Paper Number: 5517

Tectonic processes and metallogeny along the Tethyan Mountain ranges of the Middle East and South Asia

Searle, M.P.[1], Robb, L.J.[1], Gardiner, N.J.[2]

[1]Department of Earth Sciences, University of Oxford, Oxford OX1 3AN, United Kingdom
[2]Centre for Exploration Targeting – Curtin Node, Department of Applied Geology, Curtin University, Perth 6102, Australia

---

The genesis of mineral deposits has been widely linked to specific tectonic settings, but has less frequently has been linked to tectonic processes. Understanding processes of oceanic and continental collision tectonics is crucial to understanding key factors leading to the genesis of magmatic, metamorphic, hydrothermal and sedimentary-related mineral deposits. Geological studies of most ore deposits typically focus on the final stages of concentration and emplacement. The ultimate source (mantle, lower crust, upper crust) of mineral deposits in many cases remains more cryptic. Uniquely, along the Tethyan collision zones of Asia, every stage of the convergence process can be studied from the initial oceanic settings where ophiolite complexes were formed, through subduction zone and island arc settings with ultra-high-pressure–high-pressure (UHP–HP) metamorphism, to the continental collision settings of the Himalaya, and advanced, long-lived collisional settings such as Afghanistan, the Karakoram ranges and the Tibetan Plateau. The India-Asia collision closed the intervening NeoTethys ocean at ~50 Ma and resulted in the formation of the Himalayan mountain ranges, and increased crustal thickening, metamorphism, deformation and uplift of the Karakoram–Hindu Kush ranges, Tibetan Plateau and older collision zones across central Asia.

Metallogenesis in oceanic crust (hydrothermal Cu-Au; Fe, Mn nodules) and mantle (Cr, Ni, Pt) can be deduced from ophiolite complexes preserved around the Arabia/India-Asia collision (Oman, Ladakh, South Tibet, Myanmar, Andaman Islands). Tectonic-metallogenic processes in island arcs and ancient subduction complexes (VMS Cu-Zn-Pb) can be deduced from studies in the Dras-Kohistan Arc (Pakistan) and the various arc complexes along the Myanmar–Andaman segment of the collision zone. Metallogenesis of Andean-type margins (Cu-Au-Mo porphyry; Au-Ag) can be seen along the Jurassic-Eocene Transhimalayan ranges of Pakistan, Ladakh, South Tibet and Myanmar. Large porphyry Cu deposits in Tibet are related to both pre-collisional calc-alkaline granites and post-collisional alkaline adakite-like intrusions. Metallogenesis of continent-continent collision zones is prominent along the Myanmar-Thailand-Malaysia Sn-W granite belts, but less common along the Himalaya. The Mogok Metamorphic Belt of Myanmar is known for its gemstones associated with regional high-temperature metamorphism (ruby, spinel, sapphire etc). In Myanmar it is likely that extensive alkaline magmatism has contributed extra heat during the formation of high-temperature metamorphism. This paper attempts to link metallogeny of the Himalaya-Karakoram-Tibet and Myanmar collision zone to tectonic processes derived from multi-disciplinary geological studies.