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№ 12900

USING STABLE OXYGEN ISOTOPES TO DEVELOP A CONCEPTUAL MODEL OF GROUNDWATER FLOW IN A VERMONT UPLAND BASIN

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Characterization of groundwater flow on a regional scale is a difficult problem, especially in a complex geologic setting. This study uses stable isotope tracing techniques, to determine groundwater flow patterns in an upland watershed, a first for New England.

The Browns River originates on the slopes of Mt. Mansfield, the highest peak in Vermont, in the form of several steep tributaries in glacial till overlying shallow fractured metamorphic bedrock (schist). The lower portion of the river basin consists of a broad valley with thicker interbedded glacial deposits and lacustrine sands and clays overlying bedrock. This geologic setting creates a complex arrangement of interconnected surficial and bedrock aquifers of varying permeabilities and storage capacities. Several small but rapidly developing towns are located in the lower valley, and draw their water supplies from both porous overburden aquifers and wells intersecting highly transmissive fracture zones in the bedrock.

For the purpose of predicting future sustainability of the water supply under rapid population growth in the area, a predictive numerical model is under development. To construct such a model, a conceptual understanding of the relationship between upper elevation recharge areas and the lower valley aquifers is necessary. In precipitation, depletion of heavy oxygen and hydrogen isotopes increases with elevation. Recent studies in Vermont have shown a gradient in oxygen isotope composition of -0.16 $^{o}/_{oo}$ per 100m elevation. As part of this study, precipitation samples from 16 stations are being collected on a weekly basis and analyzed for $^{18}O/^{16}O$ at the University of Vermont isotope laboratory. Additionally, sampling of several hundred groundwater wells and numerous stream baseflow locations is being conducted. Spatial patterns of isotopic composition in the groundwater and surface water are being compared to the isotopic signature of precipitation. This information is being used to delineate recharge locations for the water supply aquifers, and to determine groundwater flow paths in the basin.

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