HIGH RESOLUTION MULTI-TRACER STUDY OF WATER FLOW AND SOLUTE TRANSPORT IN THE GLACIAL TILL

*Edward Komla Pappah Bam[1]

1. University of Saskatchewan

The aim of this study was to explore water flow and solute transport mechanisms in the unsaturated and saturated zone (aquitards) and how the mechanisms differ between uplands and lowlands in the Canadian Prairie glacial till. Past and recent studies on surface water-groundwater interaction involving physical measurements and stable isotope tracers show that prairie wetland ponds have distinctive isotope signatures from till aquitards and aquifers and that they may not play significant roles in groundwater recharge. Tritium data from aquitards and aquifers also suggest that aquifers are recharged with modern water. The observations suggests that uplands may play an important role in prairies groundwater recharge and possibly contribute more recharge water to aquitards and aquifers. We studied three soil profiles depths (0.2- 8 m, 0.2-10 m, and 0.2 -14 m) obtained from uplands and lowlands to identify the extent of deep percolation in the uplands and the lowlands and to test the established hypothesis of depression focused recharge, and critique it. We employed sets of tracers ($\delta^{18}O$, $\delta^{2}H$, Cl^- & SO_4^{2-}), line condition (lc)-excess, complemented by soil analysis and physical measurements from piezometers. The depth profiles show a steady increase in both $\delta^{18}O$, $\delta^{2}H$ tracers and lc -excess below depth, from the ground surface to >2m in lowlands and >5m in both uplands and piezometers. The Cl^- and SO_4^{2-} also showed leaching to similar depths. The change in $\delta^{18}O$, $\delta^{2}H$ and lc-excess values below 7 m depth is muted and no significant evaporated water signals was found in the aquitards. It is suggested that the major process responsible for enhancing deep water flow and solutetransport into aquitards and intertill aquifers is not soil infiltrability beneath permanent recharge wetlands (i.e., depression focused) but rather preferential flow; since the former will lead to greater degree of evaporation before recharge.

Keywords: Glacial till, stable isotopes, lc-excess, chemical ions, water flow and solte transport, mechanisms

