Abstract, Geological Association of Canada, May, 2014

Detection of deeply buried uranium deposits using radon gas: a case study in the Athabasca Basin.

M Devine[1], **K Hattori**[1], **J Cornett**[1], **T Kotzer**[2]

[1]Department of Earth Sciences, University of Ottawa, Ottawa, ON, *mdevi032@uottawa.ca*;

[2]Cameco Corporation, Saskatoon, SK

The Athabasca Basin, Saskatchewan, hosts many world-class high-grade uranium deposits and many occur along the unconformity between the crystalline basement and Athabasca sandstones. The unconformity is at shallow depths in the eastern part of the Athabasca Basin, but it is at deeper levels towards the centre of the Basin. This poses a challenge in finding deposits below thick sandstones. Furthermore, recent discoveries were made in the basement rocks. This opened the possibility of finding more in the basement far below the unconformity. This study examines the behaviour of radon (Rn) dissolved in groundwater at Cameco's Millennium deposit: a high-grade, basement-hosted uranium deposit, which has 68.2 M lbs (indicated) and 22.3 M lbs (inferred) U_3O_8 at a depth of approximately 750 m. In August 2013, samples (n = 32) of gas dissolved in groundwater were collected from cased and cemented drill holes (n = 11) and monitoring wells (n = 2). Sample locations were chosen based on varying proximity (0 - 700 m) to the surface projection of the deposit. Groundwater shows neutral pH (6.9 - 7.5), low conductivity (134 - 287 µS/cm), low Cl (8 - 11.3 mg/L) and ^3H concentrations (< 8.8 TU). Three different techniques (water, mineral oil extraction, gas diffusion sampler) were employed to measure Rn and they yielded similar results. Turbidity of water and colour appear to not affect the counting efficiency of Rn with liquid scintillation spectroscopy. All samples in the area of 1.5 x 1 km show detectable levels of Rn varying from 0.8 to 277.6 Bq/L. The highest was observed in DDH CX-40, directly above the deposit and the lowest was in DDH CX-44, approximately 300 m from the surface projection of the deposit and upslope of groundwater flow. A depth profile from 10 m - 50 m of the borehole CX-40 shows Rn concentration is highest at 10 m below surface (278 Bq/L), the lowest at 30 m (189 Bq/L). The contents of U increase from 1.7 ppb at 10 m depth to 46 ppb at 50 m, suggesting that U is not causing the increase in Rn at shallow depth. The variation in Rn contents does not correlate with other parameters of water such as pH, conductivity, and halogen contents. This preliminary data indicates that the measurement of Rn provides an efficient tool in identifying deeply buried uranium deposits. *CMIC-NSERC Exploration Footprints Network Contribution XXX.*