Muruntau, Uzbekistan: A Giant, Pluton-Related Auriferous System

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Muruntau is situated in the Central Kyzylkum of Southern Tian Shan, Uzbekistan, with gold production of ~60 tonnes per year. The main geological characteristics of the giant Muruntau auriferous system are revisited to improve genetic and exploration models. Field-based research in the Muruntau district, its deep drill holes, as well as complex geoscientific data have been integrated with regional geology and geophysics.

Deposit formation occurred through a multi-stage process involving sedimentation, regional metamorphism including thrusting, magmatism with formation of hornfels aureoles, and several stages of hydrothermal activity. Late-orogenic granitic magmatism (294-288 Ma) occurs roughly within the same time interval as the main hydrothermal gold precipitation (~288 Ma) expressed by intense, high-temperature fluid-wall-rock interaction resulting in the formation of gold-bearing cone-like stockworks with veins, veinlets, and metasomatites.

Muruntau and other gold deposits in the Kyzylkum are hosted by a distinctive metasedimentary package (the "variegated Besapan," BS3, a Lower Palaeozoic siliciclastic continental margin assemblage) that is dominated by psammopelites and contains major carbonaceous units. Ore-stage veining, mineralization and metasomatism are focused in the hornfelsed package, the more ductile carbonaceous pelites constituting local "screens" partitioning strain and fracture. The auriferous systems underlie a Devonian-Carboniferous (D-C1) carbonate-dominated package which acted as a low-permeability seal/cap on these systems.

Gold ores occur mainly in south-dipping zones enveloped by lower-grade material. High-grade ore zones comprise sheeted quartz±feldspar vein networks and enveloping biotite-orthoclase-quartz–rich metasomatised metasediments with ore-stage arsenopyrite, pyrite, and pyrrhotite.

Main stage gold mineralization is accompanied by biotite±amphibole stable, potassic alteration that is thermally compatible with host-rock thermal metamorphic assemblages. The latter overprint deformation fabrics resulting in massive textures in psammites and psammopelites and outlining a broad thermal aureole related to block uplift serving as fluid conduit that is intruded by underlying granitoid plutons.