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Geodynamics and Metallogeny of the Eastern Tethyan Metallogenic Domain

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The Tethyside orogen, a direct consequence of the separation of the Gondwanaland and the accretion of Eurasia, is a huge composite orogenic system that was generated during Paleozoic–Mesozoic Tethyan accretionary and Cenozoic continent–continent collisional orogenesis within the Tethyan domain. The Tethyside orogenic system consists of a group of diverse Tethyan blocks, including the Istanbul, Sakarya, Anatolide–Taurides, Central Iran, Afghanistan, Songpan–Ganzi, Eastern Qiangtang, Western Qiangtang, Lhasa, Indochina, Sibumasu, and Western Burma blocks, which were separated from Gondwana, drifted northwards, and accreted to the Eurasian continent by opening and closing of two successive Tethyan Oceanic basins (Paleo-Tethyan and Neo-Tethyan), and subsequent continental collision.

The Tethyan domain represents a metallogenic amalgamation across diverse geodynamic settings, and is the best endowed of all large orogenic systems, such as those associated with the Cordilleran and Variscan orogenies. The ore deposits within the Tethyan domain include porphyry Cu–Mo–Au, granite-related Sn–W, podiform chromite, sediment-hosted Pb–Zn deposits, volcanogenic massive sulfide (VMS) Cu–Pb–Zn deposits, epithermal and orogenic Au polymetallic deposits, as well as skarn Fe polymetallic deposits (Fig. 1). At least two metallogenic supergroups have been identified within the eastern Tethyan metallogenic domain (ETMD): (1) metallogenesis related to the accretionary orogen, including the Zhongdian, Bangonghu, and Pontides porphyry Cu belts, the Pontides, Sanandaj–Sirjan, and Sanjiang VMS belts, the Lasbela–Khuzdar sedimentary exhalative-type (SEDEX) Pb–Zn deposits, and podiform chromite deposits along the Tethyan ophiolite zone; and (2) metallogenesis related to continental collision, including the Gangdese, Yulong, Arasbaran–Kerman and Chagai porphyry Cu belts, the Taurus, Sanandaj–Sirjan, and Sanjiang Mississippi Valley-type (MVT) Pb–Zn belts, the Southeast Asia and Tengchong–Lianghe Sn–W belts or

districts, the Himalayan epithermal Sb–Au–Pb–Zn belt, the Piranshahr–Saqez–Sardasht and Ailaoshan orogenic Au belts, and the northwest Iran and northeastern Gangdese skarn Fe polymetallic belts. Mineral deposits that are generated with tectonic evolution of the Tethys form in specific settings, such as accretionary wedges, magmatic arcs, backarcs, and passive continental margins within accretionary orogens, and the foreland basins, foreland thrust zones, collisional sutures, collisional magmatic zones, and collisional deformation zones within collisional orogens.

Synthesizing the architecture and tectonic evolution of collisional orogens within the ETMD and comparisons with other collisional orogenic systems has led to the identification of four basic types of collision: orthogonal and asymmetric (e.g., the Tibetan collision), orthogonal and symmetric (Pyrenees), oblique and symmetric (Alpine), and oblique and asymmetric (Zagros). The tectonic evolution of collisional orogens typically includes three major processes: (1) a syn-collisional continental impact, (2) a late-collisional tectonic transform, and (3) post-collisional crustal extension, each forming distinct types of ore deposits in specific settings. The resulting synthesis leads us to propose a new conceptual framework for the collision-related metallogenic systems, which may aid in deciphering relationships among ore types in other comparable collisional orogens. Three significant processes, such as breaking-off of subducted Tethyan slab, large-scale strike-slip faulting, shearing and thrusting, and delamination (or broken-off) of lithosphere, developed in syn-, late- and post-collisional periods, respectively, were proposed to act as major driven forces, resulting in the formation of the collision-related metallogenic systems. Widespread appearance of juvenile crust and intense interaction between mantle and crust within the Himalayan–Zagros orogens indicate that collisional orogens have great potential for the discovery of large or giant mineral deposits.

