# Microthermometric and Raman analysis of fluids that interacted with variably graphitic pelitic schist in the Dufferin Lake zone, south-central Athabasca Basin: Implications for graphite loss and uranium deposition

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The Athabasca Basin (Canada) contains the highest grade unconformity-type uranium deposits in the world. Underlying the sedimentary rocks of the basin in the Dufferin Lake zone are variably graphitic pelitic schists; altered to chlorite and hematite, and locally bleached near the unconformity (Red/Green Zone: RGZ) during paleoweathering or later fluid interaction.

Fluid inclusions (FI) were examined in quartz veins, using microthermometry and Raman analysis, to characterize and compare the different fluids that have interacted with the RGZ and the graphitic pelitic schist. The inclusions appear to be secondary, which is compatible with quartz veins from deformation zones.

Monophase vapor are the dominant type of FI in the graphitic pelitic schist, whereas aqueous two-phase (L+V) and three-phase (L+V+Halite) FI occur in the RGZ. The temperature of ice melting of aqueous fluid inclusions from the RGZ are between -23 and -26°C, which suggests a salinity of 34wt% using the $H_2O$-NaCl-$CaCl_2$ system. The temperature of homogenization (TH) varies mainly between 90 and 170°C. The temperature of dissolution of halite (190-200°C and 210-220°C) yields a salinity of about 32wt% eq. NaCl for the paleofluid. In the graphitic pelitic schist, all FI homogenize into the vapor phase. The $CH_4$ dominant fluid has a TH between -81 and -74°C. The $N_2$ dominant fluid has a TH between -152 and -100°C. Some contain $CO_2$ and traces of $H_2S$. The aqueous fluid is interpreted to be the regional basinal fluid. The monophase vapor FI could be the break down of graphite to $CH_4$ and associated feldspars/micas to $NH_4$ and $N_2$; three possible reductants for uranium mineralization.

# Zn-Pb-Fe sulfide formation in Grieves Siding peat, Tasmania

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Aqueous aluminosilicate colloids in mineral formation had been studied in hydrothermal systems, but little is known in low temperature environments. The Grieves Siding Zn-Pb rich peat was investigated to understand the role of organic matter and colloids in the transport and formation of metal-bearing minerals at ambient conditions. The peat samples revealed pronounced enrichment in Zn (up to 28.6 wt%), Pb (up to 3.8 wt%) and other metals. Highly unusual assemblages of sulfides, carbonates, phosphates, oxides, sulfates, silicates, native metals and inorganic carbon were identified in addition to the ubiquitous organics. Dominant sulfide is ZnS with minor PbS and $FeS_2$. ZnS commonly exhibits colloform texture appearing like schalenblende at smaller scale. The banded ZnS incorporates O (up to 18.5 wt%), Al (up to 4 wt%) and Pb (up to 2.3 wt%), as well as minor (<0.5 wt%) Si, Cd, Fe, As, Ag, and Ni. Carbon is also present. The banding indicate variability in the distribution of Al, O and occasionally C, relative to Zn and S. Dark bands corresponds to an elevated concentration of Al, O and C whereas light bands are linked to diminishing abundance of Al-O-C and prevalence of Zn-S. Sulfate reduction by bacterial action is implicated in the formation of the sulfides. Metal-rich aqueous aluminosilicate colloid precursor to colloform ZnS is possibly produced from the bioweathering of silicates. Organics may also have participated in the transport, deposition and retention of the metals in the peat.

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