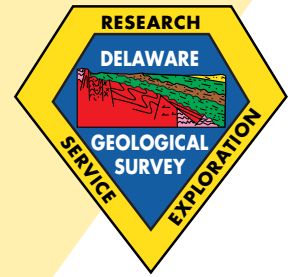


First State Geology

Current information about Delaware's geology, hydrology, and mineral resources

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DGS Co-Hosts Piedmont Field Conference

By W. S. Schenck

The DGS was privileged to co-host the 69th Annual Field Conference of Pennsylvania Geologists on October 7-9. The main focus of the conference was the Wissahickon Formation within the central Appalachian Piedmont Province. The Wissahickon Formation functions as an aquifer in portions of southeastern Pennsylvania and northern Delaware and is a source of public, domestic, commercial, and industrial water supply. An understanding of this formation is necessary for making land-use decisions related to such things as water supply, wastewater disposal, and construction.

Fieldtrip leaders from the Pennsylvania Geological Survey, West Chester University, and the Delaware Geological Survey shared their knowledge of the rocks in this area which included Wilmington Complex arc-related units, metasedimentary rocks of the Wissahickon and Setters formations, Cockeysville Marble, and Baltimore Gneiss of Laurentian continental affinity.

According to Gale Blackmer of the Pennsylvania Geological Survey, the Wissahickon Formation has been an enigma for nearly 100 years. "One look at an outcrop of the Wissahickon Formation tells even the most casual observer that these rocks have had a long and complicated history. The term Wissahickon Formation has a history which, although much shorter, is no less complicated than that of the rocks it is used to define." Fieldtrip leaders asked participants how they would separate the Wissahickon Formation, currently mapped across Maryland, Pennsylvania, and Delaware, into three different units based on depositional and tectonic environments and on the possibility of different metamorphic histories. Categorizing these rocks has been difficult due to the high metamorphic grade, intense deformation, and lack of outcrops in highly populated areas. Since most of the variation in the mineral assemblage is due to metamorphism, field evi-

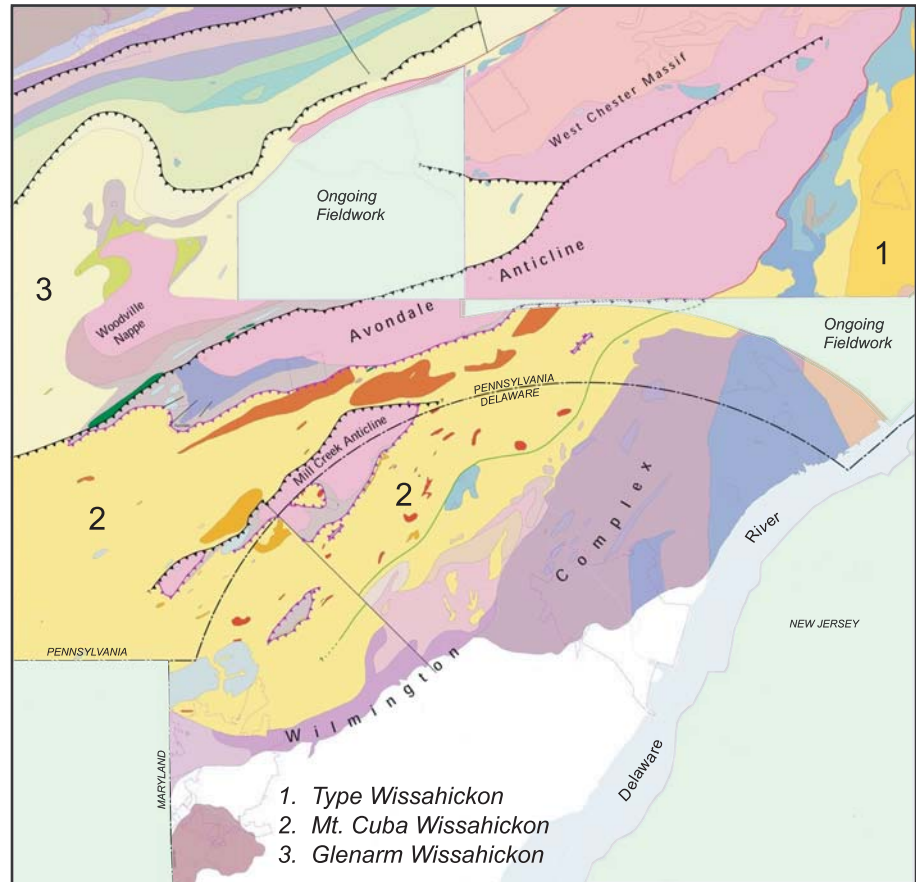


Figure modified from Blackmer, G.C., 2004, 102 years of Wissahickon-An introduction to the 69th Field Conference of Pennsylvania Geologists, in Blackmer, G.C., and Srogi, L., *Marginalia-Magmatic arcs and continental margins in Delaware and southeastern Pennsylvania: Guidebook, 69th Annual Field Conference of Pennsylvania Geologists, West Chester, Pa.* p. 1-5.

dence is difficult to interpret.

