
Permeability Evolution Within an Orogenic Disseminated Gold Deposit: Evidence from Liba Gold Deposit, Central China

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The nature of permeability associated with pervasive hydrothermal alteration within disseminated orogenic gold deposits is under-researched. The Liba orogenic gold deposit, located in West Qinling, Central China, hosts 112t of gold resources, predominantly in the form of disseminated gold. The slate wall rock mainly consists of quartz and sheeted silicate minerals such as sericite, biotite, and chlorite. Interparticle pores, found between sheeted minerals and/or quartz, have straight boundaries and appear as relatively regular polygons ranging in size from 5μm to 20μm. They are isolated and not interconnected, representing the intrinsically low permeability of the wall rock. In slate ore, iron-bearing minerals biotite and chlorite have been completely altered to pyrite and sericite. To be receptive to pervasive hydrothermal alteration, wall rock permeability needs to be enhanced. Notably, there are no significant differences in the types, sizes, and densities of pores within the ore compared to those in the wall rock, but these pores in the ore present distinct tortuous boundaries and irregular shapes. Significant pore differences imply that interconnected pores provide channels for pervasive fluid flow. Moreover, disseminated pyrite within the ores indicates the absence of macroscopic fractures, implicating the infiltration of hydrothermal fluid into the rocks through grain-scale microcracks. Mass balance and theoretical calculations suggest that after hydrothermal alteration, the solid volume of the rock increases (maximum up to 38%), leading to a decrease in rock permeability. Grain-scale microcracks thus should be induced by tectonic loading and hydraulic fracturing, which connect the pre-existing pores and serve as channels for fluid flow. The isolated pores within the ores represent destroyed permeability, which should be caused by the precipitation of hydrothermal minerals. Therefore, the evolution of permeability is controlled by a competition between permeability enhancement processes and permeability destruction processes.