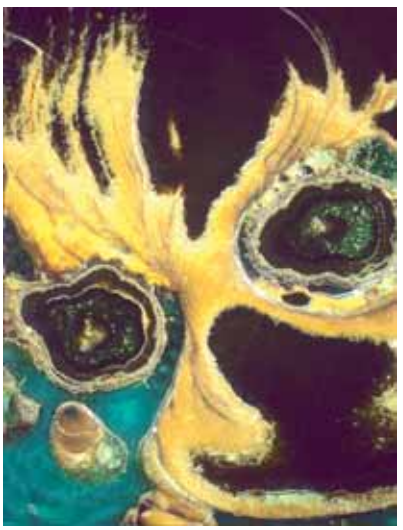
# ON GENESIS OF THE MEDNORUDYANSKOE DEPOSIT AND PARAGENETIC SEQUENCE OF MINERALS IN ITS ORES



239. **Malachite** in limonite-psilomelane aggregate, polished section in oblique-ligth. Mednorudyanskoe deposit.
Specimen: V.A. and V.I. Popovs #96, collected by N.I. Kozin. Photo: V.A. Popov.

240. **Cuprite** skeletal crystals with acicular **brochantite.** 0.7 cm.
Mednorudyanskoe deposit.
Specimen: V.A. and V.I. Popovs #518, collected by N.I. Kozin. Photo: V.A. Popov.

Mednorudyanskoe is a skarn-type deposit formed at the contact between magmatic rocks and limestone (Ovchinnikov, 1998). Its *"iron cap"* (brown iron) extends down to 100 and 180 m below the surface in the northern and central part, respectively. The weathered crust with the oxidation zone of sulfide ores extends down to a depth of 300 m to form karst in blocks of carbonate rocks. There are no quantitative data on the distribution of minerals within the deposit because there was no mineralogical mapping during its mining. However, some evidence for the sequence of crystallization, brecciation and dissolution of minerals in the samples and workings allows some researchers to express ideas on the genesis of various types of mineralization.

For instance, Eremeev (1859) considered this deposit as *"a secondary sequence in the karst depression,"* which was filled by clay with clusters of copper ore resulted from the collapse of the depression walls and an influx of massive primary copper sulfide and magnetite-chalcopyrite ores. Meyer (1876) expressed a similar opinion, indicating that the ores are deposited along a large northwest-trending fissure.

The model by Soloviev (1953) is based on the concept of Cu and S chemical migration. He assumed that surface waters at the copper deposit contained significant amounts of carbon dioxide and they were enriched in sulfuric acid (formed from the decay of sulfides) with depth. First, copper sulphates were formed after sulfides and, then, carbonates, phosphates, arsenates and silicates precipitated.

A similar model was adopted by Vertushkov *et al.* (1976): an accumulation of copper as sulfides near the contact of the syenite intrusion with limestone → oxidation of sulfides to sulphates → hydrolysis of sulphates to form of major sulphates, carbonates, and oxides → formation of copper bi-carbonate and its redeposition as "droplet" malachite → conservation of cluster segregations of copper minerals by viscous clays → formation of eluvial placers. It was proposed that there was a concentration of copper concentrates in limestone as malachite owing to alkaline solutions, as Gladky (1888) previously considered. Both models correspond to the general mineralogical observations that copper mineralization was first sulfides and then oxygen compounds.

The material from many collections studied by us and predecessors allows for the assumption of a very complex history of mineral bodies in the karst part of the deposit and a significant contribution of Fe, Cu, S, P, Mn, and Si in the mineral formation.

One of the important reasons for intense karst formation at the Mednorudyanskoe deposit is blocks with high concentrations of chalcopyrite (*"hills"* of copper sulfide). Sulfuric acid resulted from their oxidation, causing dissolution of carbonate rocks to form large cavities and caverns with the deposition of stalactites and stalagmites of various minerals. The most intense dissolution and formation of supergene minerals took place during mining of the deposit in the 19th century, when water of the