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Late Paleozoic tectonic evolution and concentrated mineralization in Balkhash and West Junggar, western part of the Central Asian Orogenic Belt

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The Central Asia Orogenic Belt (CAOB) is an important area with significant growth of the crust and metallogeny in the Late Paleozoic. The Balkhash-Junggar tectono-metallogenic belt consists of the Balkhash, the West Junggar, and the East Junggar tectono-metallogenic belts in western part of the Central Asian Orogenic Belt (CAOB). According to the structural geological relationship, the East Junggar, the West Junggar, and the Balkhash belts are considered to be once a continuous E-W-trending tectono-metallogenic belt in Late Carboniferous. The West Junggar belt is featured with NE-trending left-lateral strike-slip faulting tectonic system (WJTS), while the left-lateral strike-slip faults are E-W-trending in the Balkhash belt. The WJTS consists of the Darabut, the Mayile, and the Baerluke faults, and the blocks among them. All these left-lateral strike-slip faults are forming due to the transition of tectonic settings from syn-collisional orogeny to post-collisional extension during the closure of the ocean (the Junggar Sea) in Late Carboniferous, with significant intrusion of batholiths and crust growth occurred in this period. These faults are truncated by the right-lateral strike-slip faults, such as the Chingiz-Junggar fault, and the Central Balkhash fault in Mesozoic.

The Balkhash-Junggar tectono-metallogenic belt is important for the occurrence of many well-known super-large and large porphyry Cu-Mo deposits (such as the Kounrad, the Aktogai, the Borly, and the Baogutu deposits), large skarn Cu deposits (in the Sayak ore-filed), large rare metal deposits (such as the East Kounrad, the Zhanet, and the Akshatau deposits), and large gold deposits (such as the Hatu deposit). Zircon U-Pb ages, Re-Os isotopic dating of molybdenites, 40Ar/39Ar thermochronology of hornblendes, muscovites, biotites, and K-feldspars, and zircon and apatite fission track (FT) and (U-Th)/He dating and thermal history modeling, provide a multidisciplinary approach to constrain the whole course thermo-history of the minearl deposits from their formation in the deep to the exhumation in the surface. It reveals the arc-related granitic magmatism and the metallogeneses of skarn Cu, porphyry Cu-Mo, quartz-vein/greisen W-Mo, and orogenic Au in Late Paleozoic, the medium-temperature regional cooling in Late Paleozoic and Early Mesozoic, and the low-temperature exhumation of the deposits in Mesozoic. The timing, combined with geochemistry of granitoids, suggests a transition of tectonic environment from syn-collision and volcanic arc in Late Carboniferous to post-collision extension in Early Permian, and the concentrated mineralization of Cu, Mo, rare metals, and Au during this tectonic transition. The complete metallogenic series for the concentrated mineralization are from skarn and porphyry Cu-Mo deposits to rare metal and gold deposits.

Key words: Late Paleozoic; Tectonic evolution; Concentrated mineralization; Balkhash-Junggar tectono-metallogenic belt; Central Asian Orogenic Belt