



MINERALOGICAL CHARACTERISTICS OF CU-AG FROM KYAUKSE SABE TAUNG COPPER DEPOSIT, SHAN PLATEAU, MYANMAR

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Introduction

Myanmar has a great diversity of copper occurrences, including porphyry-style mineralization, VHMS, skarn and world class low- to high-sulphidation copper and/or gold systems with potential for new discoveries (Khin Zaw *et al.*, 2017). The study area, where the Kyaukse Sabe Taung copper deposit is located, lies in the western margin of the Shan Plateau and east of the Shan Boundary Fault. At Kyaukse Sabe Taung deposit, copper and silver mineralization is found in silicified limestone of Middle Ordovician age. Copper and silver have been mined mainly from tetrahedrite. There is a debate over origin of this deposit with propositions ranging from deformed Cu-MVT/Irish-type deposit, through SEDEX to structurally controlled orogenic base metal-gold deposit (Khin Zaw *et al.*, 2017).

Samples and methods

This study is based on several samples collected from the Kyaukse Sabe Taung copper deposit, Kyaukse District, Mandalay region, Myanmar. Polished thin sections of samples were investigated in both reflected and transmitted light microscopes. A FEI QUANTA 200 Field Emission Gun scanning electron microscope (SEM) equipped with the energy dispersive spectrometer (EDS) was used to document textures and to carry semi-quantitative analyses in order to identify selected minerals and the geochemical analyses were performed using JEOL Super Probe JXA-8230 electron microprobe (EMP) at the Laboratory of Critical Elements AGH-KGHM, AGH-University of Science and Technology, Krakow, Poland. The electron microprobe was operated in the wavelength-dispersion mode at an accelerating voltage of 20 kV, a probe current of 20 nA, focused beam with a diameter of 1 μm . Counting times of 20 s on peak and 10 s on both (+) and (-) backgrounds were used. For acanthite analytical conditions were 20 kV accelerating voltage, 10 nA probe current and 5 μm beam size. Counting times for Ag-amalgams and tetrahedrite were 10 s on peak and 5 s on both (+) and (-) backgrounds. Acanthite stars were identified during routine semi-quantitative analyses using the energy dispersive spectrometer (EDS) system related to the FEI electron microscope. The Ag_2S stars were evaporated during standard analyses. Sulfide bearing vein, including chalcopyrite and tetrahedrite were separated from crushed unweathered vein samples for sulfur isotope studies. The minerals concentrates were pulverized in an agate mortar. Sulfur isotope analyses were undertaken at the Faculty of Geology, GGEP/AGH/UST Krakow. The $\delta^{34}\text{S}$ values were calculated using calibration curves obtained using International Atomic Energy Agency's (IAEA) reference materials (IAEA-S-1 and -S-3). The precision of the data is $\pm 0.2\text{‰}$.

Results

1.1 Ore petrography

The main ore minerals in the deposit are chalcopyrite, bornite, chalcocite, tetrahedrite, covellite, native copper, malachite and azurite together with pyrite and tetrahedrite. Gangue minerals are quartz, dolomite and calcite. Ag-Hg rich silver minerals occur as free grains and coating of the quartz grain indicating that late state of mineralization.

1.2 Silver minerals

WDS analysis of the silver grains showed that the content of Ag ranges from 73.404 to 98.551 wt.% and Hg is ranging from 2.153 to 26.686 wt.%. One measured point shows that chemical composition very closely to Eugenite ($\text{Ag}_9\text{Hg}_2 - \text{Ag}_{11}\text{Hg}_2$) (Kucha, 1986). WDS mapping of the silver, copper and mercury show clear zonation. The central part of the analyzed grain contains elevated amount of Hg that is correlated with Ag



(Fig.1). Acanthite (Ag_2S) was found at the edge of the tetrahedrite crystals and developed during the young alteration stage. It was not possible to analyse it properly by microprobe (WDS) because decomposed during WDS measurements.

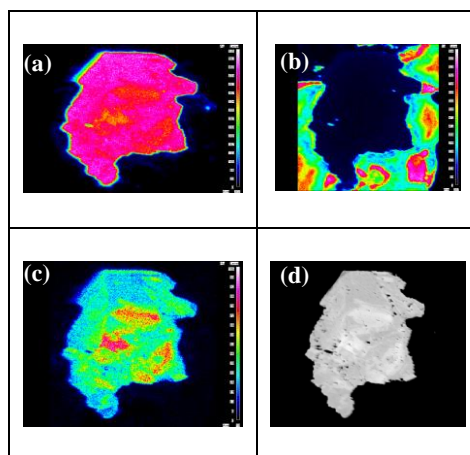


Figure 1. Electron microprobe mapping of trace-element distribution in a single euhedral crystal of silver from Kyaukse Sabe Taung copper deposit (a) Map of silver distribution (b) Map of copper distribution (c) Map of mercury distribution (d) Backscattered electron image of silver.

1.3 Bismuth sulphosalts

WDS measurement let to recognize some members of the bismuthite-aikinite series namely hammerite, fridrichite, fridrichite-aikinite and hammerite-fridrichite solid solution series. The chemical formula for bismuthite-aikinite series is based on the substitution $\text{Cu}+\text{Pb} \leftrightarrow \square + \text{Bi}$ (\square where is a vacant tetrahedral position) and the empirical formula $\text{Cu}_x\text{Pb}_y\text{Bi}_{8-1/2(x+y)}\text{S}_{12}$ on the basis of $(\text{Cu} + \text{Pb})/2 + \text{Bi} = 8$ atoms per formula unit, where x is approximately equal to y . The calculated n_{aikinite} values range from 66.45 – 88.61 and the Cu:Pb values are from 1.03 to 1.16. Several grains have intermediate compositions between hammerite and fridrichite.

1.4 Sulfur isotopes

The $\delta^{34}\text{S}$ values of chalcopyrite are +5.7 to +10.7 ‰ and those of tetrahedrite are +1.6 to +1.7 ‰. Sulfides in in Cobar base metal orogenic deposit in Australia has $\delta^{34}\text{S}$ values from 3.8 to 11.2‰ (Seccombe et al. 2017) and orogenic gold deposits typically have $\delta^{34}\text{S}$ ranging from 0 to +9‰.

Conclusions

Evidenced from the field study, textural investigations, mineralogical and chemical analyses, the following conclusions can be drawn from this investigation:

- (1) This report is the first minerals characterization of silver amalgam, acanthite and Bi-sulfosalts at this Kyaukse Sabe Taung copper deposit area. Ag-Hg rich silver mineral occurs as free grains and coating the quartz grain revealing that late state of mineralization.
- (2) Presence of bismuth sulphosalts is unlikely in the MVT-Irish type deposits therefore results support alternative genetic models (e.g. structurally controlled orogenic veins or carbonate replacement deposit).

References

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