Defining the hydrogeological framework for environmental studies in Newfoundland and Labrador

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Most of Newfoundland and Labrador is underlain by fractured bedrock, characterized by low matrix porosity and permeability, with a thin veneer of overburden. In most places, this overburden consists of a thin soil cover over glacial till and/or glacial-fluvial material with moderate porosities and permeabilities. Peat bogs and wetland areas are common. Significant deposits of alluvium with high porosity and high permeability are restricted to a few areas of the province. In contrast to many other parts of North America, the overburden in Newfoundland generally has a very low clay content. In addition, except for the western part of the island of Newfoundland and the southern coast of Labrador, the bedrock and the locally derived overburden generally have low buffering capacities.

Coupling these hydraulic properties with the high precipitation and relatively high relief of most areas of the province, produces complex groundwater flow systems with strong interactions between surface water and groundwater flow systems. This presentation reviews the use of three-dimensional groundwater flow and transport models to determine the configuration of two regional flow systems, one in fractured granitic rocks and the second in fractured sedimentary rocks. The configuration of the flow system and the predicted travel times determined using these three-dimensional flow and transport models provide a tool for evaluating changes in the isotopic and chemical composition of surface and ground waters between different parts of the flow systems and a basis for distinguishing between changes that reflect natural groundwater evolution and anthropogenic effects. The complex flow system configuration and short residence times in the shallow part of the groundwater flow system, predicted by these models and confirmed by the groundwater isotopes, show the need to carefully define the configuration and dynamics of the groundwater flow system as an integral part of most environmental studies and, given the low natural attenuation capacity of the natural system, when siting hazardous waste facilities.

Atlantic Geology, July 1993, Volume 29, Number 2