Ore-Forming Conditions, Chemical Compositions, and Sources for the Dongping Gold-Telluride Deposit, NE China, Based on Fluid Inclusion, EMPA and H-O-S Isotopes Studies

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The Dongping goldfield is located within the Shuiquangou alkaline complex of the western Yanshan Mountains of Hebei Province, on the northern margin of the North China Craton. It is one of the largest gold deposits in China, with a planned gold production of 2.57 t annually over a lifespan of 12 years. The elements Au, Te, Ag, Pb, Bi, Sb, and As were analyzed with the goal of characterizing the type of gold deposit represented at Dongping. Most gold is present in the telluride minerals calaverite (43% Au, 38% Ag) and petzite (23% Au, 46% Ag). Gold mineralization is hosted mainly by K-feldspar-quartz (stockwork and veins) and disseminated sulfides.

The deposit contains three ore types that are distinguished by their mineral associations: quartzose gold, telluride gold, and disseminated gold. The paragenesis of the ores exhibits three distinct hydrothermal stages, of which the second was the main ore-enrichment stage. The Dongping alkalic gold deposit is characterized by a low grade base metal, anomalous association with W, Sn, and Mo) and low total sulfide content (<3 wt %). Fluid inclusions in quartz from the deposit trapped dilute fluids with variable salinity (2–12 wt % NaCl equiv) at homogenization temperatures between 236° to 417°C, at depths of 1124 to 1264 m below sea level, with the ore-forming process pressure varying (53–97 MPa). The laser raman spectrum of the inclusions indicates the fluid vapor compositions are mainly in H_2O, CO_2, accompanied by small amounts of CH_4 and N_2. Hydrogen isotope compositions of the fluid inclusions of quartz-vein are (-100.3 to -74.7‰ (δD)) and oxygen isotope compositions for fluids calculated from $\delta^{18}O$ values are (+11.7 to +13.1‰, SMOW) for quartz minerals. These values indicate that the fluid came from sedimentary rocks or organic water. The sulfur isotope negative values from the pyrite varies (S=-7.3 to -5.6‰, VCDT), indicating that the sulfur has a sedimentary source. These isotopic data show that the gold-rich telluride mineralization processes come from a basinal fluids source.