

Structural Controls on Gold Mineralization in the Jiaojia Gold Field

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Jiaodong is the largest gold province of China, and contains a large number of “Jiaojia-type” gold deposits which are famous for their unique mineralization style. The Jiaojia gold district is the place where the name Jiaojia-type gold deposits came from, and the first place where the first kiloton class gold ore field in China was found. The Jiaojia-type gold deposits (bodies) are structurally controlled by the NE-NEE trending Jiaojia fault and its near-parallel subsidiary faults of the footwall, and therefore are also referred to as structural fracture zone altered rock type gold deposits. There is a diversity of forming conditions and mineralization styles of gold deposits in the Jiaojia gold district, even in a single gold deposit such as the Sizhuang gold deposit where the association of the altered rock-, disseminated/veinlet-, and gold-bearing quartz veins-types mineralization would be found. In order to find out how structure controls gold mineralization, based on the analysis of ore-controlling structure, three-dimensional finite element model was made to calculate the change of Coulomb Failure Stress (ΔCFS) during mineralization epoch through stress transfer numerical modeling. The result shows all discovered deposits are located in stress increase areas and the amount of gold deposits has a positive correlation with the extreme ΔCFS value of the area (amount of gold $Q=4.526 \times \Delta CFS - 83.27$). As ΔCFS during mineralization epoch is caused by the fault activities, the uniformity in spatial distribution between gold deposits and the ΔCFS indicates the formation and presence of the Jiaojia-type gold deposits are controlled by the Jiaojia fault and its secondary faults in ore field scale. In the Sizhuang gold deposit, by analyzing the ore controlling structure and the occurrence of ore bodies, we find the altered rock type orebodies, located in a narrow belt area along the wall rock of the fault, are controlled by the Jiaojia fault; the NE-NEE trending disseminated/veinlet type ore bodies are controlled by secondary faults and the gold-bearing quartz veins-type ore bodies are controlled by tenso-shear fissure far away from Jiaojia fault. In deposit scale, structure controlling tectonic lens zone and joint zone formed during brittle deformation, ore-bearing thermal fluid driven by tectonic stress migrated to these areas, and structural controlled orebodies came into being. Combined with chronological data, we can finger out the fact that during Late Jurassic-Early stage of Early Cretaceous, NE right lateral fault formed under the action of NWW-SEE maximum principal stress along the contact zone of Jiaodong Group and Linglong granite; during the Early stage of Early Cretaceous, previous Jiaojia fault changed into right normal fault under the action of NNE-SSW maximum principal stress; during the Late stage of Early Cretaceous, NE-SW maximum principal stress resulted to a series of SN-EW secondary faults. The ore fluids controlled by tectonic dynamics flowed from the high pressure zone to the low pressure zone under the effect of deformation activities and diffused and migrated to the structure fracture zone, which resulted in the superimposition of alteration and mineralization, gold deposits (orebodies) formed under suitable physicochemical conditions.