

^{14}C Ages and $^{87}\text{Sr}/^{86}\text{Sr}$ Isotopic Values for Water Samples Collected from Drift Aquifers in the Athabasca Oil Sands In-situ Area, Alberta

Tony Lemay
EUB/Alberta Geological Survey
4th Floor, Twin Atria Building, 4999-98 Ave., Edmonton, Alberta
Tony.Lemay@gov.ab.ca

Isotopic analyses ($\delta^{14}\text{C}$ and $^{87}\text{Sr}/^{86}\text{Sr}$) were performed on water samples from three inter-till aquifers, one basal aquifer resting on bedrock and one Quaternary/Tertiary buried channel aquifer in order to better understand aquifer geometries, recharge characteristics and geochemical processes.

Ages for the inter-till aquifer samples in years are: 1557 ± 90 , 2402 ± 110 , 2532 ± 58 . The basal aquifer age is 30880 ± 257 years. The age for the buried channel aquifer sample is 11186 ± 79 years. Although unlikely, mixing of ^{14}C sources to account for the calculated ages cannot be discounted at this stage.

The three youngest-aged water samples are from piezometers installed at the same site. Ages increase with depth suggesting that the aquifers were recharged since the last glaciation. $^{87}\text{Sr}/^{86}\text{Sr}$ values decrease with depth and Sr- $^{87}\text{Sr}/^{86}\text{Sr}$ plots reveal a mixing relationship between the aquifers. Additionally, hydraulic heads measured in these piezometers suggest hydraulic connection. The age for the basal aquifer suggests it contains water recharged during the onset of the last glaciation and is isolated from the regional groundwater flow system. $^{87}\text{Sr}/^{86}\text{Sr}$ values at this location decrease with depth but Sr- $^{87}\text{Sr}/^{86}\text{Sr}$ plots do not show a mixing relationship. Hydraulic heads differ significantly between piezometers at this site, further implying aquifer isolation. The age of the buried channel aquifer sample suggests it contains water recharged near the end of the last glaciation. The $^{87}\text{Sr}/^{86}\text{Sr}$ value is consistent with other wells completed in this aquifer.

The ^{14}C ages, $^{87}\text{Sr}/^{86}\text{Sr}$ values and hydraulic heads from these aquifers reveal complex recharge pathways and variable aquifer geometries and interconnectivities.