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GEOCHEMICAL ANOMALIES IN SURFACE MEDIA AND UPPERMOST SANDSTONES OVERLYING THE CONCEALED PHOENIX URANIUM DEPOSIT, ATHABASCA BASIN, CANADA

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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 resource estimates between 52 to 55 million lbs. U₃O₈. Mineralization occurs as mainly monominerallic uraninite with in four pods pods termed the A, B, C and D ore zones. This deposit has no surficial expression, and occurs near the unconformity between the crystalline basement rocks and overlying Athabasca sandstones at approximately 400 meters depth. The surficial environment consists of gently rolling hills covered by glacial tills and moraine, with overburden varying in thickness from 25 to 100 m. In September 2011, we initiated a study to evaluate whether geochemical anomalies related to such a deeply seated deposit exist in surface media or the overlying sandstones. A total of 226 soil samples (humus, B, E, and C-horizon) from 59 sites along 3 transects over the "A" and "B" ore zones were collected approximately 10 meters apart. In addition, traverse sampling was done to determine "background values" in the settings.

Geochemical analyses of the samples revealed the presence of strong U, Mo, Co, Ag and W anomalies in humus, B-horizon soil and uppermost sandstones not only overlying the A and B zones, but also over a nearby northeast-trending "WS Hanging Wall" Shear Zone. Peak to background ratios were up to 6 times (5.7 ppm) for U, 5 for Mo (4.8 ppm), 4 for Co (5.2 ppm) 20 for Ag (0.98 ppm) and 18 for W (100 ppm), respectively, in the various surface media. The geochemical anomalies in the surface media and the uppermost sandstones over the shear zone suggest that the fault is acting as a conduit for upward movement of fluids from the deposit. This fluid movement and resulting geochemical expression in surface media provides excellent exploration tools for deeply seated unconformity-related uranium deposits in Proterozoic sedimentary basins.

The 5.7 ppm U anomaly by aqua regia digestion method of the humus layer yielded among the strongest and most robust geochemical anomalies, and therefore is recommended as the leach of choice in this arid area of the Basin.