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Discussion on origin of ore-forming fluid in the Liaotun gold deposit in Bama County, Guangxi, China

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The Liaotun gold deposit, located in northwestern Guangxi Province, is the only gold deposit spatially related to a quartz porphyry body. The mineralization is associated with NW- and E-W-trending faults that cut Middle Triassic pelitic siltstone and graywacke country rock. Some gold orebodies are hosted within the quartz porphyry and two quartz porphyry dikes in the area strike NE. The $^{40}Ar/^{39}Ar$ dating of muscovite from the quartz porphyry yielded dates of 95.5±0.7 Ma. Orebodies are present as veins or as lensoid bodies. Gold mainly is hosted in pyrite, quartz, organic matter, and clay minerals. Wallrock alteration includes silicification, sulfidization, and argillization. The hydrothermal mineralization include at least two stages that pre-date and post-date emplacement of the quartz porphyry.

Studies on the petrography of fluid inclusions in quartz in the mineralization stages suggest that inclusions are mainly two-phase aqueous (VH_2O+ LH_2O) and two-phase carbonic (VCO_2+LCO_2). Microthermometry of fluid inclusions in the main ore stage shows that the homogenization temperatures range from 160 to 240℃. The ice melting temperatures range from -7 to -4℃ and the the salinities range from 1.57 to 12.28 wt% NaCl equiv.. The densities range from 0.77 to 1.01 g/cm^3. Laser Raman Spectroscopy indicates that the fluid is rich in non-aqueous volatile components, such as CO_2 and CH_4. Based on all of the above, the ore-forming fluids are moderate temperature, low salinity, low density fluids, and care aqueous-carbonic.

The δD of fluid inclusions in hydrothermal quartz ranges from -61.1‰ to -49.3‰. The $\delta^{18}O_{quartz}$ ranges from 18.7‰ to 20.5‰.The calculated $\delta^{18}O_{water}$ ranges from 7.71‰ to 9.51‰. The data for hydrogen and oxygen isotopes indicate that the ore-forming fluids were probably derived from magmatic fluids. In this district, the quartz porphyry was emplaced in late Yanshanian, and there is a large mass of concealed intrusive rock at depth in the Yunnan-Guizhou-Guangxi border area. This accounts for the magmatic derivation of the ore-forming fluids. The $^{40}Ar/^{36}Ar$ for fluid inclusions in hydrothermal pyrite is 308.4, and the percentage of radioactive Ar* is 4.14%, The data for argon isotopes thus indicate that the ore-forming fluid is mainly meteoric water. The $^{40}Ar/^{36}Ar$ of fluid inclusions is slightly higher than that of the air saturated water (295.5), and we suggest that it may have seeped downward along the fault systems and extracted radiogenic ^{40}Ar by water-rock exchange with country rocks. Therefore, we speculate that the ore-forming fluids were probably derived from a mixture of magmatic fluids and meteoric water.