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title: **Waters and minerals in weathering zone of polymetallic deposits of Miedzianka-Ciechanowice and Stara Góra, Sudetes Mts, Poland**

author(s): **Marcin Stępień**
Warsaw University, Faculty of Geology, Poland, stempel@uw.edu.pl

Rafał Siuda
Warsaw University, Faculty of Geology, Poland, siuda@uw.edu.pl

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The investigation are carrying in dumps which are remains after some mines worked on polymetallic deposits. The first is Miedzianka-Ciechanowice situated in the Czarnów Schist Formation which is mainly composed of mica-schists and amphibolites. This tectonic unit is a part of eastern metamorphic cover of Karkonosze granitic pluton (Rudawy Janowickie Mts.). Two types of ores build this deposit: the massive magnetite-pyrite-pyrrhotite ore connected with skarns and ore veins with polymetallic mineralization. In weathering zone of this deposit about 70 of secondary minerals occur. Waters samples were collect on dump of old "Neu Adler" mine (closed in 1925). On the dump occur fragments of amphibolites and shists. Polymetallic mineralization contain rich assamble of ore minerals (native silver, löllingite, saflorrite, pyrite, arsenopyrite, chalcopyrite, galena, sphalerite, tetrahedrite-tennantite and other sulphosalts of Cu and Pb. Calcite, fluorite and barite occurs as a barren minerals.

Different groups of supergene minerals are products of weathering processes. Paragenesis of copper secondary minerals is the most popular. Malachie, langite, brochantite, devilline and chrysocolla create coatings on the weathering Cu ore minerals. The second associations contains arsenates of Fe, Zn, Co and Cu such as scorodite, erythrite and Co-bearing köttigite. The third paragenesis of secondary minerals contain hydrozincite and gypsum. Diversity of parageneses of supergene minerals reflects variable geochemical conditions in different parts of the "Neu Adler" mine. Parental solutions for the minerals of the second paragenesis were enriched in Fe, Zn, Cu and As, originated from alteration of polymetallic ore mineralization. Presence of scorodite shows, that pH of the crystallization environment was very low.

The polymetal deposit of Stara Góra is located within Radzimowice village (Kaczawskie Mts.). The quartz-sericite and quartz-sericite-graphite schists exposed in this area are cut by rhyolites, rhyodacites and trachytes intrusions and also by polymetall ore veins. Ore veins contain pyrite, arsenopyrite, chalcopyrite, sphalerite, thetraedrite, bournonite, boulangerite, galena and other ore minerals. Quartz, rhodochrosite, siderite, dolomite, ankerite, and calcite are barren minerals. Mining activity was stopped in Radzimowice area at 1957. Near old mine is located numerously waste dumps contains primary and secondary arsenic minerals. Very intensive processes of alteration of ore and barren minerals took place in old adits and on waste dumps. Oxide iron hydroxides, sulphates, carbonates and arsenates are the products of these processes. The water samples were collected on the dump in place where was store material from arsenopyrite ore vein. Scorodite, kaňkite and pitticite are very popular secondary minerals in this place. Scorodite and kaňkite are associated with jarosite and gypsum. Small amounts of malachite, base copper sulphate and aragonite are present to.

Groundwater samples are taken thanks to ceramic and Teflon-quartz Eijkelkamp and Prenart probes from depth 30–120 cm. It were measured temperature, pH, conductivity and redox potential of water. After that in laboratory its chemical composition were investigated. These waters are very strong mineralized (till about 10 g per liter) and acidify ($3<pH<7$). Knowing primary and secondary minerals occurred in dumps and chemical composition of groundwater in weathering zone of these dumps carried out geochemical modelling using PHREEQC code. Results of speciation modelling shows tendencies to precipitation secondary minerals and to dissolve primary minerals. Inverse modelling shows quantitative and qualitative effects of this processes.

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