

Geology, Hydrothermal Evolution, and Multi-Stage Mineralisation of the Piyazbashi High-Sulfidation Gold Deposit, Nakhchivan, Azerbaijan

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The Piyazbashi gold deposit, located in Nakhchivan, Azerbaijan, represents a high-sulfidation hydrothermal system developed within Lower to Middle Eocene volcanic sequences. The deposit is geographically bounded by the Meskhet River to the north, Ordubad Fault to the northeast, Gerdenichay River to the east and southeast, and Piyazbashi Mountain to the west, covering an area of approximately 5 km² along a 2–3 km strike. Host rocks comprise andesites and fragmental tuffs of Eocene age, which provide the primary framework for gold-bearing quartz-sulfide veins. Structural controls include northwest-trending faults and subordinate subparallel (latitudinal) and submeridional (longitudinal) fault systems, likely related to Eocene or pre-Eocene volcanism, with major tectonic movements concentrated along these structures. Minor intrusive rocks, mainly granodiorite-porphyry derivatives of the adamellite complex, are present within the region.

Ore is hosted predominantly in quartz-sulfide veins and disseminated sulfide zones, crosscutting pre-existing intrusions, dikes, and metasomatic alterations. Veins are characterized by intense pyritization, chloritization, and minor kaolinite alteration, with locally iron-hydroxide-cemented quartz and disseminated pyrite. Host rocks exhibit weak quartz alteration, chloritization, epidotization, and pyritization. Two principal ore types are recognized: primary (unaltered) and oxidized ore, the latter formed through supergene processes and displaying higher gold content associated with limonitization. Boundaries between these ore types are gradational.

Mineralization occurred through multiple hydrothermal stages under moderate-to-low temperature conditions, including quartz-sericite, quartz-pyrite-gold, polymetallic, and carbonate stages. Wall-rock alteration, mineralogical assemblages, and ore textures indicate formation at depths of approximately 1 km. Contemporary studies by Azerbaijan International Mining Company Limited classify the Piyazbashi deposit as a High-Sulfidation Hydrothermal Gold Deposit, reflecting its complex tectono-hydrothermal evolution and multi-stage ore formation.