

Genesis of the Mandongshan gold deposit in Xinjiang, NW China: T-P- f_{S_2} and phase equilibria constraints from the Au-As-Fe-S system

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The Mandongshan gold deposit, located in the west Junggar, Xinjiang, China, is hosted in Early Carboniferous basalt and tuff. Orebodies mainly consist of gold-bearing hydrothermal veins, and mineralized basalt and tuff with disseminated sulfides. Hydrothermal paragenesis can be identified based on ore petrographic studies: quartz-albite-sulfide-native gold (stage I), arsenopyrite-calcite-native gold (II), and pyrite-calcite (III). Microthermometric and laser Raman spectroscopic analysis of fluid inclusions in quartz demonstrate the ore-forming fluid at stage I was moderate temperature (360-398 °C), low-salinity (0.5-5.1 wt% NaCl equiv.), and H₂O-CH₄-dominant, which evolved to low-salinity (0.2-1.2 wt% NaCl equiv.) with an insignificant content of CH₄ at 219-267°C (stage III). Many ore-related elements (As, Au, Cu, Sb, Ba, Cs, Rb) are enriched in the mineralized basalt relative to the fresh basalt. Phase equilibria analysis for the Au-As-Fe-S system using the SUPCRT92 software package with the updated database of slop98.dat indicates that a decrease of H₂S activity and oxygen fugacity, which was caused by phase separation and fluid-rock reactions, induced native gold precipitation during stage I. The decrease of H₂S activity triggered by arsenopyrite crystallization caused native gold deposition during stage II.