

Ni-Co MINERALIZATION FROM DZIEĆMOROWICE U MINE, SUDETY MOUNTAINS, POLAND: MINERALOGY AND CHEMICAL COMPOSITION OF Ni-Co-Fe ARSENIDES AND SULFARSENIDES

PRSEK, J. MEDERSKI, S. & KOZIOL, M.

AGH-UST, University of Science and Technology, Faculty of Geology, Geophysics and Environmental Protection, Kraków, Poland

E-mail: prsek@agh.edu.pl

Uranium deposit, Dziećmorowice-Stary Julianów, is located in the Góry Sowie Mts – part of the Sudety Mountains, Poland. The area is build up by various types of gneisses (cordierite, biotite, mica) with bodies of migmatites and amphibolites. In the broad area of the deposit also Carboniferous rock of the Middle Sudety depression could be found. Whole area is cut by system of faults which were used like channels for the intrusions of acid porphyres. Barite-sulphide (Pb-Zn-Ag) mineralization is connected with that intrusions. Some of that acid intrusions are located directly in the studied U deposit. Two main mineralization type were identified in the deposit – quartz-barite and quartz-calcite mineralization. The quartz barite veins hosted base-metal mineralization (galena, sphalerite and copper minerals) whereas in quartz-calcite veins Ni-Co-Bi-U mineralization occurs.

Minerals from the Ni-Co group are part of the hydrothermal veins. Mineralization is mainly formed by Ni-Co-Fe diarsenides and triarsenides which form massive aggregates in white or pinkish calcite. Size of that aggregates is up to few cm in size. Ni-Co mineralization (stage) is oldest one in the veins. The main minerals in the Ni-Co stage are diarsenides (löllingite-safflorite-rammelsbergite solid solution), triarsenides (mainly skutterudite and Ni-skutterudite, less Fe-skutterudite) and less sulfarsenides (members of cobaltite-gersdorffite solid solution and pure arsenopyrite). Oldest arsenide phases are minerals of the skutterudite group. They occur in form of isometric crystals, often crushed and cataclased. They are partly replaced and overgrown by diarsenides I. Size of the skutterudite aggregates is few mm – up to 1cm. All members of the skutterudite series are presented. Content of As in all phases is similar and mean value is 2.87 apfu. Content of S is up to 0.07 apfu. Fe dominant member is rare and usually it occur in form of veinlet in Ni or Co dominant members. The chemical composition is close to the triple point and average contents of Fe, Ni and Co are 0.36, 0.31 and 0.32 respectively. Co dominant phase – skutterudite is common and generally it forms aggregates with Ni-skutterudite. Average content of Co is 0.52 apfu and it contains 0.2 apfu of Fe and 0.28 apfu of Ni. Ni-skutterudite is the main part of the skutterudite aggregates. Average chemical composition of Ni-skutterudite is characterised by Ni content of 0.53 apfu, 0.21 apfu of Fe and 0.26 apfu of Co. Main phases of the Ni-Co paragenesis are diarsenides I. Its chemical composition is very variable.

Diarsenides I are characteristic by intermediate chemical composition with broad Ni-Co-Fe variability. Later chemical composition of the diarsenides II is shifted to the Fe rich members (löllingite II) and Ni rich members (rammelsbergite II) which are younger. Aggregates of the diarsenides are often zonal, where zonality is following bands or crystal shapes or could be completely independent from crystal boundaries. Younger diarsenides II are practically unzonal. The size of the diarsenides I+diarsenides II aggregates is few cm in size. All diarsenides have variable S content which could vary from 0.06 up to 0.2 apfu. Content of Fe in rammelsbergite II is up to 0.2 apfu but generally it is less than 0.1 apfu. Similarly content of Co is up to 0.2 apfu. Löllingite II is generally close to the end composition with content of Ni up to 0.1 upfu and Co 0.09 apfu. Sulfarsenides of the cobaltite-gersdorffite series usually form small thin rims (up to 100 microns) overgrowing triarsenides, diarsenides I and diarsenides II. Sometimes they forms central part of the zonal crystals where younger zones are formed by löllingite III. Similarly arsenopyrite occurs. It forms usually rims or small unzonal crystals growing on the diarsenides I and II or it forms small crystals disseminated in calcite – always in the central part of the veins. Sometimes arsenopyrite form idiomorphic, crushed crystals with weak zonality. Rarely, arsenopyrite form zonal crystals where central part if form by cobaltite and outermost part by pure löllingite III. Arsenopyrite is close to the ideal composition and content of Ni and Co occasionally reach max. 0.4 apfu and 0.24 apfu respectively, but generally it is lower than 0.03 apfu. Content of As vary from 0.86 up to 1.07 apfu. Minerals of the gersdorffite-cobaltite are more variable. Content of Fe in Co-rich phases is up to 0.2 apfu whereas in Ni-rich phases could reach up to 0.4. apfu. Generally content of Fe in both phases is below 0.06 apfu. Content of Ni in Co-rich phases is dominantly between 0.2 up to 0.46 pfu only in cobaltite in association with löllingite III is up to 0.06 apfu whereas Co content in gersdorffite is between 0.2 and 0.47 apfu. Both members are slightly enriched in As and content of As could be up to 1.3 apfu with mean value 1.15 apfu. It could be caused by replacement of di- and triarsenides by minerals of the cobaltite-gersdorffite series.

General succession of crystallization for Ni minerals is as follows: calcite-triarsenides-diarsenides I – diarsenides II-sulfoarsenides+arsenopyrite I, arsenopyrite II-diarsenides III