Ansdell K, Kyser TK, Wasyliuk K, and the Exploration Footprints Project team, 2018, Footprints of the Millennium, and McArthur River unconformity-related uranium deposits, Saskatchewan, Canada: highlights and challenges, Abstract, Society of Economic Geology, Keystone, USA

The McArthur River and Millennium unconformity-related uranium deposits in the eastern Athabasca basin are the focus of the uranium site in the CMIC Mineral Exploration Footprints Project. These deposits are associated with structures that cut the unconformity at the base of the basin and occur at depths over 500 m below surface. High-quality, closely spaced geological, geochemical, and geophysical data are available in the vicinity of the deposits and along the structural corridors, and the aim is to constrain the extent of the footprint of alteration in the Athabasca Group sandstones extending from the deposits to the surface within a self-consistent Common Earth Model. Geochemical investigations utilizing data from sandstone drill core have confirmed previously identified pathfinders, but the use of molar ratios (K, Mg, Al) has broadened the alteration footprints. Identification of the footprint at surface is complicated by the presence of distally and proximally sourced tills, although these can be distinguished using airborne radiometric data. New sampling has confirmed radiogenic Pb and uranium anomalies in soils, tree cores, and boulders above the McArthur River deposit, and investigations of fractures in the sandstones, along with lithogeochemical chimneys, provide evidence of pathways for dispersion of specific elements and radiogenic lead toward the surface. Identifying geophysical footprints in the sandstones has proven to be challenging due to the small physical property changes related to alteration, and the subtle geophysical responses are masked by the stronger overburden and basement signatures. However, low Q values (attenuation factors) derived from seismic surveys at the Millennium deposit appear to be recording altered rocks. Modeling of synthetic and real geophysical data has constrained approaches to be used in stripping the signature of the overburden. Overall, establishing best practice methodologies for inversion and geophysical surveys will provide useful approaches for exploration at depth in the Athabasca basin.

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