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Genetic and exploration model of Jiadong-type gold deposits

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The giant Jiaodong gold province with proven gold reserves of as much as 4500 tonnes stretches across the North China Craton (NCC) and Sulu ultra-high pressure metamorphic belt. It underwent three significant orogenic events including the Paleoproterozoic Jiao-Liao-Ji orogenesis, the Triassic collision between Yangtze Craton and NCC, and the subsequent subduction of the paleo-Pacific plate beneath the Asia continent during Jurassic to Cenozoic. In this area, the high Ba–Sr Linglong granite intruded into the Precambrian basement rocks at ~163-155 Ma with the formation of the Linglong Metamorphic Core Complex and beginning of a lithospheric-scale extension in East Asia, which was induced by slab-rollback-related asthenospheric upwelling. Under control of brittle-ductile deformation, hydrothermal alteration initiated at 130±4 Ma with insignificant gold mineralization in the Linglong detachment fault (LDF) zone, which is corresponding to the rapid cooling and exhumation of the footwall along the LDF as well as the intrusion of the Guojialing granitoid at 132-123 Ma. It was always overprinted by the major gold mineralization and related intense brittle deformation at ca. 120 Ma. Regardless of the duration of the mineralization, it occurred in an extensional environment at a background of rollback of ancient Pacific Izanagi subduction plate. Similar to orogenic gold deposits, the Jiaodong-type deposits are strictly controlled by faults, while their mineralization is dominated by disseminated and stockwork ores with little auriferous quartz sulfide veins as well as breccia, this is distinct from typical orogenic deposits. Besides, the Jiaodong-type deposits are also characterized by wide Fe-rich K-feldspar alteration zone and relative high amount of iron sulfide in the ores. Although Jiaodong-type deposits have similar S and Pb isotope ratios with their host rocks, the host rocks cannot provide substantial gold due to its low content of invisible gold in pyrite. On the other hand, relative high $^{87}Sr/^{86}Sr$ ratios, and enrichment of heavy H-O isotopes of the deposits indicate that ore-forming materials may mainly derive from recycling crustal rocks, such as subduction slabs and their overlying gold-rich pyrites. Sulfidation reactions and phase separation induced the mineralization. Thermochronological data revels that the ores have been partly eroded with the major orebodies in the deep have been preserved well. In a reasonable exploration model proposed based on geological, geochemical and geophysical data, diamond lattice faults, which are the first indicator for exploration, play a vital role in the formation of the mineralization. The orebodies are always located in the jogs and connections of faults. Certainly, they are also in the alteration zones. Hence, for the exploration, structure-lithofacies mapping, and gravity and magnetic measurements are primarily carried to locate the ore-controlling faults. Secondly, alteration and mineralization mapping, and electromagnetic measurement are used to locate the ore-bearing alteration zones. Then targets of ores will be determined by synthetically structural analysis, and geochemical and geophysical abnormities. Finally, the drilling and comprehensive logging are supposed to reveal the concealed orebodies. Huge gold resources have been successfully located with the application of these procedures in the Jiaodong Peninsula.