

Integrated Approach for Characterization of Au-Ag Mineralization at the Kosmonachi Deposit, Uzbekistan. Insights From Magnetism, Remote Sensing, and Petrography

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Uzbekistan hosts several world-class Au deposits, well known across the world. The main Au-Ag district falls within the desert region of Central Kyzylkum, hosting the famous Muruntau and Daugyztau deposits. However, some smaller deposits in the district still remain understudied, due to their lower commodity content. Nevertheless, understanding of structural and alteration controls of small-scale orogenic systems is necessary for a comprehensive consideration of exploration strategy at the district scale. The Kosmonachi Au-Ag-(W) deposit lies within the Paleozoic Tamdytau metamorphic belt approximately 20 km NW of the giant Muruntau orogenic gold deposit. Host rocks are represented by fine-grained clastic-metasedimentary rocks metamorphosed to low-greenschist facies, also known as Besapan sequence.

We integrated high resolution magnetism and remote sensing alteration mapping approach with petrographic-geochemical analyses to characterize the mineral system at Kosmonachi. Sentinel 2 satellite images were used to build main mineral indices, followed by creation of composite images highlighting Fe-oxide and clay-silica alteration zones associated with mineralization. ASTER imagery was used to create alteration maps delineating zones of phyllic and argillic alteration. High-resolution ground magnetic data with 50 m line spacing and 0.5 m sampling interval, delineate low magnetic intensity values reflecting lineaments and the associated alteration zone. These signatures find spatial correlation with alteration imagery. Petrographic observations show a multi-stage hydrothermal overprint: 1) early quartz-carbonate-K feldspar with disseminated pyrite; followed by 2) main hydrothermal ore stage with formation of polymetallic sulfides and sulfosalts; and 3) late-stage carbonates, scheelite and native Ag

All this evidence illustrates how multi-stage hydrothermal fluids channeled along fault zones produced alteration and metal zoning at Kosmonachi. The main results of this study include structural control of alteration and spatial correlation of lineaments with alteration zones helping define an exploration vector.