The chemical and isotopic composition of groundwater in Northeast British Columbia: implications for local and regional groundwater flow systems

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ABSTRACT
Water demand in Northeast British Columbia (NEBC) is increasing due to a growing population and increasing agricultural and industrial needs. Groundwater is critical to meeting that demand, and gaining a better understanding of the groundwater flow systems is vital for resource management. In this study, 243 groundwater, spring and surface water samples as well as 3 years of monthly atmospheric precipitation samples from the Peace River Regional District of NEBC were collected and analyzed for the chemical and isotopic composition. These data were used to identify the relationships between the different aquifer systems and the chemical composition and mean residence time of the groundwater. The groundwater composition is strongly controlled by the lithologies that constitute the two near surface aquifer systems recognized in NEBC. The Quaternary sediment aquifers are dominated by Ca-Mg-HCO_3 to Ca-Mg-HCO_3-SO_4 type waters reflecting the role of carbonate and gypsum dissolution in the near surface systems. In the Cretaceous bedrock aquifers, cation exchange, calcite dissolution and pyrite oxidation result in the shift to Na-HCO_3 and Na-SO_4-HCO_3 type waters. Recharge appears to be dominated by spring and fall rain even though the region has the highest rainfall during the summer months. The presence of tritium in the Quaternary hosted groundwater suggests relatively recent recharge while the bedrock-hosted groundwater typically contained little or no tritium indicating a much longer mean residence time. The groundwater chemistry supports that the Quaternary aquifers are local and discontinuous and the bedrock aquifer systems tend to be more regional and have very low flow rates.