Delaware Groundwater Monitoring Network: Geochemical Analyses for Sustainable Resource Management

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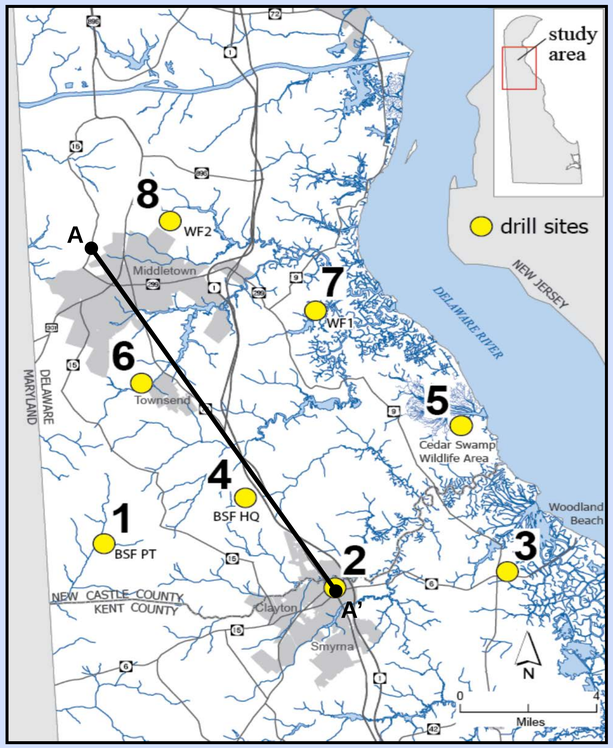
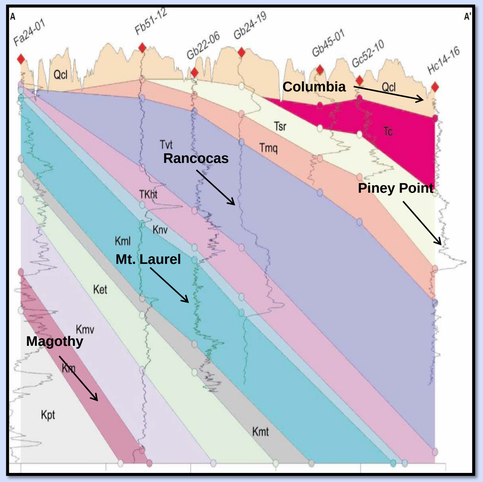
Objective

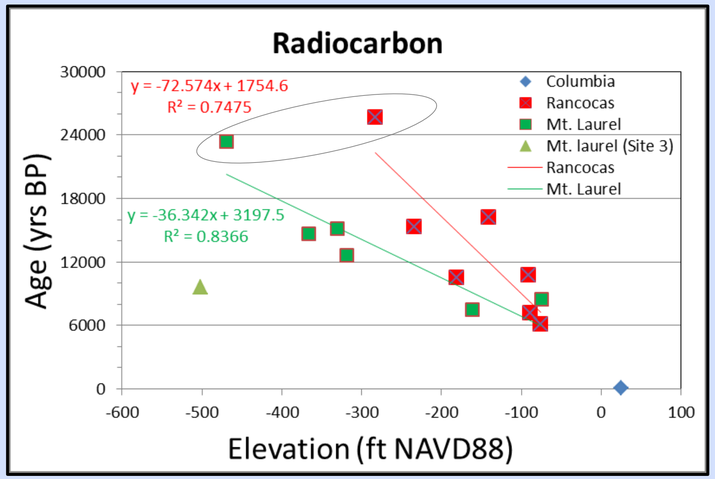
The Delaware Groundwater Monitoring Network has collected detailed hydrogeologic information from wells constructed in the coastal plain, unconfined (Columbia) and confined aquifers (Piney Point, Rancocas, Mt. Laurel, and Magothy) that address near-term critical water resource management issues in southern New Castle and northern Kent Counties.

