

MINERALOGY AND GENESIS OF THE POWDER-LIKE SPHALERITE (BRUNCKITE) VEINS FROM THE OLKUSZ MINE, UPPER SILESIA, POLAND

NEJBERT, K.^{1*}, BAŁEŁ, M.¹ & CIEŚLIK, B.²

¹ University of Warsaw, al. Żwirki i Wigury 93, 02-089 Warszawa, Poland

² ZGH "Bolesław" S.A., ul. Kolejowa 37, 32-332 Bukowno, Poland

* E-mail: knejbort@uw.edu.pl

Veins of the powder-like sphalerite (brunckite) occur in the Upper Silesia Zn-Pb deposits, representing the Mississippi-Valley type (MVT) (GÓRECKA *et al.*, 1996). Brunckite accumulations are known from the mines near Olkusz and Bytom (HARAŃCZYK, 1959; ZAWIŚLAK, 1970; SASS-GUSTKIEWICZ, 2007). Brunckite was described as a new mineral by HERZENBERG (1938), from the Cercapuquio Mine in Peru. Later XRD studies showed that it is a textural variety of sphalerite. HERZENBERG (1938) described brunckite as a white-grey cryptocrystalline highly porous mass, which easily adhere to a tongue and is easily crumbled into powder when rubbing with fingers. Some authors include also the well lithified, yellowish sphalerite showing colloform texture into brunckite (HARAŃCZYK, 1959). In this report we apply the original Herzenberg's definition of brunckite to describe unlithified accumulations of the powder-like sphalerite.

Studied brunckite was sampled in the Olkusz Mine, where it occurs in veins, as infillings of caverns within breccia-type Zn-Pb deposits, and as thin laminae within internal sediments recorded at the bottom of the Zn-Pb ore bodies in the Upper Silesia (ZAWIŚLAK, 1970; SASS-GUSTKIEWICZ, 2007). The brunckite veins (1–20 cm thick) are met mainly at the contact of the ore-bearing dolomite with the internal sediments. The veins commonly show massive texture. In some veins horizontal lamination and laminae of organic matter were recognized. The sedimentological structures indicate that the accumulation of brunckite took place in open free spaces. The examined brunckite veins represent the last generation of Zn-sulphides in this area. The brunckite occurs in close association with the accumulations of amorphous organic matter, recognized as highly oxidized dopplerite by SASS-GUSTKIEWICZ & KWIECIŃSKA (1999). These authors suggested that the organic matter precipitated from humic acids during their interaction with Ca-rich solutions. Field studies indicate that the brunckite and the amorphous organic matter were deposited simultaneously. The XRD examination revealed that the brunckite veins nearly entirely consist of sphalerite. In some samples Ca-Mg-carbonates and gypsum were recorded. The SEM-EDS studies showed that the sphalerite form separate randomly oriented euhedral crystals forming porous masses. The majority of crystals range from 0.5 to 3 (max. 15) μm in size. The grains are commonly isometric, the needle-like forms were not observed. Chemical composition of the sphalerite is close to stoichiometric, the Fe content is less than 0.2 wt% (data from EDS analyses in small areas).

The origin of the brunckite veins was so far explained by the two genetic models: (1) the spontaneous crystallization from low-temperature hydrothermal solutions at the end of Zn-Pb mineralizing processes (HARAŃCZYK,

1959; GÓRECKA *et al.*, 1996), (2) the result of granular disaggregation of the Zn-ores with well developed colloform texture (SASS-GUSTKIEWICZ, 2007). The euhedral habit of sphalerite crystals together with their uniform grain sizes, and lack of any needle-like sphalerite crystals, commonly met in the colloform Zn-ores (GÓRECKA *et al.*, 1996; SASS-GUSTKIEWICZ, 2007), strongly support the origin by direct spontaneous crystallization from hydrothermal solutions. This interpretation is also consistent with the sulphur isotope data (GÓRECKA *et al.*, 1996). The $\delta^{34}\text{S}$ of the Olkusz Mine brunckites ranges from -32 to -15‰, while the older generations of the Zn-Pb-Fe-sulphides are characterized by much heavier S-isotopes. Their $\delta^{34}\text{S}$ values are from 2 to 12‰ for sulphides from the yellowish sphalerite and galena, and from -15 to -2‰ for sulphides from the brown sphalerite and pyrite-marcasite (op. cit.). The low values of $\delta^{34}\text{S}$ ranging from -30 to -5‰ are recorded from many MVT deposits, and are commonly interpreted as the result of activity of sulphate-reducing bacteria during crystallization of Zn-Pb-Fe sulphides (FALLICK & ASHTON, 2001).

The origin of the studied brunckite is interpreted as the result of low-temperature hydrothermal crystallization of Zn-sulphides driven by activity of sulphate-reducing bacteria responsible for the reduction of the $(\text{SO}_4)^{2-}$ to S^{2-} . Spontaneous brunckite precipitation presumably took place during mixing of some genetically different hydrothermal fluids. The precipitated fine ZnS grains (brunckite), together with the amorphous organic matter, were immediately deposited in tectonic fissures and other free spaces common in the Zn-Pb deposits. Such interpretation explains close association of the Upper Silesian brunckite with the oxidized amorphous organic matter, being probably a product of bacterial degradation of the humic acids in the subsurface.

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