

The geochemistry of springs and surface waters of Wood Buffalo National Park, Canada

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ABSTRACT

Wood Buffalo National Park (WBNP) is Canada's largest national park with an areal extent of almost 45,000 km² encompassing millions of hectares of boreal forests, extended wetlands and prairie, karstic landforms, and groundwater-dependent ecosystems. Geochemical compositions of groundwaters and surface waters in the region were mapped, and used to investigate possible rock-water interactions. Surface waters and springs in the area show significant variability in geochemical characteristics, i.e., total dissolved solids ranging from less than 1,000 mg/L to more than 300,000 mg/L. Hydrochemical facies of the waters varies from end-members of Ca-HCO₃-type to more evolved Na-Cl-type waters. Analysis of oxygen and hydrogen stable isotopes revealed that groundwater in the region has a strong correlation with the average isotopic composition of local precipitation, thus it is believed that groundwaters originate from meteoric water, rather than from formation waters of the Alberta Basin. Dissolved NaCl content of groundwaters in WBNP is not related to evaporation of seawater; instead, the dominant processes affecting the waters are dissolution of halite, sulphate minerals and carbonates. The source of solutes in the groundwater is thought to be Devonian evaporites and carbonates; however, halite-bearing units can only be found 70-100 km west of the brine springs discharging at the eastern edge of the area. It follows that these waters must have traveled in the subsurface from the halite dissolution edge to their discharge location; consequently, they are thought to form a regional-scale flow system.

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