

# **Mineralogy and geochemistry of advanced argillic alteration and associated mineralization in ore bodies from the western sector of the Chelopech high-sulfidation epithermal Cu-Au deposit, Bulgaria**

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Samples from several ore bodies in the western part of the Chelopech high-sulfidation epithermal Cu-Au deposit (west of the block 151 and the Western prospects–WP), were studied using SEM-EDS and LA-ICP-MS to characterise their mineral composition, critical element content and potential for mineral vectoring.

The advanced argillic alteration assemblage developed on various magmatic and volcano-sedimentary rocks consists mainly of quartz, kaolinite/dickite, aluminum-phosphate-sulphates (APS), pyrite and rutile. Alunite is established in the area of WP. The altered rocks are cut by pyrite veins and late disseminated enargite/luzonite-tennantite, chalcopyrite, bornite and galena. Rare goldfieldite, tetrahedrite, mawsonite, hessite, µm-sized gold, clausthalite, sphalerite, and barite are documented in the area west of block 151, while only vincienite is established in WP as an accessory phase. Late kaolinite is typical for both areas but with characteristic association of anhydrite and celestine in WP. APS belong mainly to the woodhouseite-svanbergite-hinsdalite solid solution series, with compositions ranging from Ca-, Sr- to Pb-rich members. Barium and LREE are also detected. Compared to the previously studied APS minerals from block 151, where crandallite and florencite were described, the APS at WP are depleted in REE and P and enriched in Pb, K, Na, S, and Ba. Alunite from WP is distinctly K-rich, compared to alunite from block 151. Enargite/luzonite and tennantite are carriers of elements such as Zn, Te, Sb, Sn, Bi, Pb, Se, Ag, Ge, Ga, Tl, Au, Cd, In (hundreds to thousands ppm). Sphalerite contains up to thousands ppm of Ga, Cd, In, while bornite is enriched in Se and Ag. Copper, As, Pb, Zn, Bi, Ag, Te, Tl (hundreds to thousands ppm), and tens of ppm Au have been detected in pyrite.

The studied samples close to block 151 show greater mineral diversity (including µm-sized gold) compared to samples from the WP. The presence of K-rich alunite and APS (±Pb) from the studied WP areas suggests distal position to the intrusive center. The presence of anhydrite±celestine from WP might suggest the influx of seawater-derived fluids in the periphery of the