The 'type' Wissahickon is located near and around the Philadelphia area, the 'Mt. Cuba' Wissahickon lies between the Wilmington Complex arc in the east and the Avondale Anticline in the west, and the 'Glenarm' Wissahickon includes the rocks currently mapped as Wissahickon northwest of the Avondale Anticline to the Woodville Nappe. According to Blackmer, "recognition of divisions within the Wissahickon Formation has allowed us to construct tectonic models that place the individual units in different depositional units and tectonic environments. These models refine previous models that proposed differing environments for parts of the Wissahickon. Still, we do not all agree on

a single model and questions remain."

There were over 180 participants in this year's conference who came to share geologic insight on the rocks. Some of the participants were Delaware licensed professional geologists who will use the fieldtrip as part of their continuing education requirements for license renewal in the fall of 2006. Everyone left with a better understanding of these complexly deformed and metamorphosed rocks in this part of the central Appalachian Piedmont.

For a copy of the 69th Annual Field Conference fieldguide contact Gale Blackmer of the Pennsylvania Geological Survey at gblackmer@state.pa.us or by phone at (717) 702-2032.

The DGS Welcomes Steven Bertsche

Steven Bertsche, of Newark, Delaware, joined the DGS staff in September as a campus information technology associate (CITA II) and is responsible for providing network and desktop computer support. Steven was previously employed at the University of Delaware in a variety of technical capacities from 1981 through 1996.

Steven received both his Bachelor of Music and Master of Music degrees in music theory/composition from Illinois State University and was a member of the music faculty at the University of Wisconsin-Superior. As a software developer, he developed educational applications in the areas of music, and foreign language.

We welcome Steven to the DGS and look forward to his invaluable support for our research, service, and exploration efforts related to geologic, hydrologic, and natural hazard investigations that the DGS conducts throughout Delaware.

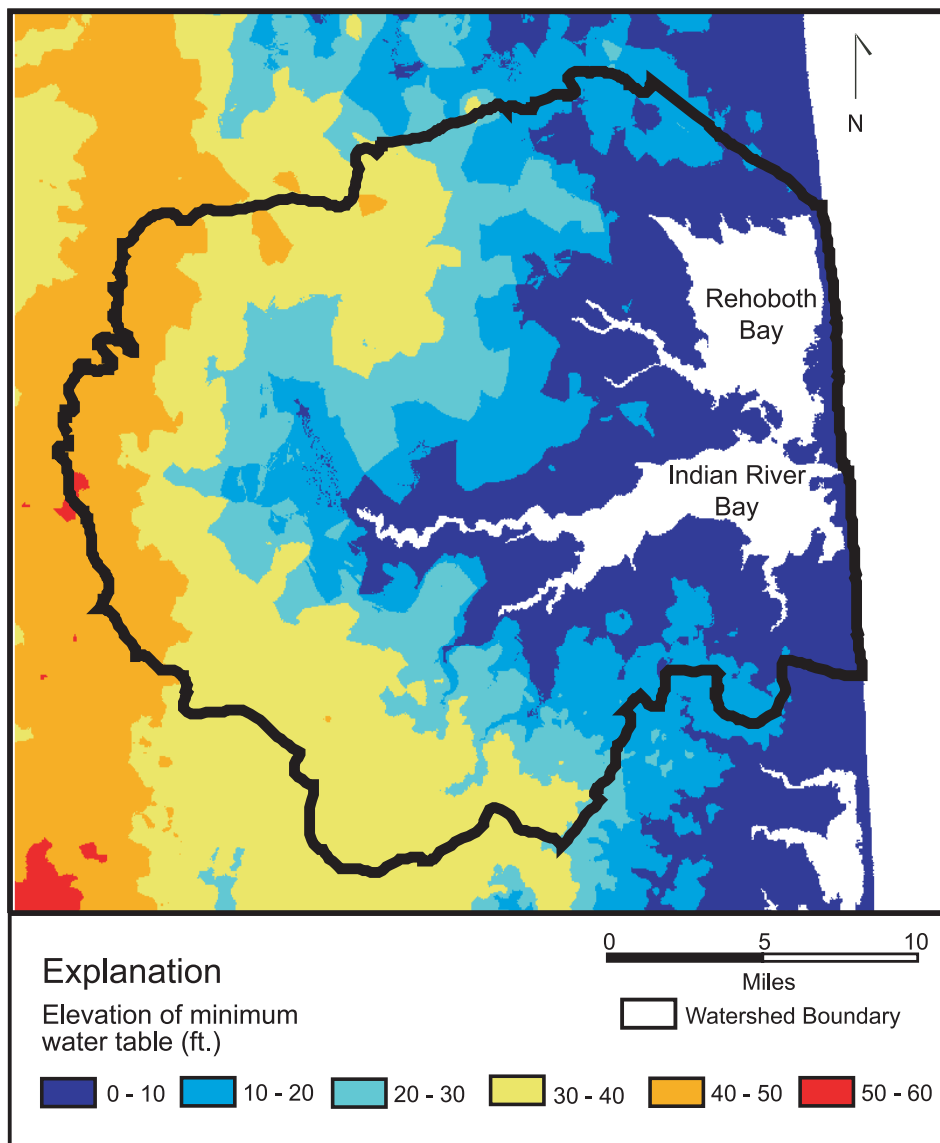
New DGS Report on Water-Table Mapping in the Inland Bays Watershed

