# Skarn mineralizations in the Bor ore district: new evidence from study of bornite-chalcopyrite-hematite paragenesis

*Aleksandar Pačevski[1], Kristina Šarić[1], Miodrag Banješević[2], Trajče Tončić[3], Vladica Cvetković[1]*

[1]University of Belgrade - Faculty of Mining and Geology, Đušina 7, 11000 Belgrade, Serbia, aleksandar.pacevski@gmail.com
[2]University of Belgrade - Technical Faculty Bor, Vojske Jugoslavije 12, 19210 Bor, Serbia
[3]Mining and Smelting Basin Bor, Đorđa Vajferta 29, 19210 Bor, Serbia

## Introduction

The Bor ore district is situated in eastern Serbia and it mainly consists of porphyry-copper and related high-sulfidation epithermal deposits. This N-S stretching ore district is hosted by the Timok magmatic complex (TMC) which is predominantly composed of Late Cretaceous andesitic volcanic and plutonic rocks, associated with roughly contemporaneous sedimentary deposits. At the contacts between the magmatic and the surrounding sedimentary rocks, predominantly limestones, marbles and skarns are commonly formed. These contact-metamorphic rocks occur both on the east and west side of the TMC and they frequently contain Cu- and polymetallic mineralizations (Antonijević, 1997). The skarn mineralizations is genetically related to only a few known polymetallic ore bodies in this district, e.g. Tenka and Valja Saka (Antonijević, 1997). However, given that the mineralized marbles and skarns are widespread, such mineralizations could play an important role for discovery of new ore bodies. In this contribution, we summarize the similarities in mineralogical features of the copper mineralization in the andradite skarns of two actual prospects in the TMC.

## Results and discussion

The studied skarn mineralization belongs to the two prospects in the east side of the TMC. The first is Kriveljski Kamen near the town of Bor and the second is situated about 25 km northwards, near Majdanpek. Both copper mineralizations are formed along the contacts between volcanic rocks of the TMC generally formed during the first volcanic phase, and surrounding limestones and other sedimentary rocks. These mineralizations, consisted predominately of chalcopyrite, are hosted by hydrothermally altered andesites, skarns and marbles. The skarns of both studied areas show similar mineral assemblage consisting of andradite, quartz, calcite and chalcopyrite-bornite-hematite aggregates. Andradite is predominant mineral in the skarns and it was the first crystallization phase in this assemblage. Other above mentioned minerals are deposited subsequently, during a single mineralization stage when andradite grains were cemented. Chalcopyrite and bornite form typical textures of decomposition of bornite solid solution and replacement of bornite by chalcopyrite. Thus, their precipitation simultaneously started and the deposition of chalcopyrite continued after the deposition of bornite. This typical Cu aggregate consisted of chalcopyrite and bornite contains also hematite that was precipitated simultaneously with and mostly after these copper minerals, along the rims of chalcopyrite. A remarkable feature of these chalcopyrite-bornite-hematite aggregates is the occurrence of carollite exsolutions (up to 50 μm in size). They were found in both studied areas whereas exsolutions of hessite (up to 10 μm in size) were found in the Kriveljski Kamen prospect exclusively. To our knowledge, this is the first evidence of carrollite, $Cu(Co,Ni)_2S_4$ in the Bor ore district. Hessite, $Ag_2Te$ and other tellurides are economically important minerals as they carry precious metals, silver and gold. Exsolutions of these two minerals in Cu sulfides may indicate occurrence of a typical mineralization in Bor ore district formed from a hydrothermal solution enriched in Co, Ni, Ag, Te. Additionally, this distinctive chalcopyrite-bornite associations suggesting decomposition and replacement processes could indicate the vicinity of a porphyry-copper system.

## References:

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