

# Northeast Section Meeting of the Geological Society of America Burlington, Vermont, 2001

## *FRACTURE DETECTION IN CRYSTALLINE BEDROCK USING SQUARE-ARRAY RESISTIVITY METHODS, EASTERN CONNECTICUT*

GAYLORD, Tracy J. and CARLSON, Catherine A., Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



Fractures in crystalline bedrock in eastern Connecticut were detected using azimuthal square-array and crossed square-array direct-current resistivity methods. To determine anisotropy as a function of depth, the square arrays were expanded and rotated around a central point, with each array sampling a cube of earth with dimensions approximately equal to the length of the side of the square (i.e., a-spacing).

Two field sites in the footwall of the Honey-Hill Lake Char Fault, both underlain by porphyritic gneiss, yielded different fracture strikes despite being only ½ mile apart. Whereas graphical representations of azimuthal data from Site A indicate one principal fracture strike of 045°-060° for a-spacings of 5.00m to 40.00m (with apparent minor strike directions), data from site B indicate three recurring fracture strikes of 120°, 030°, and 150°. At Site B a fracture strike of 120° dominates at a-spacings of 5.00m to 14.14m; 030° dominates at 20.00m and 28.28 m; and 165° dominates at 40.00m. At least three directions of fracture strike are apparent at Site B at each a-spacing.

The fracture strikes (at both sites A and B) determined using the azimuthal square-array data are consistent with data collected by colleagues conducting a detailed structural analysis of the region during the same field season. Due to multiple fractures detected at both sites, the crossed-square array method was not successful in analytically determining fracture orientation. In this study, we attempt to resolve the complex azimuthal plots into their respective apparent resistivity ellipses in order to determine the coefficient of anisotropy and the secondary porosity of the fracture systems.

## ***PRELIMINARY HYDROGEOCHEMICAL INVESTIGATION OF A RECONSTRUCTED VERNAL POOL, EASTERN CONNECTICUT***

**MARTYNIAK, Amylynn C.** and **CARLSON, Catherine A.**, Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



The hydrogeochemistry of a reconstructed vernal pool is being investigated as one approach to assessing the success of the reconstruction. Vernal pools are unique temporary wetlands found throughout the world that fill with water for at least two months a year and dry up yearly. Because vernal pools dry up, they are free of predatory fish and provide important habitats for amphibians and invertebrate communities. Only recently has the role of vernal pools in preserving biological diversity been recognized and efforts made to reconstruct them. The purpose of this study is to investigate the hydrogeochemistry of one reconstructed vernal pool in a glaciated terrain.

The reconstructed vernal pool at Gay City State Park, Hebron, CT, is located in an isolated depression in glacial till deposited during the Pleistocene. Direct precipitation and some runoff from surrounding uplands are the only sources of water to the vernal pool. Water is lost from the pool via evapotranspiration and leakage into the subsurface. The water chemistry of the pool is primarily the result of the precipitation chemistry, geologic materials/soil, and biological activity. As with all wetlands, pH and mineral and nutrient content influence biological activity and diversity.

Preliminary results indicate that the vernal pool water chemistry is significantly different from precipitation, the main source of water to the pool. Acid precipitation (pH 4-5) is buffered in the pool yielding pH values more conducive to biological activity (pH 6-7). Although both precipitation and pool water are dilute, the pool water exhibits slightly higher electrical conductivity, indicating an increase in dissolved solid content likely due to chemical interactions with geologic materials. Decreased values of dissolved oxygen in the pool relative to precipitation indicate that oxygen is being consumed in the pool as would be expected with biological activity. Water samples for major cation and anion content are being analyzed to investigate seasonal variations in vernal pool water chemistry and the hydrogeochemical reactions occurring within the pool.

# Northeast Section Meeting of the Geological Society of America New Brunswick, New Jersey, 2000

## *PRELIMINARY INVESTIGATION OF A RECONSTRUCTED VERNAL POOL: WHY DOES IT HOLD WATER?*

**SIDLIK, Alicia** and CARLSON, Catherine A., Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



Vernal pools are unique temporary wetlands found throughout the world that fill with water for at least two months a year and dry up yearly. Because vernal pools dry up, they are free of fish that prey on amphibians and invertebrates. Thus, vernal pools provide important habitats for amphibians and invertebrate communities. Only recently has the role of vernal pools been recognized and valued in preserving biological diversity. The purpose of this study is to investigate the hydrology of a vernal pool by the Inland Water Commission of the CT Department of Environmental Protection in Gay City State Park within the past year.

The vernal pool lies within a closed depression in glacial till that receives no surface inflows or outflows. Water levels in the pool and an adjacent piezometer (1.0 ft below land surface) indicate that the vernal pool is perched above the water table. Thus, water enters the pool via precipitation and leaves via evaporation and infiltration. From late September through early November, water was lost from the vernal pool at a rate of 0.03 ft/d. Initial data from an evaporation pan installed in the pool in November suggest that evaporation is responsible for approximately 45% of the water lost, while infiltration is responsible for 55% of the water lost.

