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Booth No. 173 THE ROLE OF STABLE ISOTOPES (δ^{37}CL, δ^{81}BR, δ^{18}O, δ^{2}H) IN ASSESSING SALINITY IMPACTS ON THE WATER RESOURCES OF THE OAK RIDGES MORAINE, ONTARIO, CANADA

Monday, 5 November 2018
09:00 AM - 06:30 PM
Indiana Convention Center - Halls J-K

The Oak Ridges Moraine (ORM) is recognized as a regionally significant groundwater recharge area and is a source of domestic water for the Greater Toronto Region. It is important to understand the elements derived from natural and anthropogenic sources that mix within and infiltrate this groundwater system.

In the last 50 years, the application of deicing chemicals (road salt) to southern Ontario roadways has become the standard practice during the winter season. Approximately 4.9 million tonnes of road salt is applied annually to Canadian roadways; this accounts for about 3.0 million tonnes of chloride. [1].

Stable isotopes of water (δ^{18}O and δ^{2}H) and tritium (^{3}H) provide an initial classification of groundwaters for age and mixing within the aquifer of the study area. In order to understand the origin of salinity inputs into the aquifers, samples of localized road salt and bedrock brines were analyzed for δ^{37}Cl and δ^{81}Br and were compared with the isotopic signature of groundwater samples obtained from a number of regional production and municipal wells across the ORM. The impact of each potential source is assessed using an appropriate comparison of isotopic ratios and geochemical plots which identify specific isotopic signatures of these sources. The stable isotopes were analyzed at the University of Waterloo Environmental Isotopes Laboratory, Waterloo, Ontario [2,3].

The highest chloride concentrations (800-1400 mg/L) are found at shallow depths and carry the localized isotopic signature for road salt. However, high concentrations (>200 mg/L) are also found in both older and recently recharged waters up to 170 metres in depth, some of which carry the road salt signature. This discovery suggests high chloride concentrations are not limited to shallow depths where the anthropogenic input is high, but also at greater depths where contributions from both natural and anthropogenic sources are present. This study's findings suggest that both natural and anthropogenic sources need to be considered in the monitoring of chloride in the groundwaters of the ORM.

[1] Environment Canada (2001) Technical Report.

[2] Shouakar-Stash et al. (2005a) Analytical chemistry 19(2)

[3} Shouakar-Stash et al. (2005b) Analytical chemistry 77(13)

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