

Fluid Evolution of Vein-Type Gold Deposits, Porto Nacional Province, Tocantins – Brazil: Fluid Inclusion and Oxygen Isotope Evidence.

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Fluid infiltration into a complex, transcurrent, shear system has produced phyllonite-hosted, quartz vein-gold mineralization in the Porto Nacional Province.

Based on fluid inclusion measurements and oxygen isotope studies of quartz and carbonate from the veins, three fluid events have been recognized. (i) The earliest stage is related to carbonic fluids that comprise two-phase $\text{CH}_4\text{-CO}_2\text{-H}_2\text{O}$ inclusions (type C) with low salinities (1-2.5 eq. wt % NaCl), and homogenization temperatures of 353°-355°C. These fluids preceded the mineralization and their calculated $\delta^{18}\text{O}_{(\text{f})}$ values (3-10‰) are compatible with metamorphic fluids. (ii) as the system evolved, the fluids became less carbonic as indicated by aqueous carbonic (type AC) inclusions. This type has a wide salinity range (1-15 eq. wt % NaCl), does not contain CH_4 , and is related to the gold formation. Homogenization temperatures range from 310° to 273°C, and calculated $\delta^{18}\text{O}_{(\text{f})}$ values vary from 2.7 to 4.4 ‰.

(iii) The latest stages of fluid evolution are related to aqueous fluids. These are characterized by high salinity (10-16 eq. wt % NaCl) two-phase inclusions (type A), with still lower homogenization temperatures (254°-219°C) and calculated $\delta^{18}\text{O}_{(\text{f})}$ values of 0.2 to 1.7 ‰.

Fluid evolution in this system has been characterized by a progressive decrease in temperature, carbon content (and CH_4/CO_2 ratio) and $\delta^{18}\text{O}_{(\text{f})}$, and an increase in fluid salinity. These data, along with the lack of evidence for boiling, suggest that gold precipitation may have resulted from the mixing of low-salinity, metamorphic (type C) and shallow, high-salinity (type A) fluids.