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SECONDARY (Cu, Zn)-OXYMINERALS FROM THE MIEDZIANKA COPPER DEPOSIT IN RUDAWY JANOWICKIE, SUDETES MTS. PRELIMINARY REPORT

Polymetallic ore deposit in the Miedzianka vicinity is located in the northern edge of the Rudawy Janowickie (Sudetes Mts.). It was discovered and exploited in 12th century. Geological investigations were mainly published by Traube (1888), Teisseyre (1968), Zimnoch (1978) and Mochnacka (1982).

The complex ore deposit in the Rudawy Janowickie is known as a hydrothermal ore of chlorite copper system. It was formed as a result of the main Intra-Sudetic fault formation and the contact metamorphism of the Karkonosze granitic body. The surface of contact of granite with crystalline schists of Rudawy Janowickie is steep and extends from SW to NE (Zagożdżon, Zagożdżon, 2002).

The presence of secondary minerals formed in oxidation zone of Miedzianka ore deposit were mentioned even in early publications. But the characteristics of the minerals based mainly on macroscopic observations. Precise characteristics of secondary Cu-oxycompounds were collected by Lis and Sylwestrzak (1986), and published by Pieczka et al. (1988), Holeczek (1990) and Holeczek and Janeczek (1991). The following secondary minerals were described: chrysocolla, malachite, azurite, pyromorphite, pseudomalachite, wulfenite, chalcophyllite, erythrite, pharmacolite, mimetesite, olivenite, cornwallite, volborthite, torbernite and uranophane. Holeczek and Janeczek (1991) postulated, that many specimens collected from the Sudetes Mts. ore deposits and referred to as malachite may in fact be other species, e.g. pseudomalachite, tyrolite, olivenite, etc. It was confirmed by Gołębiowska (1999, 2000), who has found an abundance in a variety of Ca-Pb-Cu-Zn arsenates and vanadates in the deposit of dolostones in quarries at Rędziny.

The purpose of this paper is to characterise the identified (Cu, Zn)-oxyminerals in Miedzianka ore deposit as the investigations of specimens of malachite-like mineral have given us unexpected results.

On the basis of X-ray diffraction, IR absorption, scanning microscopy and chemical analyses (EDS, WDS) the Cu and Zn arsenates and phosphates were identified. They are macroscopically seen as massive or radial aggregates of acicular

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crystals up to two millimeters, of dark green to yellowish-green colour. The crystals are translucent.

X-ray data indicate the presence of the following mineral phases in investigated samples: cornwallite (hydrated, with Zn^{2+} substitution – JCPDS 12-0287 and anhydrous), philipsburgite (JCPDS 38-0384), and legrandite (JCPDS 42-1356). For some specimens all the d_{obs} values are consistent with intermediate data between pseudomalachite and anhydrous corwallite (JCPDS 36-0408 and 39-1357, respectively).

IR spectrum of specimens with intermediate XRD data was compared with the IR spectrum of pseudomalachite from Radzimowice (Holeczek, Janeczek, 1991). Almost all absorption bands are shifted to lower wave numbers, indicating higher percentage of As^{5+} in sample from Miedzianka. As As^{5+} substitutes approximately 16% of P^{5+} in pseudomalachite from Radzimowice Holeczek and Janeczek (1991) suggest the existence of limited solid solution between pseudomalachite and cornwallite.

EDS analyses have indicated the presence of oxygen, Cu, As and P. Si is present in traces. Additionally Zn and V were determined in four samples. WDS analyses were done on three samples and the formulas based on 10 oxygens show discrepancies between P^{5+} and As^{5+} content (tab.1). Therefore, P/(As+P) ratio differs in any example and ranges from 0.1 to 0.7.

Table 1. Percentage of anionic ions in samples from Miedzianka.

No of samples	P^{5+} [%]	As^{5+} [%]	V^{5+} [%]	Si^{4+} [%]
499	42	52	-	6
MIII31	65	29	4	2
PM	10	82	6	2

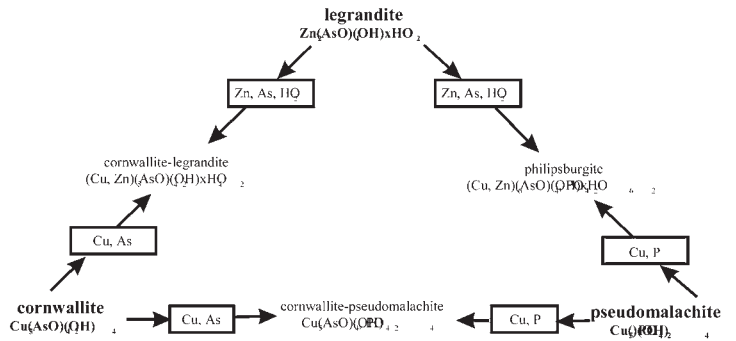

Fig. 1. Possibility of existence of limited solid solution between cornwallite, legrandite or pseudomalachite (marked in bold) based on identified mineral phases from the Miedzianka ore deposit (marked in normal type). Particles, which can be substitute in end-members, are closed in rectangles.

On the basis of identified mineral phases we postulate the coexistence of cornwallite, pseudomalachite and legrandite as a limited solid solution, from which

minerals with different percentage of AsO_4^{3-} or PO_4^{3-}, and Cu^{2+} or Zn^{2+} can crystalize during the oxidation stage of polymetallic ore deposit in Miedzianka (Fig. 1). According to the phase diagrams (Clara et al., 1986, Magalhaes et al., 1988) the stability fields of these minerals superimpose each other.

The presence of volborthite or torbernite reported by Lis, Sylwestrzak (1986) and a presence of vanadium in investigated samples from the Miedzianka ore deposit may suggest that limited solid solution can coexist between arsenates and phosphates as well as tungstates and uranyl groups.

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