By A. Scott Andres

The DGS has released a new technical report entitled "Estimation of the Water-Table for the Inland Bays Watershed, Delaware." This report was prepared by Survey staff members A. Scott Andres and Matthew J. Martin.

"This report complements two upcoming DGS publications, Digital Product 05-02, a geographic information system (GIS) product covering all of Sussex County, and Special Publication No. 27, a poster-style educational piece on the water table in the Inland Bays watershed," A. Scott Andres, DGS scientist and co-author of the report, said. "The report, digital product, and poster provide information that will be useful in guiding anticipated growth and economic development, developing and protecting water resources, and educating the public about ground water." Ground water provides nearly all fresh water for public, domestic, commercial, irrigation and industrial uses in Delaware south of the Chesapeake and Delaware Canal and about 25 percent north of the Canal.

The report documents technical aspects of the water-table mapping program, including method development, analysis of the relationships between depth to water, soils, and geomorphology, and potential applications such as ground-water recharge, onsite waste water disposal, storm water



Map of minimum water table from Report of Investigations No. 68.

management, wetlands, construction activities, and sand and gravel mining. The method is now being applied to mapping in Kent and New Castle counties. The resultant GIS products replace paper-based maps that were produced in the early 1960s.

The report and maps have direct application to Delaware's Source Water Protection Program. According to legislation enacted in 2001, counties and municipalities with populations of 2,000 or more shall adopt overlay maps of "excellent recharge areas" and shall adopt regulations governing land use in such areas as part of their 2007 Comprehensive Land Use Plans. Recharge Resource Protection Areas, including excellent recharge areas and well-head protection areas, have been protected via code in New Castle County since the early 1990s.

The project was conducted with the cooperation and support of the Delaware Department of Natural Resources and Environmental Control. Report of Investigations No. 68 is available in pdf for-

mat from the DGS web site at <http://www.udel.edu/dgs/> under "Publications." Printed copies of the publication may be requested by contacting the Survey at (302) 831-2833 or via email at delgeosurvey@udel.edu.

Tri-State Area Hit by Tropical Storm Jeanne

By J. H. Talley

The remnants of Hurricane Jeanne caused widespread flooding in the Red Clay Creek, White Clay Creek, and Christina River drainage basins in northern New Castle County, Delaware on September 28 - 29. Recorded rainfall in northern Delaware ranged from 8.2 inches in Ogletown to 3.52 inches in east Wilmington.

Reported rainfall in the Brandywine, Red Clay, and White Clay creek drainage basins in nearby southeastern Pennsylvania ranged from 8.91 inches in West Chester to 6.56 inches near Strickersville. According

	<i>Floyd 9/16/1999</i> 100-year precipitation	<i>Henri 9/15/2003</i> 500-year precipitation	<i>Jeanne 9/28-29/2004</i> 100-year precipitation
<i>Water Course</i>	<i>Peak Discharge Recurrence Intervals (years)</i>		
Shellpot Creek	>10 & <25	5	5
Brandywine Creek	50	20	25
Red Clay Creek	>50	>500	>100
White Clay Creek	>100	>50	>100
Christina River	>100	2	>50

Peak discharge recurrence intervals were provided by the U.S. Geological Survey and are subject to revision.

