Without geology there would be no hydrogeology - a Canadian perspective

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Canada is perceived as a land of limitless water, whether that be snow and ice, or rivers and lakes big enough to be seen from space. Our predominantly urban population has long viewed water as safe, cheap and limitless. This is not the case. In 2000, 7 people died and 2500 people become seriously ill from drinking municipally supplied water contaminated with E. Coli. The province of Ontario has now passed legislation mandating the development of watershed based Source Water Protection plans to ensure the future safety of our water resource. Watershed characterization, regional groundwater flow models, the establishment of aquifer recharge and well protection zones and identification of threats to water safety are key elements of the plans.

Providing a holistic understanding of the rock and sediments that water flows through underpins the Provincial government's water protection policies for southern Ontario. The Ontario Geological Survey has contributed by releasing fully attributed GIS-based maps including bedrock geology, surface geology and drift thickness. The survey is currently focusing on regional scale three-dimensional (3D) mapping of Quaternary and bedrock aquifers, and ambient groundwater geochemistry.

Geologically, southern Ontario is characterized by predominantly glacial sediments up to 275 m thick. Surface and buried valley systems are important as they may contain significant aquifers which can act as conduits for moving groundwater between watersheds. In the Barrie-Oro moraine area of south central Ontario, glacial sediments up to 180 metres thick are bisected by a partially in-filled tunnel-valley network. Separation of upland and valley-fill sediment packages during the modelling process has allowed the development of more realistic surfaces than those used in previous flow models and identified potential connections between aquifers.

An extensive network of buried bedrock valleys in southern Ontario is evident on the provincial bedrock surface. The water well records used to generate the bedrock surface, however, have a sporadic distribution and many valleys are either poorly defined or missed. Augmentation of this legacy data by a ground-based gravity survey and a series of boreholes has allowed definition of one buried valley system. The valley serves as a point of connection between different bedrock aquifers and an escarpment confined to the buried valley separates the sandy valley-fill it into two distinct sediment aquifers.

The 3D program is demonstrating that a systematic understanding of geology in 3D enables an evidence-based approach to water resource assessment and protection on a regional scale. Further, the program is developing novel ways of communicating its scientific results to geologists, engineers and the public. This presentation will use examples from the Ontario program to demonstrate the strengths and weaknesses of multi-disciplinary research and 3D modelling in water resource planning.

aquifer, hydrostratigraphy, 3D mapping