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The occurrence of gold in Voia deposit, South Apuseni Mountains, Romania

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Voia deposit belongs to the Săcărâmb-Cetraș-Cordurea Miocene volcano-tectonic alignment of the South Apuseni Mountains, Romania. This large volcanic complex represents a Sarmatian-Pannonian magmatic-hydrothemal mega-system of around 5 km^2 with an estimated 3–4 Ma time-space evolution, consisting of seven andesitic volcanic structures grouped in a circle, three subvolcanic andesite-quartz porphyry microdiorite and associated porphyry Cu-Au(Mo), pyrite Ca-Mg skarns and epithermal Au-Ag-Pb-Zn-Cu mineralizations.

The mineral assemblages of alteration and mineralization processes belong to several mineralized zones on a vertical scale, according to sampling evidence and laboratory studies. HS products are found in the upper part of the structure (300-500 m), with dominant advanced and intermediate argillic alterations and sulfide-sulfate gold-poor veins (pyrite, marcasite, base metal sulfides, Fe-Ti oxides, vuggy quartz, alunite, gypsum, anhydrite). Within the 500-1200 m depth, the HS mineral assemblages gradually decrease in favor of IS and LS products. It is characterized by the coexistence of gold-rich LS assemblage (native gold, base metal sulfide, adularia, sericite-illite, chlorite, carbonates ± anhydrite veins), with the IS assemblage (iron oxides, chalcopyrite, pyrite, quartz, anhydrite). These assemblages overprint the HS mineral associations, resulting in a transition zone characterized by gold - pyrite - chalcopyrite - iron oxides - quartz - anhydrite mineral assemblage characteristic for HS and native gold - pyrite - base metal sulfides - carbonates - quartz mineral assemblage corresponding to IS+LS type.

Gold is present in all of the identified mineralization forms: porphyry-epithermal Cu-Au, epi-mesothermal carbonate veins with gold - base metal sulfides, quartz veins with pyrite - chalcopyrite - magnetite ± hematite ± anhydrite, anhydrite veins with base metal sulfides and sulfosalts, anhydrite veins with pyrite - anhydrite ± quartz, vuggy quartz (silica residue) with gold-poor pyrite veins and impregnations in porphyry systems.

Drilling core samples revealed that in Voia deposit, gold is concentrated in chalcopyrite (drills no. 7, 19, 37) along with pyrite - magnetite - hematite - quartz assemblage from the late potassic stage. The major amount of gold associated with chalcopyrite tends to be mainly submicroscopic. Pyrite from anhydrite veins of the early potassic stage ± phyllic alteration is relatively poor in gold (drills no. 1-6, 8-14). However, the highest gold contents are present in pentagonal dodecahedron pyrites (drills no. 33, 38, 39) of pyrite-chalcopyrite-magnetite ± hematite-quartz assemblage from late

potassic stage ± phyllic alteration. Pyrite associated with magnetite from anhydrite veins tends to be poor in gold (drills no. 8, 11, 15, 28, 29). A carbonate vein containing gold-bearing base metal sulfides that was intercepted at 960,00-960,30m depth by drill no. 17 is one of the richest in gold.

Native gold occurs as fine inclusions in ore minerals (5-20 μm). Large irregular grains of native gold (>50 μm) appear at mineral boundaries and along the fissures. The gold color is bright yellow and has a measured Au:Ag ratio of 5:1, suggesting that native gold has been formed at a relatively high temperature.

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