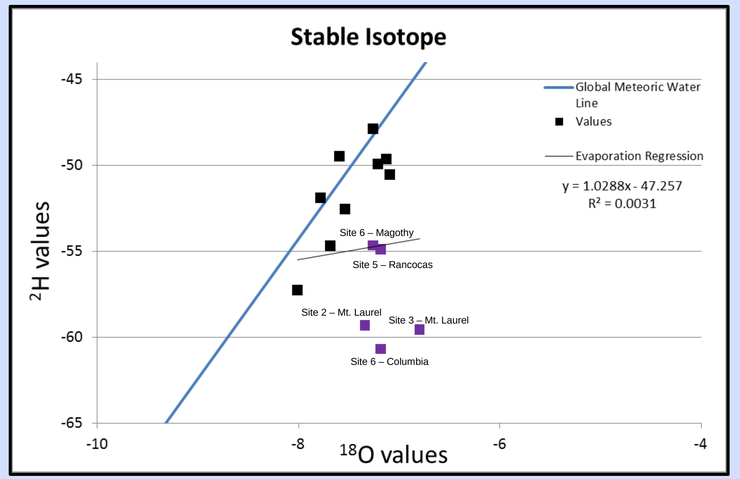
Methods

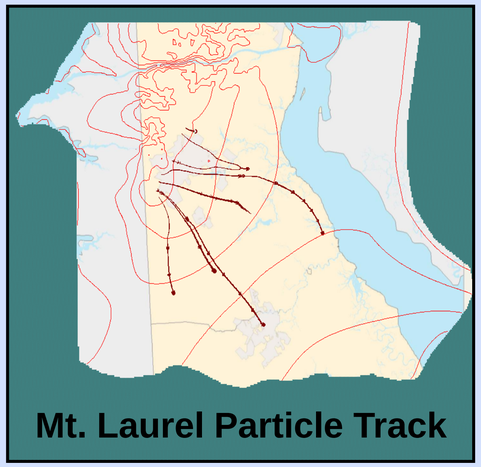
^{14}C: Beta Analytic Radiocarbon Dating
^{18}O and ^{2}H: Cornell University Stable Isotope Laboratory
TDS and Major Ions: University of Delaware Soil Testing Laboratory

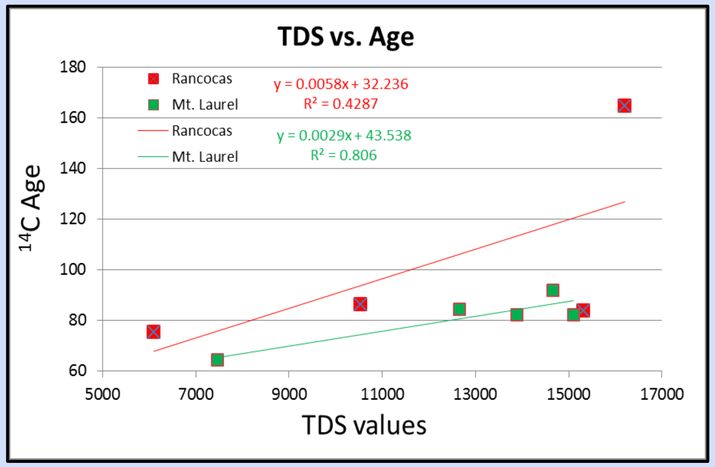


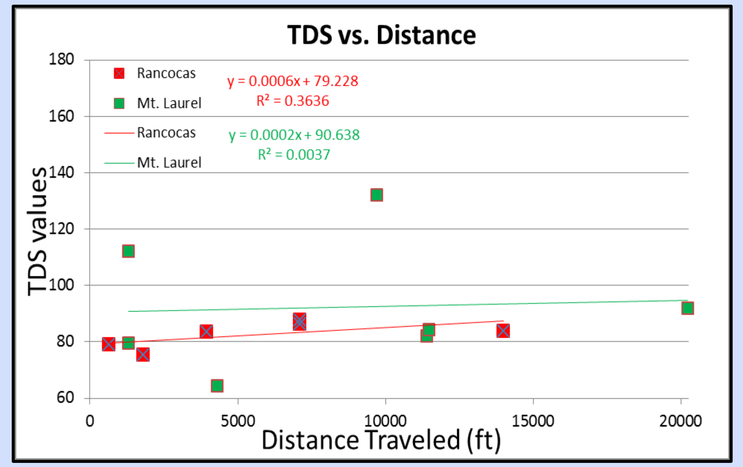


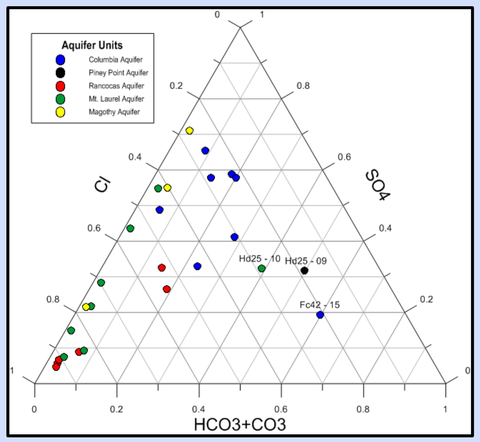












Selected Results

- ^{14}C samples collected from the Mt. Laurel and Rancocas aquifers indicate an age of 6.5 – 25.6 Ka. Aquifer matrix modeling indicates conventional ^{14}C ages are 10 – 30% too old. ^{14}C data supports the hypothesis that modeled age increases with decreasing elevation. Elevated ages (circled) may be due to methane leaching from the Queen Anne Basin beneath the sample location and mixing with groundwater.
- ^{18}O and ^{2}H corroborate the ^{14}C data and suggest a cold recharge temperature (~15 Ka). The ^{18}O and ^{2}H values position with respect to the GMWL indicate evaporative effects (purple data points) prior to infiltration due to potentially smaller paleo-recharge areas (permafrost, lakes?).
- TDS increases with age and decreasing elevation, supporting the notion that relative groundwater age can be determined from TDS concentrations (strong R^2). TDS does not increase along flow path (weak R^2).
- A small fraction of wells in the Piney Point, Rancocas, and Mt. Laurel (Hd25-09, Fc42-15, and Hd25-10, respectively) have been affected by pumping – induced saltwater intrusion based on the chloride – bicarbonate ratio and chloride concentration data.
- The groundwater geochemistry is affected by local, hydrogeologic factors and the leaching of agricultural contaminant run – off upgradient rather than regional, pumping – induced saltwater intrusion.

References

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