Lead isotopes in exploration for basement-hosted structurally controlled uranium deposits

A. BENEDICTO[1], D. QUIRT[2] AND J. ROBBINS[3]

[1] Université Paris Sud, UMR GEOPS, 91405 Orsay. France
[2] University of Manitoba, Winnipeg, MB, Canada R3T 2N2
[3] Orano Canada, Saskatoon. SK S7L 5X2. Canada

Lead isotopes have been proposed as indicators of the fluid evolution of sedimentary basins and as guides for exploration of Athabasca Basin sandstone-hosted (egress-style) unconformity-type uranium deposits. The Pb isotope ratios provide information on timing of mineralization and element remobilization, and presence and timing of U and Pb migration. In sandstone, samples proximal to mineralization display dominanat radiogenic Pb isotope ratios unsupported by the amount of U in the sandstone. However, the Mesoproterozoic Kiggavik uranium deposits of the NE Thelon Basin region, Canada, are all basement-hosted, within a completely different variety of Neoarchean metamorphic rocks, and the mineralization displays a strong structural control. The Kiggavik basement samples were analysed for Pb isotopes by both partial-digestion and WAL. Attention was focused on the 3D distribution of the Pb isotopes at the Contact prospect (Fig.1) in which mineralization extends along the NE-trending Andrew Lake fault. Plots using the 206Pb/204Pb, 207Pb/204Pb, 208Pb/204Pb, and 207Pb/206Pb ratios show systematic trends and show Pb isotope halos outside of the mineralized area. While the halo footprints are limited in extent, reflecting the structural control, they confirm that Pb isotopes can be useful for indicating elevated potential for presence of uranium mineralization and can provide vectoring information useful for U exploration within basement lithologies, outside of the sandstone environment.

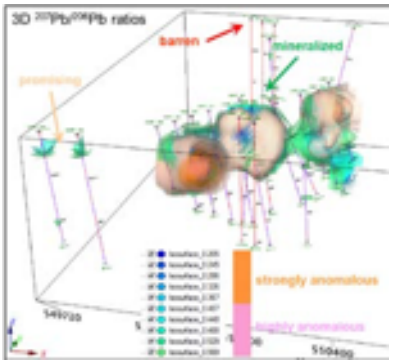

Fig. 1. 3D model of 207Pb/206Pb isotope ratios distribution at the Contact prospect.