

Setauket Pond, Long Island New York, USA: An Anthropogenically Influenced Natural Laboratory to Study Boron Isotopes in Surface and Groundwaters

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Abstract:

The Long Island aquifer system is a sole-source aquifer that provides drinking water to most of the population on the island. The United States Geological Survey (USGS) estimates that about 630 Bgal/d of water enters the flow system as recharge at the water table from rainfall and flows in the subsurface. Some 20% of the pumped water is returned to the aquifer system as wastewater from septic systems and cesspools in medium to high-density residential areas. Additionally, lawn care and agriculture are sources of leached nutrients to the groundwater system. Nitrate is a primary contaminant to surface waters, groundwater, and local water bodies such as the Long Island Sound. Surface waters often experience harmful algal blooms and/or eutrophication, particularly in the summer, driven by elevated nutrient loads, which is detrimental to the health of ecosystems. Boron isotopes have a proven track record as a tracer of groundwater contamination, but their use has rarely been employed in coastal regions where seawater's high concentration and heavy $\delta^{11}\text{B}$ value has a profound influence on the boron isotope budgets. We report on the boron concentrations and isotope compositions of a variety of sources including septic and fertilizer samples and rainwater and compare these to a three-year study of boron in the Setauket Pond and the springs that feed into that pond. The results do not point to a single source in this system, and in fact, our study shows a dynamic response over storm events, and gradients through the water column and across the pond. A main take away point from this study is that the glacial aquifer appears to be compartmentalized such that each spring has its own signature, and therefore its own contaminant history.