



Halite Brine in the Onondaga Valley near Syracuse, New York: Simulation of Variable-Density Flow

**Presented by Richard Yager
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Halite brine that discharges from a glacial aquifer through springs at the south end of Onondaga Lake near Syracuse, New York has been exploited for salt production since at least the 18th century. The halite brine is confined within a narrow bedrock valley that extends from the north end of Onondaga Lake and south through the Tully Valley. The brine pool lies within glacial deposits that were deposited from 16,000 to 14,000 years before present (BP) during the northward recession of the glacial ice margin from the Valley Heads Moraine near Tully, New York. Brine-saturated deposits up to 300-ft thick are estimated to cover an area of 10 square miles and contain about 45 million MT of halite. The mass of halite in the current reservoir, combined with an estimate of halite production in the 19th century, is equivalent to a 2-mile slab of salt 20-feet thick extending across the bedrock valley (4,300 ft).

The halite brine is assumed to have formed through dissolution of bedded halite that sub-crops eight miles south of Onondaga Lake. Vertical salinity profiles obtained from core samples of glacial materials indicate that the highest salt concentrations occur at the north end of the bedrock valley and then decline southward (upgradient) to the sub-crop area, where fresh water occurs in the glacial deposits. The estimated age of the brine is 16,500 years based on geochemical reaction modeling with NETPATH that match measured values of ^{13}C and ^{14}C of inorganic carbon, suggesting that the bedded halite was dissolved by glacial melt water. The geochemical evidence suggests that the brine pool originated from a relict source of salt, migrated to its present position and is slowly being depleted.

The movement of the brine and fresher waters in the glacial aquifer system is simulated with two- and three-dimensional variable-density transport models constructed using SEAWAT. Steady-state and transient simulations are calibrated to represent the present distribution of the brine, together with the past effects of brine pumping for salt production in the 1800's and saline-water recharge from waste beds associated with the production of soda ash in the 1900's. Model parameters were adjusted through nonlinear regression to match observations of water levels, ground-water discharges, chloride concentrations and chloride loadings observed in wells, springs and streams in the Onondaga Valley. Simulation results were used to predict the extent of saline-water migration from the waste beds, and assess current hypotheses regarding the origin and fate of the halite brine.

CNYAPG

Richard Yager is a research hydrologist with the United States Geological Survey (USGS) and has been involved with ground-water modeling studies for over 25 years in western New York. He graduated from Cornell University with a BS in Civil Engineering (1973) and MS in Agricultural Engineering (1981). His research interests include application of nonlinear regression to parameter estimation in model calibration, and flow and transport modeling in fractured rock terranes. He is currently involved in ground-water modeling studies of the Shenandoah Valley in Virginia and in Rockland County, New York.

Meeting logistics: The meeting will take place on Thursday, April 20th at the LeMoyne Manor, located at 629 Old Liverpool Road in Liverpool, New York. A social hour will be held from 5:30 p.m. to 6:30 p.m. and will be followed by a buffet dinner starting at 6:30 p.m. The main presentation by Mr. Yager will begin at about 7:30 p.m.

The cost of dinner is \$20 for members, \$22 for non-members and \$15 for student members. People may also attend the presentation only for a nominal fee of \$3. Please RSVP by Monday, April 17th to Bonnie at Parratt-Wolff via e-mail at bolney@pwinc.com or (315) 437-1429

