3–2: The Chelopech high-sulphidation epithermal Cu–Au deposit

Ore deposit: Lat. 42°41’ N, Long. 24°05’ E

Robert Moritz*a, Isabelle Chambefort*a, Silvina Georgieva*b, Stéphane Jacquat*a, Rumen Petrunovb

*a Earth Sciences Institute, University of Geneva, Rue des Maraîchers 13, 1205 Geneva, Switzerland
*b Geological Institute, Bulgarian Academy of Science, Acad. G. Bonchev St., 1113 Sofia, Bulgaria

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Mining: underground production since 1959 (see Figs. 1, 2 and 3).

Commodities: Cu, Au.

Total of past production + resources: 42.5 Mt @ 1.1%Cu and 3.12 g/t Au.

Type: high-sulphidation epithermal deposit.

Nature of the host rocks: mainly andesite and phreatomagmatic breccia, subsidiary volcanic tuff and sedimentary rock.

Age of andesite host rocks: 91.45 ± 0.15 Ma.

Age of mineralization: <91.45 ± 0.15 Ma.

Alteration: advanced argillic (quartz, kaolinite/dickite, pyrite, APS minerals, Fig. 4), grading into phyllic (quartz-sericite), and distal propylitic. At depth: diaspore, pyrophyllite, alunite and zunyite.

Ore control: fault and lithological controls.

Ore geometry: veins, dissemination, breccia, and massive sulphide lenses with replacement textures.

Main ore minerals: pyrite, enargite, luzonite, chalcopyrite, tennantite, bornite, native gold-electrum, goldfieldite, colusite, digenite, chalcocite, covellite, sphalerite, galena, tellurides.

Fig. 1. Horizontal section, level 405.

Fig. 2. Cross-section through the Chelopech deposit based on surface and underground mapping, extensive drillcore descriptions and observations, and including information from Popov and Kovachev (1996) for the north-western part at Vozdol. The present mining level is at ~400m. Rock units are Late Cretaceous, unless stated otherwise.

* corresponding author: e-mail Robert.Moritz@terre.unige.ch

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Fig. 3. Typical ore paragenesis, subdivided into three main stages: (a) early massive pyrite (py) stage with a banded texture; (b) enargite ± luzonite (enr ± lz) association of the intermediate Cu–Au–As–S stage; (c) tennantite (tn), chalcopyrite (cp) ± bornite vein of the intermediate Cu–Au–As–S stage; (d) sphalerite (sl), galena (gn) vein of the late base-metal stage, ba: barite. The intermediate Cu–Au–As–S stage constitutes the economic Cu and Au ore.

Fig. 4. Advanced argillic alteration assemblage, (a) (plane polarized light): kaolinite/dickite (kao/dic), quartz (qtz), pyrite (py), svanbergite–woodhouseite (sv–wh); aluminium–phosphate–sulphate minerals (APS) alteration at shallow depth (~400 m level, at the present mining level); (b) and (c) (crossed polars): alteration assemblage at depth (~1,000 m level below the present mining level, drillcore observation) including zuñyite (zun), pyrophyllite (prl), diaspore (dsp), alunite (alu) and anhydrite (anh). Scale bar = 100 µm.

Key References: