Fluid composition and evolution of the Tiriganiaq Gold deposit, Meliadine project, Nunavut, Canada

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The Meliadine Gold Project is an iron formation-hosted orogenic gold deposit located about 25 km north of Rankin Inlet in the Kivalliq region of Nunavut. Gold mineralization of the Meliadine project are spatially associated with the Pyke Fault, a regional structure that extends up to 80-km length. Previous work has identified four major deformation events in the area (D_1-D_4). The interpretation was originally that gold mineralization was limited to D_3 with no remobilization, whereas the current interpretation suggests mineralization in an interval of D_1-D_3 with potentially significant remobilization. Fluid inclusion petrography of 13 samples from the Tiriganiaq deposit has led to the identification of four major types of inclusions that will be subject to microthermometry. Quantitative analysis of volatile gases by mass spectrometry was performed for normalized mol% values of H_2, He, CH_4, H_2O, N_2, H_2S, Ar and CO_2 on the same samples. The results will help to identify processes, constrain temperature, pressure, redox and the activity of sulfur for these hydrothermal fluids; parameters that have not been fully constrained for Meliadine yet. The studied inclusions range in both salinity and CO_2 content. We consider the possibility of the separation of a hypersaline aqueous fluid and a CO_2-dominated vapor from a single phase fluid while dropping under its critical point. In systems like these, it is possible for the vapor phase to be the primary agent for gold transport. This interpretation is further supported by the gas analysis data which shows a correlation between high gold grades and high CO_2/CH_4 ratios. One particular sample with 66.3 g/t Au yielded CO_2 content up to 74.3 mol% and a CO_2/CH_4 ratio as high as 189.7. It has been suggested that the gold found in the Meliadine deposit was transported by arsenothio complex, however there is a lack of experimental data for arsenothio gold complexes under hydrothermal conditions. This means that attempts to quantify the solubility of gold in these fluids must use the equations and constants originally derived for reduced-sulfur complexes. These calculations however, may prove to be critical for understanding the maximum gold solubility and the mineralization mechanism for the Meliadine Gold Project.