Precipitation information provided by State Climatologist, Dr. Daniel Leathers, University of Delaware.

to Dr. Daniel Leathers, State Climatologist, the precipitation exceeded the 100-year return period for the area. The provisional peak stream discharges of 11,600 cubic feet per second (5.2 million gallons per minute) recorded on Red Clay Creek at Wooddale, 10,900 cubic feet per second (4.9 million gallons per minute) on Red Clay Creek at Stanton, and 12,200 cubic feet per second (5.5 million gallons per minute) on White Clay Creek at Newark were the second highest of record. Peak gage heights were the third highest of record on Red Clay Creek at Wooddale and Stanton and were exceeded only by those associated with Floyd (1999) and Henri (2003). The calculated recurrence intervals were greater than 100 years.

Comparisons of precipitation and peak discharge recurrence intervals for Jeanne (2004), Henri (2003), and Floyd (1999), are presented in the accompanying table. All three of these major flooding events were associated with very intense precipitation (4-10 inches) in a relatively short period of time (4-10 hours). Charts and photographs associated with Jeanne are located at <http://ag.udel.edu/dwrc/Forum2004/jeanne.pdf>.

In response to flooding that has occurred in the state over the past several years, Governor Ruth Ann Minner, through Executive Order sixty-two, established the Task Force on Surface Water Management. John Talley, Director of the DGS, has been appointed to the Task Force which includes representatives of State and local governments, and persons with special expertise on the issues of drainage, flood control, and water management. Included in the Task Force charges will be recommendation of a statewide organizational structure to coordinate surface water management strategies, an analysis of the costs and funding sources for implementing a statewide plan to address flooding and drainage issues, and recommendation of strategies to preserve and enhance aquifer recharge.

DGS Welcomes Mark Neimeister

Mark P. Neimeister, a recent graduate with a dual degree in geography and history from the University of Delaware, started in September as a limited term researcher with the DGS. Mark joined the DGS staff to work with HAZUS-MH. HAZUS-MH is a GIS-based loss estimation software tool developed for the Federal Emergency Management Agency (FEMA) which is used to estimate the economic and societal impacts of natural disasters (earthquakes, wind, and floods) in a study region. Stefanie Baxter, geologist, is overseeing this effort. The project is being conducted with the cooperation and support of the Delaware Emergency Management Agency and FEMA. For additional information on HAZUS-MH, please refer to <http://www.fema.com/hazus/>.

Mark's other area of interest is the analysis of water quality and its impact on society and the environment. He recently completed a research internship with DGS Senior Scientist, A. Scott Andres, on a water quality investigation of the Nanticoke River Watershed in Sussex County. This project analyzed the concentration and loading rates of nutrients (N and P) in an effort to provide a better understanding on how various land-uses influence the waters of the Nanticoke River. The results are being used by the Delaware Department of Natural Resources and Environmental Control in their TMDL program.

How Many Belemnites?

By L. T. Wang

The DGS hosted activities on October 3rd at Coast Day, an annual open house sponsored by the University of Delaware, College of Marine Studies, in Lewes, Delaware. The main attraction at the DGS booth was the *Belemnitella americana* - Delaware's official state fossil. A jar containing 514 fossils was on display and visitors were asked to guess how many there were. Congratulations to our winners who out-guessed 187 other participants.

First Place – Maura Jegerski, 10 years old, from Newark

Second Place – Sabrina Hayden, 5 years old, from Lewes

Third Place – Sara Hall, 9 years old, from Long Neck

Several visitors did not realize that Delaware has a state fossil. The Martin Luther King, Jr. Elementary School (Wilmington) third grade Quest students of Kathy Tidball suggested naming the belemnite as our state fossil, and it was named as the official fossil of Delaware on July 2, 1996. Belemnites were squid-like carnivores with a soft body around an internal, pencil-shaped shell. They were common from the Lower Jurassic period to the end of the Cretaceous period and became extinct at the same time as the dinosaurs, approximately 65 million years ago. In Delaware, the best place to look for the fossil is in the dredge spoil piles on the north side of the Chesapeake and Delaware Canal, just west of St. Georges and also just east of the north side of the Reedy Point Bridge.



