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Geology, Mineralisation, and Hydrothermal Alteration of the Almalyk Porphyry Copper- Gold Deposit, Tien Shan Mountains, Eastern Uzbekistan

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The Almalyk porphyry copper-gold deposit in Uzbekistan is one of the longest economically active deposits in the world with JORC compliant resources (inferred, indicated, and measured) of over 19 billion tonnes at 0.23% Cu and 0.28 g/t Au and proven and probable reserves of 8.8 billion tonnes at 0.29% Cu and 0.34 g.t Au (AGMK 2021). It rivals some of the world-class South American and Southeast Asian porphyry deposits. It has been operating as an open pit for over 65 years.. However, despite its size and economic contribution to the Uzbek economy, it is relatively unknown outside of Central Asia. The deposit lies in Eastern Uzbekistan. It is situated geologically in the Valerianov-Beltau-Kurama magmatic arc, part of the Tien Shien Mountains. It has associated epithermal and skarn copper, gold, and base metal deposits of an Andean-type magmatic arc setting. The Almalyk “United Mine” (formed from the individual named deposits of Kalmakyr, Karabulak, Yoshlik, and Balaktyr) is a multiphase porphyry intrusive system emplaced between 337 and 306 Ma, with economic Cu, Au, Mo, and Ag mineralisation associated with quartz monzonite and granodiorite intrusions emplaced in earlier dioritic host rocks. The deposit is a multiphase quartz-sulphide vein stockwork, with a well-established vein paragenesis, and displays classic Lowell and Guilbert (1970) styles of concentric hydrothermal alteration around a central porphyritic intrusive complex. The geometries of the zones of hydrothermal alteration and mineralisation are modified by late-stage faulting to form the four individual deposits (originally a single deposit). Three principal mineralisation styles are present (oxide, transitional, and fresh-sulphide) with only minor supergene enrichment. The main copper sulphide minerals currently being mined are chalcopyrite and bornite. The area surrounding the Almalyk porphyry cluster remains highly prospective for additional porphyry, skarn, and related epithermal-style mineralisation.