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Large Gold Systems of Central Asia: Geodynamics and Metallogeny Revisited

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Major gold deposits occur across the Central Asian Orogenic Belt (CAOB), also referred to as the Altaids orogenic collage. They are attributed to diverse deposit types of which the most important ones are porphyry deposits. For example, in Uzbekistan the Kalmakyr-Yoshlik porphyry system (Middle Tienshan) hosts more gold than Muruntau (Kyzylkum accretionary zone).

In the western Altaids, the Paleozoic accretionary belts of Kazakhstan and of the Northern, Middle and Southern Tienshan as well as suture/shear zones and sedimentary basins establish central Asia as an emerging commodity basket including undiscovered deposits under cover or undeveloped mineral potential still to be unlocked.

As a result of post-collisional extension and orogenic collapse, each accretionary cycle (early, mid, late Paleozoic) is concluded by the formation of major lode Au deposits representing “orogenic-style” (and intrusion-related gold systems, IRG) as well as “Carlin-style” formations (Au associated with Sb-Hg mineralisation). These are often associated with alkaline, dominantly shoshonitic intrusions and are related to major shear zones, often of trans-crustal nature, tapping deep reservoirs through tectonic pumping related to rapid uplift and decompression, that aid focused fluid flow driven by elevated thermal gradient. The peak gold mineralisation in the CAOB (comprising the vast majority of the known gold endowment) took place around the Carboniferous-Permian boundary at ~305-290 Ma, referred to as “jackpot” event. It is represented by famous mineral systems including Muruntau, Amantaytau, Kumtor, Bakyrchik orogenic gold deposits, Zharmitan (IRG), Kochbulak (mesothermal gold), Dzhezkazgan (sedimentary copper), and Khaidarkan, Kadamjay (auriferous Sb-Hg deposits).

In addition to the tectonic, geologic and metallogenic setting and distribution of the main Au-bearing mineral systems (porphyry Cu–Au/Mo, meso- and epithermal Au, orogenic Au, VHMS, Carlin) within the CAOB, the setting, geology, alteration and mineralisation of these deposits is re-assessed based on new geochronological and isotope data (U-Pb zircon ages, Re-Os ages, Sr-Nd-Hf-Pb isotope data).