

Geological and Hydrothermal Characteristics of the Recently Discovered Epithermal-Porphyry System, Gedabek District, Azerbaijan

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A recently discovered epithermal–porphyry system in the Gedabek ore district of the Lesser Caucasus, western Azerbaijan, provides new insights into hydrothermal processes and mineralization in the region. The district lies within the Lök-Qarabağ island arc metallogenic zone of the Central Tethyan belt and the Middle-Upper Jurassic-Early Cretaceous volcanic-plutonic belt, hosting multiple epithermal and porphyry-related mineral occurrences. Recent exploration has led to the identification of several deposits, including Gadir, Ugur, Zafar, and Gilar, highlighting the district's significant mineral potential.

Host rocks comprise Middle-Upper Jurassic volcanic and volcanogenic-sedimentary sequences, including andesite, dacite, and rhyolite lava flows, pyroclastic units, and subvolcanic intrusions, intruded by multiphase granitoid bodies of the Gedabek intrusive complex. Mineralization is structurally controlled by northwest-trending transcurrent faults and associated fracture networks, which acted as pathways for hydrothermal fluids.

Hydrothermal alteration is widespread and exhibits well-defined zonation. Central zones display silicification and advanced argillic alteration, grading outward into argillic and propylitic assemblages. Low-sulfidation adularia-sericite alteration contrasts with high-sulfidation advanced argillic assemblages associated with secondary quartz and intense brecciation.

The Gadir deposit is a low-sulfidation epithermal system with quartz-adularia veins, hydrothermal breccias, and disseminated sulfides dominated by pyrite, minor chalcopyrite, and native gold. Ugur is a shallow high-sulfidation system localized at a major structural intersection, with pyrite stockworks, silicified volcanic rocks, and advanced argillic alteration including kaolinite, barite, and hematite. Zafar represents an intermediate-sulfidation Cu-polymetallic system, and Gilar is a structurally controlled Au–Cu polymetallic system with quartz–sulfide veins and localized massive sulfides.

Vein and stockwork networks display transitional features between epithermal and porphyry environments. Early quartz-pyrite (A-type) veins are associated with silicification, whereas later quartz–sulfide (D-type) veins contain chalcopyrite and base-metal sulfides. The spatial association of mineralization with intrusions, structural intersections, and hydrothermal alteration indicates that the Gedabek district represents a large, evolving porphyry-epithermal system with significant exploration potential.