The persistence of the vernal pool is attributed to the low saturated hydraulic conductivity ( $K_{sat}$ ) of the glacial till. Hydraulic conductivities of the subsurface material, determined using the Glover method and data collected with a Guelph permeameter, decrease from 0.67 ft/d at 0.18-ft depth to  $4.7 \times 10^{-3}$  ft/d at 1.03-ft depth. Soil samples collected within 1.25 ft of the surface show increasing clay content with depth, consistent with the decreasing hydraulic conductivity values observed.

# 53<sup>rd</sup> Annual Eastern Colleges Science Conference Fairfield, Connecticut, 1999

## *SUBSURFACE GEOLOGY AND FLUID TRANSPORT IN THE ECSU ARBORETUM*

**MILIKIN, Mark, E.** and CARLSON, Catherine A., Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.

The spatial distribution of surficial materials in the Eastern Connecticut State University arboretum was studied as part of a hydrogeologic investigation of the area. The published surficial geology map of the Willimantic quadrangle shows two materials, Qx (stratified drift) and Qt (glacial till), present in the arboretum. Four existing water table wells are located in these materials, 3 in Qx and 1 in Qt. Slug tests were conducted on these wells to provide information about the surficial deposits. In addition, two core samples, one from each material, were collected so that they could be described and particle size analyses could be conducted. The results of the slug tests indicate that the wells mapped in stratified drift deposit Qx have lower hydraulic conductivities ( $1.4 \times 10^{-4}$  cm/sec) than the well mapped in glacial till deposit Qt ( $5.5 \times 10^{-3}$  cm/sec). Core samples show a dominance of poorly sorted sands for both locations.

# 51<sup>st</sup> Annual Eastern Colleges Science Conference New Britain, Connecticut, 1997

## *SOIL-WATER GEOCHEMISTRY OF OUTER ISLAND, BRANFORD, CT.*

**GLEDHILL, Dwight, K.** and CARLSON, Catherine A., Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



Soil water, precipitation, and soil corings were collected for the purpose of developing a conceptual hydrogeochemical model of Outer Island, a small archipelago island in Long Island Sound. Graphical representations including Stiff and Piper diagrams were used to investigate the origin and evolution of the soil-water chemistry. Mineral-water interactions were examined using a simple mass-balance approach (Hounslow, 1995).

At most sampling sites the soil-water chemistry resembles precipitation. For locations very near the water's edge, seawater intrusion influences soil-water chemistry in the lower soil horizon. Sea-spray effects near the island's edge are apparent in the soil-water chemistry, and elevated  $\text{SO}_4$  levels observed in the upper soil horizon soil water may reflect the use of fertilizers on the island. Sodium and salinity hazards are observed at some localities that may be a threat to potable water and vegetation on the island.

***GROUNDWATER-POND INTERACTION IN A NON-TIDAL WETLAND:  
HYDROGEOLOGIC ASPECTS***

**KOSINSKI, Sean** and **CARLSON, Catherine A.**, Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



In recent years non-tidal wetlands have received increasing attention because of their environmental significance. Few studies of non-tidal wetland hydrology have been conducted, despite the fact that hydrology is the main influence on wetland ecology. This study will contribute to the understanding of wetland hydrology.

Four water-table wells were installed in a non-tidal wetland to investigate groundwater-pond interaction. The pond, located in the ECSU arboretum, straddles the contact between stratified drift and glacial till (Clebnik, 1980)—two wells in each material. Water levels in the wells and pond are measured weekly to determine groundwater flow in the pond's vicinity. Hydraulic conductivities were determined with slug tests. The combination of water-level data and hydraulic conductivities aid in the interpretation of the groundwater-pond interaction.

***GROUNDWATER-POND INTERACTION IN A NON-TIDAL WETLAND:  
HYDROGEOCHEMICAL ASPECTS***

**KRAMER, Daniel, J.** and **CARLSON, Catherine A.**, Environmental Earth Science, Eastern Connecticut State Univ., 83 Windham Street, Willimantic, CT 06226.



The hydrology of a non-tidal wetland pond in Eastern Connecticut State University's arboretum was investigated using a hydrogeochemical approach. The objective of the research was to determine whether the pond is groundwater dominated, surface-water dominated or is a mixed hydrologic system.

Four water-table wells were installed around the pond, which straddles the contact between stratified drift and glacial till (Clebnik, 1980)—two in each material. Water samples were collected and analyzed for major ions and metals from the wells, pond, and inflow and outflow streams. Stiff and Piper diagrams were used to investigate possible mixing of groundwater and pond water, and to compare water chemistry in the two geologic materials. Mineral-water interactions were examined using a simple mass-balance approach (Hounslow, 1995).