Geochemical anomalies in soil and sandstone overlying the Phoenix uranium deposit, Athabasca Basin

**Introduction**

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 (Figure 1). The mineral resources drilled to date are estimated to contain 35 to 39.5 million pounds U₃O₈, with the deposit formed in 4 distinct ore bodies which are open along strike at both ends. This deposit was originally thought to have no surficial expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones. Anomalies related to such a deeply seated deposit exist in surface media and the expression, and occurs near the unconformity between the early Paleoproterozoic crystalline basement rocks and the overlying Athabasca Group sandstones.

**Study Area**

The Athabasca Basin experiences a sub-arctic climate (Figure 2) with long, dry, and cold winters and warm, wet summers. The surface topography on the Wheeler River Property consists mainly of gently rolling hills of glacial moraines and till, and has experienced several ice flow episodes. The area is covered with ~3 m tall black pine trees (Figure 5) and carbon moss and minor shrubs. Average thickness of permafrost is approximately 25 to 100 m in places, with the uppermost sandstones below the permafrost. The study area receives approximately 475 mm of annual precipitation.

**Sampling & Analysis**

In September 2011, a total of 226 soil samples (humus, B, E, and C horizon) from 59 sites along transects over the “A” and “B” ore zones were collected approximately 10 meters apart in undisturbed forest (Figures 5 and 6). Humus samples were subjected to aqua regia digestion, whereas B horizon soil samples underwent both an ammonium acetate and hydroxylamine leach, with all being measured with ICP-MS. Soils were dried at 60°C to minimize loss of volatile elements, and screened at 180 µm (~60 mesh ASTM).

**Ongoing Work**

- Lead isotope compositions will be determined with a TIMS noble gas abundance analysis of gas samples collected from selected sites.
- Distribution of geochemical anomalies in surface media in near, normal, and far away 10 meters away from the ore bodies through sandstone.
- Broad anomalies in the uppermost sandstones near shear zone suggest upward movement of elements from the ore bodies through sandstone.
- Geochemical anomalies in surface media overlying the Phoenix uranium deposit, Athabasca Basin.

**Results**

**Humus & Sandstone**

<table>
<thead>
<tr>
<th>Element</th>
<th>Co</th>
<th>Ni</th>
<th>U</th>
<th>Mo</th>
<th>Ag</th>
<th>W</th>
</tr>
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<tbody>
<tr>
<td>Distance (m)</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**B horizon & Sandstone**

- Geochemical anomalies in surface media overlying the Phoenix uranium deposit, Athabasca Basin.
- Geochemical anomalies in surface media overlying the Phoenix uranium deposit, Athabasca Basin.
- Distribution of geochemical anomalies in surface media in near, normal, and far away 10 meters away from the ore bodies through sandstone.

**References**

- Gamelin et al. (2010). The deposit straddles the WS Hanging Wall Shear Zone (dashed line)."