Groundwater Recharge and Mixing in the Oak Ridges Moraine Complex, Ontario Canada

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The Oak Ridges Moraine (ORM) is a 160-km long ridge of sand, silt and gravel deposits north of Lake Ontario, which extends west from the Niagara Escarpment and eastwards to the Trent River. Understanding the complex flow system is complicated by the regional geology, which includes bedrock valleys, till aquifers, aquitards, and eroded tunnel channels. The ORM is recognized as a regionally significant groundwater recharge area because it is responsible for the recharge of aquifers which provide drinking water for hundreds of thousands of residents and also provides base flow to the headwaters of hundreds of streams. Understanding the groundwater flow system, protection of this region and management is an vital matter for the entire region.

To date most studies use environmental age tracers to study flow and mixing in aquifers [1], however on the scale of the Oak Ridges Moraine there has not been a study that examines the use of multiple environmental age dating tracers to constrain the end members. This study endeavors to use geochemical data, including age dating tools to help characterize the complex aquifer and flow systems of the Oak Ridges. Using both old and new age determination tools this study examines old glacial sedimentology (~130k) to considerably younger sediments (~20k) [2] and allows for an understanding of the complex flow system within the Oak Ridges Moraine, its end members and mixing scenarios. Rare gas data combined with stable isotopes and environmental tracers will help to understand the different flow systems within the ORM, mean residence time, temperature at the time of recharge and mixing. The next step in understanding the ages of this complex aquifer system involves accounting for age determination issues such as those posed by the influence of methane on carbon-14 dating and the connection between methane and ^{13}C from carbonate dissolution of old carbonates.

[1] Solomon *et al* (1995) *Ground Water*, **33** (6), pp. 988-996
[2] Barnett *et al* (1998) *Can. J. Earth Sci.*, **35**, pp. 1152-1167