Vol. 89 No. 1 pp. 300–303 ACTA GEOLOGICA SINICA (English Edition) Feb. 2015

News and Highlights

Introduction to “Metallogenesis of Continental Collision”

HAO Ziguo[1,2], FEI Hongcai[1,2], HAO Qingqing[3] and LIU Lian[1,2]

1 *Chinese Academy of Geological Sciences, Beijing 100037, China*
2 *Editorial Office of Acta Geologica Sinica (English edition), Geological Society of China, Beijing 100037, China*
3 *Editorial Office of Geology and Exploration, Institute of Mineral Resources Research, China Metallurgical Geology Bureau, Beijing 101300, China*

There is a general consensus that Plate Tectonics can explain metallogenesis based on the collisions between oceanic and continental crust. For instance, the large-sized porphyry copper deposits that occur along the Cordillera of the Andes around the east coast of the Pacific, and in the Phillipines, Malaysia and Indonesia along the western coast of the Pacific that sit upon the massive Pacific plates. They are considered to be typical of deposits resulting from collision between the oceanic and continental crust. Many experts, however, have long held a negative view about whether the collision between continental crusts can lead to metallogenesis. In recent years, Chinese geologists have proposed a new concept for “Continent–Continent Collision Metallogenesis” after many years of studying in the Qinghai–Tibet Plateau. Here we give a brief introduction to this idea.

Towards this aim, detailed researches were conducted on the collisional orogeny and metallogenesis in the Qinghai–Tibet Plateau, which finally helped the geologists to propose an innovative, systematic metallogenesis theory of continental collision, herein simply named “The Metallogenesis of Continental Collision” (MCC). This theory suggests that ore-forming settings in the Tibet collision orogen can be subdivided into main-collisional intracontinental accretion, late-collisional transitional, and post-collisional crustal extension settings, which were in response to main-, late- and post-collision processes.

During the main-collisional period --- continental impact and slab underthrusting resulted in crustal shortening, thickening, and associated syn-peak metamorphism, which produced crust-derived low- fO_2 felsic melts by crustal anatexis and CO_2-fluids of metamorphic origin, as well as relevant Sn-W-U and Au mineralization in a collisional or central axial zone and in the foreland basin. Subsequent breakoff of the subducted slab triggered upwelling of the asthenosphere, mantle/crust melting and stress relaxation, creating hydrous, high-fO_2 felsic melts, a MASH process at the bottom of the lower crust and formation of magmatic-hydrothermal polymetallic systems as well as MVT deposits in the foreland (Fig. A).

Late-collisional period --- transform structural setting, characterized by large-scale strike-slip faulting, shearing and thrusting, was developed in the edges of the orogenic belt, to absorb and adjust strain and stress caused by collision. Translithospheric mega-shearing probably triggered upwelling of the asthenosphere, which resulted in potassic felsic, lamophyric and carbonatite-alkalic magma systems, derived from lithospheric mantle and crust-mantle transitional zone, and relevant magmatic-hydrothermal systems to form porphyry Cu-Mo-Au and complex-hosted REE deposits. Thrustnappe systems at shallow structural levels controlled sediment-hosted base metallic deposits formed by long-distance migration of basinal brines (Fig. B).

Post-collisional period --- lithospheric delamination, thinning at depth and crustal extension at shallow levels caused intense melting of the thickened crust. Anatexis of the middle-upper crust generated leucogranitic magmas and associated Sn-W-U mineralization in the central axial zone and Au mineralization in the foreland. Melting of a thickened, newly-formed lower-crust created potassic felsic magmas with porphyry Cu-Mo mineralization in the collisional zone. The detachment fault systems related to extension and high-level emplacement of felsic magmas commonly drive convective geothermal systems and associated Au, Au-Sb, Sb, and Cs mineralization in the rift zone and in the exhumed core complex or domes. Infill by terrestrial sediments in the foreland basin and in rift basins within the orogenic belt is commonly