Future paleontologists at Coast Day 2004

Publications

Recent DGS Publications

Report of Investigations

No. 68, Estimation of the Water Table for the Inlands Bays Watershed, Delaware: **A. Scott Andres** and **Matthew J. Martin**, 20 p.

Digital Products

No. 05-01, Nanticoke Watershed Water-Quality Database: **A. Scott Andres**, Karen B. Savidge, and William J. Ullman.

No. 05-02, Sussex County, Delaware, Water-Table Map: **Matthew J. Martin** and **A. Scott Andres**.

Other Publications by DGS Staff

Thomas E. McKenna, coeditor with J. B. Martin of a special issue of *Ground Water*; **Thomas E. McKenna** and J. B. Martin, "Ground-water discharge to estuarine and coastal ocean environments," *Ground Water*, vol. 42, no. 7, p. 957-958; D. W. Urish and **Thomas E. McKenna**, "Tidal effects on ground-water discharge through a sandy beach," *Ground Water*, vol. 42, no. 7, p. 971-982.

Sugarman, P.J., Miller, K.G., **McLaughlin, P.P., Jr.**, Browning, J.V., Hernandez, J., Monteverde, D., Uptegrove, J., **Baxter, S.J.**, **McKenna, T.E.**, **Andres, A.S.**, **Benson, R.N.**, **Ramsey, K.W.**, **Keyser, T.**, Katz, M.E., Kahn, A., Friedman, A., Wojtko, M., Feigenson, M.D., Olsson, R.K., Brenner, G., Self-Trail, J.M., and Cobbs, G., III, 2004. Fort Mott Site. In Miller, K.G., Sugarman, P.J., Browning, J.V., et al., Proc. ODP, Init. Repts., 174AX

(Suppl.), 1-50 [Online]. Available from World Wide Web: http://www-odp.tamu.edu/publications/174AXSIR/VOLUME/CHAPTERS/174AXS_4.PDF

Staff Notes

Presentations

A. Scott Andres and **John H. Talley**, "Hydrology of the Lewes Area," Lewes Board of Public Works, July 15.

William S. Schenck and **Margaret O. Plank** led the 69th Annual Pennsylvania Geologic Field Conference, "Marginalia-Magmatic Arcs and Continental Margins in Delaware and Southeastern Pennsylvania," as co-hosts with the Pennsylvania Geological Survey, October 7-9.

John H. Talley participated as a panelist in a congressional briefing in Washington, D.C. hosted by the U.S. Geological Survey pertaining to "50 Years of Cooperative Water Management in the Delaware River Basin," Washington, D.C., September 22; "Streamflow Trends (?) in the Christina Basin," Delaware Water Policy Forum Series No. 4, University of Delaware, October 13.

Lillian T. Wang, "Application of GIS in Geologic Mapping, 1:100,000 Surficial Geologic Map of Delaware," at GIS Night, Lake Forest High School, Felton, November 18, and at Delaware Valley Geographic Association annual autumn meeting, December 3.

Service and Awards

The following DGS staff members were awarded secondary appointments in the Department of Geology at the University of Delaware at the respective ranks:

John H. Talley, Associate Professor; **A. Scott Andres**, Associate Professor; **Peter P. McLaughlin, Jr.**, Associate Professor; **Kelvin W. Ramsey**, Associate Professor; and **William S. Schenck**, Assistant Professor.

Congratulations to **A. Scott Andres** who became a licensed Delaware Professional Geologist, June 4; elected chairperson of the Internet Ground-Water Data Interest Group, National Ground Water Association, 2004 annual meeting, December 12-15.

William S. Schenck, served as Council of Examiners representative and Delaware voting member at the National Association of State Boards of Geology annual meeting, Nov 2-5; "What Geologists Do," Jenny Smith Elementary School, October 13; gave tours of the DGS to 12 groups during October in celebration of Earth Science Week.

John H. Talley has been appointed by Governor Ruth Ann Minner and Secretary of the U.S. Department of the Interior, Gale A. Norton, to serve a two-year term as Delaware's representative on Interior's Outer Continental Shelf Policy Committee. The Committee gives policy advice to the Secretary, through the Director of the Minerals Management Service, related to discretionary functions of the Bureau under the Outer Continental Shelf Lands Act and related statutes; appointed by Governor Minner to serve on the Task Force on Surface Water Management which was created to study and develop recommendations related to flooding and drainage problems in Delaware.



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