

PRIMARY AND SECONDARY COPPER MINERALS FROM RĘDZINY, RUDAWY JANOWICKIE, SUDETEN, SOUTHWESTERN POLAND

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Dolomite quarry in Rędziny is a place, which has a very rich polymetallic mineralization. It is a result of hydrothermal processes (precipitated primary minerals) or chemical weathering changes (precipitated secondary minerals). Proximity to Karkonosze Granite massif greatly influenced the variety of the mineralization in Rędziny.

Compared to numerous exploited mines located in the vicinity (for example Miedzianka, Ciechanowice, Czarnów, Radomierz), the dolostone quarry is relatively young, opencast mine. Sulfides are the most common primary minerals in Rędziny. This information appears in the study of Gołębiowska et al. (e.g. 1998, 2006, 2012). Secondary mineralization is very variable and it occurs as forms of arsenates, vanadates, phosphates, carbonates, silicates and oxides (Gołębiowska et al. 1998, 2006).

The aim of the study was to characterize primary and secondary mineralization, rich in copper compounds, which were located in northern hypogene zone of dolostones quarry in Rędziny.

Results were compared with other sampling points from the data of Gołębiowska's studies.

The chemical analysis in microscale was used to examine relationship between minerals. The presence of Cu-minerals in Rędziny is associated with brownish, greenish and reddish zones dispersed in dolostones. The classic mineralogical and chemical researches of the polymineral samples with macroscopically visible green mineralization with use of optical microscopy (transmitted and reflected light), X-ray powder diffraction (XRD), electron microscopy (SEM) and electron microprobe study (EDS, WDS) were also performed.

The main primary minerals are tennantite, chalcopyrite and less often galena or sphalerite.

In BSE there were also observed minor mineral inclusions of Ti, U, Ce, Fe and Ca phase, most probably brannerite. It was recognized in small cavities and fissures between relicts of tennantite and it forms prismatic crystals up to 10 μm . Origin of brannerite is probably connected with decomposition of uraninite. Minerals of Ti (e.g. titanite) were also found in the Rędziny quarry.

The most common secondary mineral phases are represented by Ca-Cu arsenate (tyrolite-clinotyrolite) and Cu-silicate (chrysocolla). X-ray powder diffraction data of blue-green spherical accumulation of small crystals, correspond to the standard data of clinotyrolite and partially of tyrolite. Detailed X-Ray studies show split basic reflections: (001) CT and (002) T, and (002) CT and (004) T. These data indicated that tyrolite is intergrowths with clinotyrolite.

The analyses of Cu-Ca arsenates were normalized to a Σ cation = 11 ($\text{Cu} + \text{Ca} + \text{Zn} + \text{Fe} + \text{Mn} + \text{Ba} = 11$) in the respective formula units of clinotyrolite: $\text{Ca}_{1.94}(\text{Cu}_{8.99}, \text{Zn}_{0.07})[(\text{AsO}_4)_{3.95}(\text{SO}_4)_{0.03}(\text{OH})_{10.17}] \cdot 10\text{H}_2\text{O}$. The amounts of H_2O were calculated by stoichiometry. Trace elements detected by EMPA are: Mn, Bi, Fe and Ba < 0.01 apfu.

Secondary minerals associations from Rędziny quarry were formed differently, which indicate various physical and chemical conditions during oxidation. Supergene phases, which occurs in the northern part of the quarry at Rędziny, were formed as a product of oxidation of primary polymetallic ores, containing sulphides, sulphoarsenides and copper-arsenic sulphosalts.

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