

Geochemical Surface Expression above the Phoenix and Millennium Uranium Deposits, Athabasca Basin, SK: Improving Exploration Vectors

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Abstract

The geochemistry of surface media above two known U deposits were examined to propose improved geochemical exploration techniques to reduce cost of finding undiscovered U resources. We examined the materials overlying the Phoenix deposits, which have indicated resources of 58.2 million lbs U₃O₈ grading 15 wt% at 400 m depth at the unconformity between the overlying sandstones and basement rocks. Aqua regia digestion, ammonium acetate at pH 5 and hydroxylamine leaches revealed U, Pb, Co, Ni, Mo, and W anomalies in humus and U, W and As anomalies in B-horizon soils above the ore zones and the basement location of a deposit-hosting “WS Hanging Wall” shear zone. Metal signatures suggest upward transport of metals from the deposits to overlying sandstones, and into the overlying till and soils. We also looked at materials above the Millennium U deposit, which has indicated resources of 68.2 million lbs U₃O₈ grading 4 wt% at ~750 m depth along a major fault in granites and metamorphosed pelites. Soil samples over the ore-hosting fault and ore zone yielded anomalous values in U, Ni, Cu and Pb in aqua regia digestion of humus and U, Cu and Pb values in ammonium acetate leach of pH 5 of B-horizon soils. ⁴He/³⁶Ar ratios of gas dissolved in water-filled drill holes were observed to be up to 700 times the atmosphere value for air-saturated water, revealing radiogenic ⁴He that was likely produced from decaying U and released in groundwater above the deposit. Results suggest upward migration of metals to surface through porous sandstone and fault systems at Phoenix, and upward migration of metals along faults and He gas at Millennium. Both studies indicate the importance of the traverse method of sampling over targets perpendicular to the last major ice-flow event to discern U deposits that are defined by other means.