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Alteration minerals and elemental assemblages around the Phoenix uranium deposit, Athabasca Basin, Saskatchewan

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The Wheeler River Property, host of Denison Mine's Phoenix Uranium Deposit, is situated near the southeastern rim of the Athabasca Basin in northern Saskatchewan. Discovered in 2008, the deposit currently has resources of 39,449,000 million lbs. U_3O_8. The Phoenix Deposit occurs at a depth of approximately 400 m. It occurs both along a shear zone and the unconformity between Athabasca sandstones and the underlying Archaean to Paleoproterzoic metamorphic rocks. The shear structure is named the 'WS shear', which occurs along the boundary between a graphitic pelite and a garnetiferous pelite in the basement and cuts through the overlying Athabasca sandstones. Rocks near the shear structure and the unconformity are commonly altered to form disseminated, very fine-grained secondary minerals.

Bulk rock compositions of drill core were determined at 10 m intervals, comprising of a dataset of over 6700 rock samples. The geostatistical analysis of the data was linked with the mineralogical-petrological observations of samples using a petrographic microscope, SEM, EPMA, XRD and TerraSpec®. The results of the rocks along the shear zone show that the alteration in the basement is characterized by the coeval formation of sulphide (pyrite and chalcopyrite) and dravitic tourmaline. It is accompanied by intensive alteration of kaolinite and illite. The alteration along the shear zone in the sandstones is represented by the formation of kaolinite-group minerals, illite, and dravitic tourmaline. The concentration of U is positively correlated with As, W and Mo but not with S, K, Al, and B within the shear zone. Therefore the introduction of U into the 'graphitic conductor' appears to have taken place as a separate event, most likely after the pervasive alteration.