Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37244

Regional-scale assessment of coastal groundwater salinization in eastern Quebec: Disentangling seawater intrusion from geological minaralization in coastal aquifers

MÉLANIE MOREIRA[1], GWENDOLINE TOMMI-MORIN[1], YAN BOULET[2], VINCENT CLOUTIER[3], THOMAS BUFFIN-BÉLANGER[2] AND GWÉNAËLLE CHAILLOU[2]

[1]Université du Québec à Rimouski, Institut des Sciences de la Mer

[2]Université du Québec à Rimouski

[3]Université du Québec en Abitibi-Témiscamingue

Coastal groundwater in the Bas-Saint-Laurent and Gaspé Peninsula region (eastern Quebec, Canada) represents a critical drinking water resource increasingly threatened by climate-driven salinization. Sea-level rise, marine submersion, and drought are shifting the freshwater–saltwater interface landward, promoting seawater intrusion into shallow aquifers. Yet in this region, groundwater mineralization is also strongly influenced by geological inheritance, including evaporitic formations and extensive glacio-marine deposits from the Goldthwait Sea. Distinguishing active seawater intrusion from water–rock interaction is therefore essential to understand salinization pathways and anticipate future vulnerability.

Here, we present the first large-scale, regional integrated hydrogeochemical assessment of coastal aquifers in eastern Quebec. A total of 212 groundwater samples, primarily from private wells located less within 1 km of the coastline, were analyzed, providing unprecedent spatial coverage across this extensive coastal territory. Hydrogeochemical characterization combined physicochemical parameters (temperature, electrical conductivity, pH), stable isotopes of water and inorganic carbon ($\delta^{18}O$, $\delta^{2}H$, $\delta^{13}C$), major ions (Ca, Na, Cl, K, HCO3, SO4, Mg) and Br as a tracer of marine influence. Piper diagram analysis reveals dominant Na-Cl and Na-HCO_3 facies, reflecting both conservative mixing and ion-exchange processes. Stable isotopes of water align closely with the Global Meteoric Water Line, indicating predominantly meteoric recharge, largely derived from snowmelt. Mixing models using rain, snow, and seawater allows the relative contributions of these sources to be assessed. Estimating the seawater endmembers were applied to quantify seawater contribution. The geochemical seawater intrusion index (GQIswi), combined with diagnostic ionic ratios (Br-/Cl-, Na+/Cl-, SO4/Cl-, and Ca/Cl-) and isotopic signatures enables discrimination between conservative seawater mixing, evaporite dissolution and cation exchange.

This regional-scale dataset establishes a geochemical baseline for eastern Quebec coastal aquifers and provides new insights into the coupled climatic and geological controls on freshwater salinization. The results contribute to a broader understanding of salinization dynamics in cold-region coastal systems undergoing rapid environmental change.