High-sulphidation (HS) epithermal gold mineralisation in the Chovdar deposit, Lesser Caucasus, Azerbaijan

Високо сулфидна (HS) епитермална златна минерализация в находище Човдар, Малък Кавказ, Азербайджан

Kamen Bogdanov[1], Shahbeddin Musaev[2], Alekper Ahmedov[2], Ramin Salmanli[2]
Камен Богданов[1], Шахбеддин Мусаев[2], Алекпер Ахмедов[2], Рамин Салманли[2]

[1] Sofia University ”St. Kl. Ohridski”, Department of Mineralogy, Petrology and Economic Geology; 15 Tsar Osvoboditel Blvd., 1504 Sofia, Bulgaria; E-mail: kamen_bogdanov@mail.bg
[2] AIMROC Ltd (Azerbaijan International Mineral Resources Operating Co. Ltd.), 48A Ataturk Ave, Baku, AZ1069Azerbaijan

Key words: epithermal gold deposits, high sulphidation (HS) gold deposits, gold, Lesser Caucasus.

The Pontide-South Caucasian island arc is part of the global Tethyan-Eurasian copper-gold belt. The arc is divided into two sections – western (Pontides) and eastern (Lesser Caucasus) that are separated by a later thick sequence of Neogene volcanics (Dilek et al., 2010; Sosson et al., 2010; Adamia et al., 2011). Andesite-dacite volcanic sequences of both Bajocian and Upper Cretaceous age dominate in the Lesser Caucasus sector. Jurassic-Late Creatceous Ca-alkaline to alkaline magmatic arc setting is characteristic of Somkhito-Karabah metallogenic zone of that is situated north of Sevan-Akeran ofiolitic suture zone (Fig. 1).

Fig. 1. Tectonic sketch of Azerbaijan (based on the tectonic map and map of the mineral resources of Azerbaijan)

The Chovdar epithermal gold deposit is situated five kilometers NW of the world-class Dashkesan Fe-skarn deposit (Baba-Zade et al., 2003; Musaev et al., 2005). The area consists of Jurassic (Bajocian) lavas, breccias and tuffs divided into Lower Bajocian (basalt-andesite) and Upper Bajocian (dacite-rhyolite) sequences. The latter consist of dacite and rhyolite lava flows, agglomerate breccias (Fig. 2) tuffs and tuff-sandstones,

Fig. 2. Agglomerate rhyolite explosive breccia

all intruded by quartz-diorite porphyries and crosscut by later trachyte and diabase porphyry dykes. Andesite volcanic, tuff and dyke sequences are more rarely observed. NW trending strike-slip fault duplexes, steeply (70–85°) dipping to NE host HS epithermal gold mineralization of the Chovdar deposit. Overall, the observed alteration and the pyrite-enargite hydrothermal breccia mineralisation in the central quartzite ore body

Fig. 3. Vuggy silica with barite and kaolinite

clearly indicate for a high-sulphidation (HS) style gold mineralization that could be part of a larger porphyry-epithermal system as indicated by Mo (10–25 ppm) content.

Gold mineralization is associated with pervasive massive silicification with fracture controlled vuggy silica (Fig. 3), advanced argillic (pyrophyllite, alunite), argillic (kaolinite, dickite) alterations. Phyllic (sericite) and propylitic alterations occur more rarely.

The main ore body has a mushroom shape 200×300 m in size (Fig. 4) and is traced well by IP survey and high gold grade pyrite-enargite breccia.

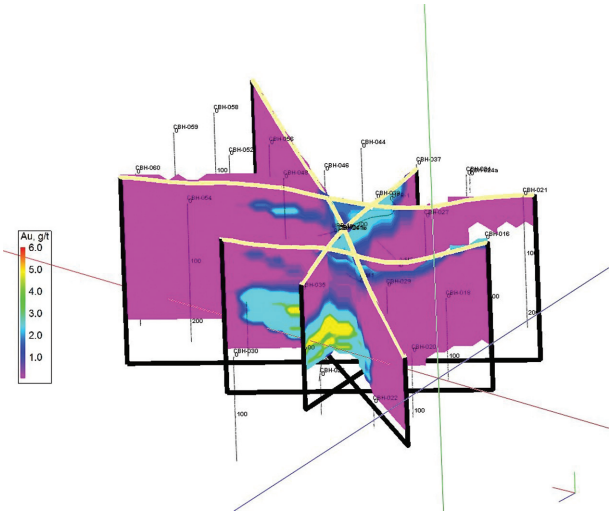

Fig. 4. 3D model of the Chovdar HS epithermal gold deposit

Laterally the IP anomalies that outline the primary Au ores are between 550 and 1100 m in size and penetrate up to 300 m in depth. Oxydation zone penetrates to about 50–80 m depth from the surface and is outlined by low chargeability values that suggest oxidation of the system, while the barren volcanic rocks are discriminated by high positive R values. Goethite, malachite, azurite and hematite are most commonly observed minerals in the oxidation zone.

Pyrite is the dominant sulphide mineral in addition to chalcopyrite, while bornite, enargite, tenantite and covellite are subordinate. Chalcocite, galena, sphalerite, pyrrhotite, marcasite, stromeyerite, magnetite and ilmenite are more rarely observed. All the opaque minerals are crosscut by 0.1–3 m thick barite veins while calcite, siderite and fluorite veinlets up to 1–2 cm wide occur more rarely. Early stage microscopic in size (1–30 μm) native gold and electrum occur as blebs, and dendrite-like microaggregates (40–65 μm) in grey quartz, associated with pyrite, chalcopyrite and enargite. The gold fineness most commonly varies between 866 and 996. Late stage microscopic in size (2–30 μm) electrum and native silver (Ag 84.1–96.7 wt.%; Cu 3.3–15.9 wt.%) have been observed in association with barite, calcite, galena and sphalerite in addition to single rare grains of stromeyerite ($Ag_{1.13}CuS_{1.13}$).

Based on the carried out exploration activities and investigations we could conclude that the main pathfinders for the high gold grade zones in Chovdar HS epithermal deposit are: fault controlled vuggy silica as a result of acid leaching; the steep fracture and strike slip fault structural control of the gold mineralization and the enargite-pyrite hydrothermal breccia bodies.

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