Integrated Geochemical Fingerprinting of Uranium Deposits for Sustainable Exploration & Development

T. Kandasamy[1], E. Bergen[2], J. Whattam[3], D. Quirt[4], J. Reid[2], L. Zuin[2], M. Fayek[3], N.R. Banerjee[1], L.L. Van Loon[2]

[1]Earth Sciences, Western University, London, ON; [2]Canadian Light Source, Saskatoon, SK; [3]Geological Sciences, University of Manitoba, Winnipeg, MB; [4]AREVA Resources Canada, Saskatoon, SK

In the next 10–20 years, the emerging economies of nations will increase the demand for energy and resources. This growth will expand the market for metals and minerals, making this important Canadian sector indispensable to the projected needs of global development. Therefore, techniques that can improve exploration models for minerals and metals will significantly benefit Canadians and Canada's economy. Uranium exploration is the foundation of Canada's nuclear energy industry and Saskatchewan has been a world leader in uranium exploration for over 60 years. New uranium deposit discoveries require new techniques to detect large-scale and deep ore-forming systems. Therefore, new methodologies and approaches to maximize the chances of success are required. The goal of this project is to create innovative, predictive geochemical fingerprinting methods for uranium exploration based on synchrotron and geochemical techniques in the Athabasca and Thelon Basins. For example, synchrotron X-ray absorption spectroscopy and isotope geochemistry, together with traditional lithogeochemistry and mineralogical analyses will lead to a better understanding of the relationships between pathfinder elements, such as boron, and uranium mineralization to provide new exploration vectors. Preliminary results from the VLS-PGM beamline, at the Canadian Light Source (a world premier beamline for the detection of light elements) show that boron in powdered, clay-altered samples can be detected and that the binding environment for boron can be characterized. Stable isotope geochemistry will provide information on the source of the fluids that formed these deep and covered uranium deposits. With new knowledge about the mineralizing system, future exploration will be focused to more prospective regions, reducing the environmental impact of an exploration program.