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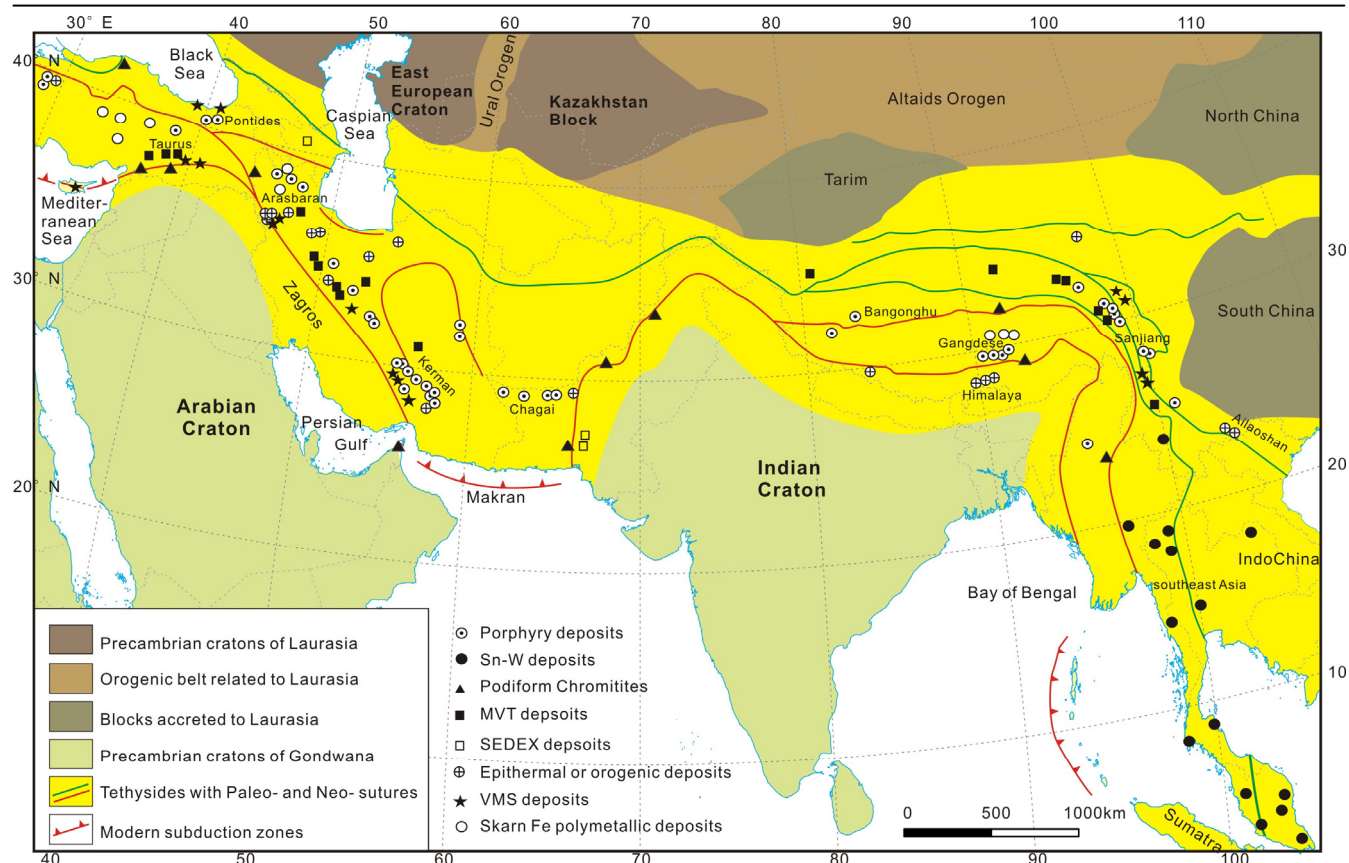


Fig. 1. Spatial distribution of some major deposits types in the eastern Tethyan metallogenic domain

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