostly within the distance of 10-20 m from the contact plane. At the same time, wollastonite was formed widely in the limestone.
- ② Ore solution passed along the fractures of the NW-SE system and deposited copper and gold ore in the pre-existing skarns.
- ③ The Kichi-Sandyk district was then tectonically deformed and divided into small blocks by thrust faults, striking N-S or NW-SE and dipping gently.
- ④ In the central mineralization zone, the vein-like skarns were exposed on the surface due to intense erosion of limestone which was laying on the intrusives having a gently dipping boundary. Reconcentration of copper and gold by meteoric water led to the formation of a secondary enrichment zone characterized by green copper minerals in oxidized zones at shallow depths.

1-1-2 Potential for ore deposits

Taking the three years survey results into consideration, potential for ore deposit in the central and northern mineralization zones in the Kichi-Sandyk district is as follows.

1) Central mineralization zone

- On the surface, three ore bodies of total 4,944 m², 1.94 g/t Au on average were calculated, adopting a cut-off grade of 1 g/t Au.
- As a result, the following probable ore reserves (C1 or C2) are calculated.

$$\begin{aligned} \text{(Ore reserves) Area } 4,944 \text{ m}^2 \times \text{Depth } 30 \text{ m} \times \text{Specific gravity } 2.6 \\ = 385,630 \text{ t} \end{aligned}$$

$$\text{(Gold content) Ore reserves } 385,630 \text{ t} \times \text{Grade } 1.94 \text{ g/t} = 748 \text{ kg}$$

2) Northern mineralization zone

- The layered skarns are distributed near the contact of the granodiorite porphyry and limestone. The vein-like skarns same as that of the central mineralization zone are also distributed in the granodiorite porphyry under the contact.
- In layered skarns in the trenches on the surface, 1.33 g/t Au in 16.2 m and 1.10 g/t Au in 9.8 m were detected.

- The existence of copper-gold bearing layered skarns is expected in the area of 1.5 km by 0.7 km.
- Drilling survey revealed that the ore grade of the downward extension of these ore bodies were very low, 0.25 g/t Au (9K044) was the highest and most of the assay were reported as less than 0.1 g/t Au in layered skarns. In vein-like skarns, two samples of 36.77 g/t Au (8K510) and 0.62 g/t Au (9K904) were detected, but other mineralized parts were low grade less than about 1 g/t Au.
- According to the results of the drilling survey, the ore grade of the northern mineralization zone is inferred as lower than 1 g/t Au. Although ore reserves can not be calculated, there is the possibility of the existence of high-grade ore bodies because the previous exploration was done in a very limited area of the vast mineralization area.

3) Discussion on potential ore reserves in 1976 study

- Initially, the existence of a promising ore deposit was expected due to the 1976 Kyrgyz survey estimated potential ore reserves (C2+P1 ore reserves) of 33 tons Au with an average grade of 3.85 g/t Au in the central and the northern mineralization zones in the Kichi-Sandyk district.
- However, it was revealed that the extension of the ore body is very limited both laterally and vertically, and the ore gold grade suddenly decreases underground.
- Therefore the existence of a promising ore deposit is hardly expected in both mineralization zones.

1-2 The Turpac-Tushty district

1-2-1 Characteristics of geological structure and mineralization

1) Geology

The Carboniferous limestone and the Carboniferous to Permian intrusive rocks such as granodiorite and diorite are widely distributed in the survey area. Tertiary sediments cover all these rocks.

2) Geological structure

The limestone occurs as a roof on the intrusive rocks.

A prominent fault of the NE-SW direction runs from the Turpac-Tushty ore manifestation to the Ak-Kamou ore manifestation resulting in considerable displacement of Tertiary sediments. The faults trending E-W and N-S are also recognized.

3) Mineralization

A number of ore manifestations are distributed in the survey area. Major ore manifestations are located in Turpac-Tushty, Ak-Kamou, Kok-Kaiky, Jety-Zinden, Perevalnoe and Bismutovoe.

Mineralization in the district is classified into the following three types.

- ① Skarn-type mineralization: These ore manifestations are widely distributed on the surface. However, its thickness is thin and metal grade is low, so it is hard to expect a promising mineral deposit.
- ② Vein-type mineralization: Vein-type ore manifestation is characterized by beresitized vein or hematite-quartz vein where high-grade ores over 10 g/t Au are often detected.
- ③ Placer-type mineralization: Placer gold deposits occur in Tertiary conglomerate and Quaternary sand and gravel beds. The latter is said to have been mined long ago.

1-2-2 Potential for ore reserves

As a result of this survey, it is concluded that small but high-grade vein-type ore deposits may be expected in both the Turpac-Tushty and the Ak-Kamou ore manifestations.

Kyrgyzstan side has previously estimated 695,000 t of possible ore reserves (P1) with 2.9 t Au (average grade: 4.22 g/t) for the Turpac-Tushty ore manifestation. In this survey, it is not sufficient up to now to make an estimation of the potential ore reserves. If assuming that the potential ore zone in the Turpac-Tushty ore manifestation has 2 km length, 2 m width, 100 m depth, 5 g/t Au and 30% rate of existence, 0.7 t of gold reserves may be estimated.

CHAPTER 2 RECOMMENDATIONS FOR THE FUTURE

Concerning the results of these three years' survey, we recommend the following for the future:

- (1) The ore body (vein-like skarn) is low grade (about 1 g/t Au) and small in the central mineralization zone of the Kichi-Sandyk district, so that the presence of a minable ore deposit is not expected. Accordingly, a further detailed survey in this zone is not necessary.
- (2) In the northern mineralization zone of the Kichi-Sandyk district, the gold grade of the layered skarn deposits was low, less than 1 g/t Au. Although the previous exploration for this vast area is very limited, the existence of an economical high-grade ore deposit is not expected. The ore grade is required to be at least 6-8 g/t Au in the case of mining in this district. Therefore, a further survey in this zone is not required.
- (3) In the Turpac-Tushty district, the existence of high-grade but small-scale ore bodies are possible in Turpac-Tushty and Ak-Kamou ore manifestations along the NE-SW faults. Further exploration aiming at high-grade ore bodies is recommended in this district and its surrounding area. Also clarifying of conditions on the existence of high-grade ore bodies is necessary. However, since the infrastructure of this mineralization zone is poor same as that of Kichi-Sandyk district, considerably higher ore grade is demanded for economically minable ore deposit.