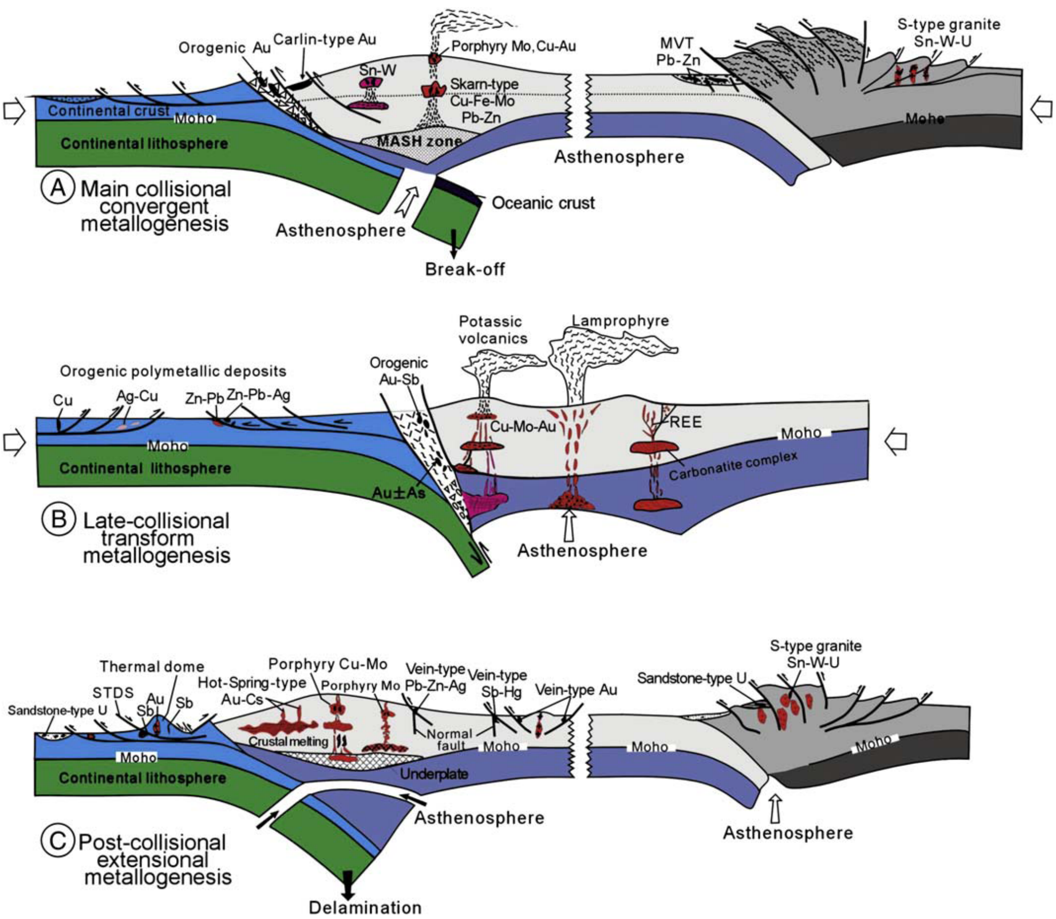

Fig. 1. Three-stage tectono-magmatic evolution and resultant typical deposits in the continental collision orogenic system (Hou and Cook, 2009).

associated with sandstone-type U deposits (Fig. C).

The theory of metallogenesis of continental collision proposed from the Tibetan orogeny has made a great contribution to the recognition, definition and exploration of different types of ore deposits in Tibet, and thus makes an exciting breakthrough for the mining economy and the geosciences in general.

References

Hou, Z.Q., and Cook, N.J., 2009, Metallogenesis of the Tibetan collisional orogen: A review and introduction to the special issue: *Ore Geology Reviews*, 36, nos 1–3: 2–24.

E-mail: haoziguo@126.com