Valentino MM, Kyser TK, 2015, Analysis of fractures in sandstones of the Athabasca basin as records of primary and secondary element dispersion, Abstract, SGS Open House, Saskatoon, SK

The McArthur River deposit, one of the largest uranium deposits in the world, is a known unconformity-related uranium deposit and is located in the southeastern portion of the Athabasca Basin in Saskatchewan, Canada. Samples of Athabasca Group sandstone containing fractures were selected from drill core of the Manitou Falls Formation. They were collected to reflect a spectrum of fracture-coating types in core within a vertical extent of 118 m to 614 m and a horizontal extent of ~2106 km, from near-ore to barren areas to compare fracture-fill mineralogy and chemistry to the background signature of the Athabasca Group. The main objective is to determine if fracture-coatings record the migration of U mineralization components resulting from primary and secondary dispersion. Fracture fillings were placed into seven fracture types through characterization by optical petrography, SEM (Scanning Electron Microscope), XRD (X-ray diffraction), and SWIR (Shortwave Infrared Reflectance Spectroscopy) that represent various colors, mineralogies, and chemistries. Sample digestion using Weak Acid Leach (WAL) digestion was performed to leach only mobile elements. The analyses were carried out using HR-ICP-MS to determine major elements, trace elements, and Pb isotope ratios, which emphasize records of primary dispersion and secondary dispersion. Fracture coatings show similarities in clay mineralogy between the fracture filling and the adjacent wall-rock, indicating that fluid-rock interaction extended into the host rock 4-7 cm away from the fracture itself. This selection of fracture types is controlled by depth and result from various fluid environments including primary and secondary dispersion, as well as diagenetic background fluids of the Athabasca Group. REE patterns on some of the leachates from druzy quartz, Fe-Mn oxides, clays and tourmaline fracture-coatings, are preferentially enriched in medium REE showing a bell-shaped pattern, which is characteristic of uraninite from McArthur River. Although APS minerals on fracture-coatings are major hosts for much of the REEs, minerals such as tourmaline, clays, and especially Fe-Mn oxides/hydroxides also host REEs, leading to normalized patterns that are enriched in LREE or have equant LREE/HREE ratios. Fractures-coatings can be used to detect primary and secondary dispersion from U mineralization at depth through geochemical and mineralogical analyses. This research may lead to the development of new U exploration techniques in the Athabasca Basin, as it will enlarge the footprint of the deposit.

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