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SULPHIDES ASSOCIATION CONECTED WITH HAUERITE OCCURENCES IN BADENIAN CLAYSTONS NEAR TARNOBRZEG

Hauerite occurs in the Carpathian Foredeep in Badenian pecten clays, directly above sulphur deposits: Jeziórko, Machów, Grzybów (Osmólski et al. 1978). The rocks bearing hauerite are rich in bivalve and gastropod shells, rarely foraminiferan shells and large amount of shell and plant detritus.

Hauerite most often occurs as combination of a cube and an octahedron, rarely as a rhombododecahedron. There are also cubic and octahedral crystals (Fig. 1). Groups of crystalline aggregates of the size reaching several centimetres occur relatively rarely. The size of hauerite crystals varies from 0.x mm to 3 cm. The faces of cubic or octahedral crystals are splited (Fig. 1.).

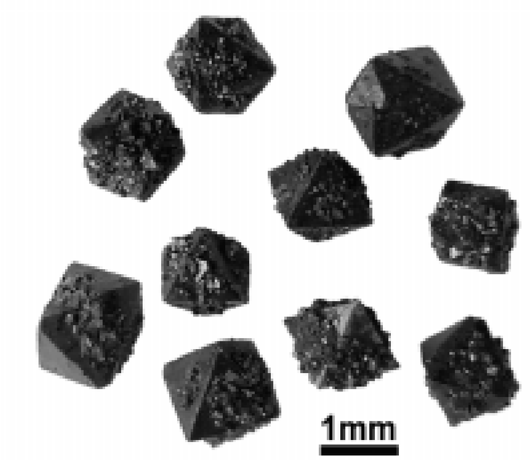

Fig.1. A hauerite crystal with splited faces.

Several scientists (Osmólski et al. 1978, Beran et al. 1984) investigated hauerite accompanying the sulphur deposits in the Carpathian Foredeep. The investigations (Beran et al. 1984) enabled to prepare detailed characteristics of variability of the value of reflection ability depending on the length of the light wave. Osmólski and Pilichowska (1978) described hauerite occurrence and formed a concept that manganese originated mainly from acroglobuline of pecten blood.

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MATERIALS AND METHODS

The investigated material consisting of hauerites has been obtained from several dozens of drill cores from Jeziórko and Machów mines. Polished specimens have been prepared from crystals. Natural surfaces of the crystals have been examined by means of a scanning microscope Philips XL 30 ESEM/TMP with EDS – EDAX attachment. An electron microscope CAMECA SX – 100 has been applied for quantitative analysis. Apart from those, petrographic examination of coal matter and examination of dispersed organic matter by means of GC - MS method has been carried out.

RESULTS

Observations of faces of hauerite crystals under a magnifying glass prove the occurrence of a navy-blue colour substance with semi-metallic lustre, holding fast to the crystal faces. Besides, aggregates with metallic lustre in yellowish colour, more orange than pyrite, have been found in the fraction washed out on sieves. Quite often small pyrite crystals and pyritized fauna (gastropod shells) have been observed. Small hauerite crystals grow on fragments of bivalve shells. The examinations in the micro-area enabled to identify the navy-blue substance as covellite (Fig. 2).

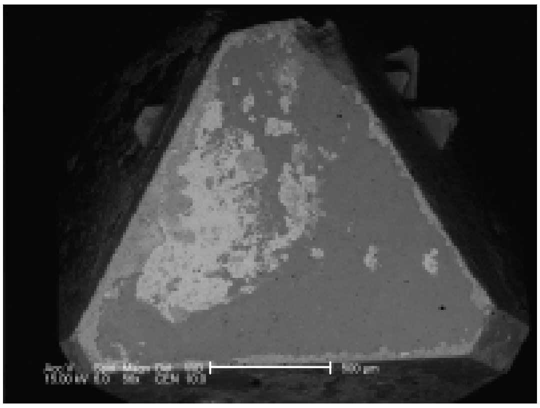

Fig. 2. Covellite (light) on the face of a (111) hauerite crystal (dark).

Analysis of the polished specimens shows that covellite crystallises not only on the surface of faces, but also immerges into small fissures. Quantitative analysis has proved the substance to be covellite. Yellowish aggregates contain nickel and sulphur. Microscopic observations and examinations in the micro-area prove occurrence of nickel sulphide - polydymite containing 2.3wt% Fe and 2,5wt% Mn. The mineral occurs as separate radial aggregates and can be found also on hauerite crystals together with clay minerals (Fig.3).

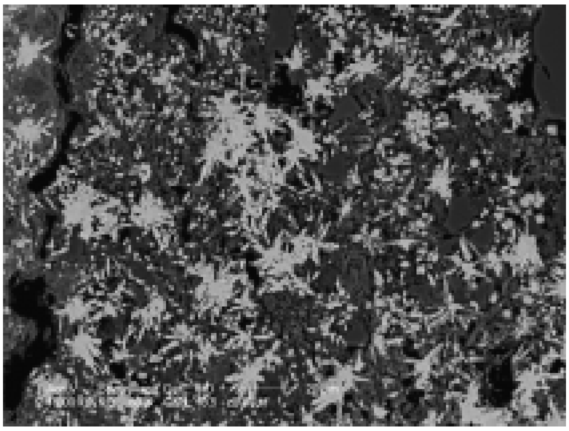

Fig. 3. Radial aggregates of polydymite surrounded by clay minerals.

Scanning of the surface of hauerite crystals proves occurrence of microcrystals of galena and non-identified tin sulphide. There have been also pyrite grains, sometimes framboids within hauerite crystals.

CONCLUSIONS

1. The succession of sulphides association accompanying hauerite may be presented as follows: polydymite, pyrite, then hauerite, covellite, and finally galena and tin sulphide.

2. Significant amount of shells of benthonic organisms suggests oxygenic conditions of sedimentation. Hence, syngenetic formation of Mn, Ni, Fe, Pb and Sn sulphides was possible. There are numerous small fragments of low carbonised higher plants and dispersed organic matter (OM). The source of OM were land and marine organisms, but we not found evidence for anoxic environment in the sedimentary basin.

3. Reduced conditions could result from fast deposition of sediments rich in non-decayed organic matter, which could have been the source of sulphide ions.

4. The source of S^{2-} ions could have been the bacterial environment of gypsum reduction located below (Hubicka-Ptasińska et al. 1969). It may be proved by micro-balls of native sulphur on the faces of hauerite crystals.

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