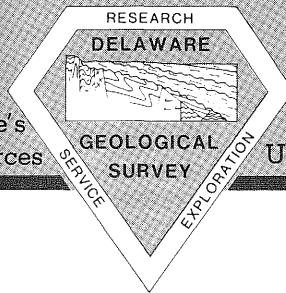


# First State Geology

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



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Summer 1991

## Delaware-Pennsylvania Boundary Work Completed with Resetting of Monument 3

By William S. Schenck

A ceremony to mark completion of the restoration of the 12-mile Circle, the unique circular boundary between Delaware and Pennsylvania, was held on March 14. After giving short speeches, Governor Michael N. Castle of Delaware and members of the Delaware State Boundary Commission unveiled the original Boundary Monument 3, a large stone now returned precisely to its proper location in Merestone, a new housing development in northwestern New Castle County.

Monument 3, found during the construction phase of the development, marks the third mile from the Arc Corner or 0 monument located in Carpenter State Park at the intersection of the Top of the Wedge Line and the Delaware-Pennsylvania 12-mile Circle. It has a 3 on its western face; a P and a D on its northern and southern faces, respectively; and the date 1892 on its eastern face for the year of its installation.

The Delaware State Boundary Commission, chaired by State Geologist Robert R. Jordan, has been working since 1984 to restore the 179 historic monuments that mark the borders with our neighboring states. The restoration of the Delaware-Maryland monuments was completed in 1987. The surveying for the six missing Delaware-Pennsylvania monuments also began in that year. Work in cooperation with the State of New Jersey is underway to replace the damaged or missing monuments along that boundary.



*Delaware-Pennsylvania Boundary Monument 3 after unveiling. From left to right Merestone developer Charles Wilkinson, Governor Michael N. Castle, Boundary Commission Chairman Robert R. Jordan, landowners Carol and James Blackburn, and Boundary Commissioner John A. Munroe. Photograph by John Foulton.*

## Two Seismic Monitoring Stations Discontinued

Two stations, Blackbird (BBD) and Georgetown (GTD), have been dropped from the Delaware seismic network because of insufficient funding. The major cost associated with these stations was the charge for the continuous transmission of data over telephone lines. The loss of these stations is part of a general reduction in funding of seismic networks in the eastern U. S. A large boost to seismic studies in the east came during the energy crisis of the 1970s when the U. S. Nuclear Regulatory Commission (NRC) needed data to judge

the earthquake hazard to a number of proposed nuclear power plants. The NRC subsequently funded much of the seismic research in the east which included the establishment and operation of networks. Some other funding was provided by the U. S. Geological Survey (USGS) although their emphasis has been mostly in the western half of the nation. Construction of nuclear plants did not occur, and, during the last two to three years, network funding has gradually been phased out. Unfortunately, economies necessary in all Delaware budgets at this time prevent the expenses of the Blackbird and Georgetown stations to be shifted elsewhere.

A national seismograph network designed to collect digital, high quality data is being established by the USGS under an agreement between the NRC and the USGS. However, spatial coverage will be limited,

small earthquakes will not be detected, and there are no plans to continue local network operations.

The DGS network is part of both the U. S. northeastern and southeastern seismic networks and, except for the transmission costs of the two discontinued stations, is entirely funded by state appropriation. Loss of the two stations will hinder epicenter determinations and detection of infrequent events in southern Delaware. We will also be unable to respond to the frequent inquiries about events thought to be earthquakes but that are found with seismographs to be due to other causes. Alternatives to continuous data transmission are being considered by the DGS.

Because Delaware's income has not met expectations in Fiscal Year 1991, reductions in expenditures are being sought throughout the state. The DGS has implemented 27 cost-cutting measures in FY 91. Users of our data and services will find, for example, that "Water Conditions Reports" are issued less frequently, lists of publications and maps will not be revised, just updated by supplements, and that the publication of results of some investigations will be delayed.

## New Report Focuses on Deep Subsurface Geology and Hydrology near Lewes

The deep subsurface geology and hydrology near Lewes is the subject of a new DGS publication. The report focuses on analyses of sedimentary rock samples, geophysical logs, and water samples derived from a 1,337-foot borehole drilled in 1986 and other shallower holes nearby.

Published as Report of Investigations No. 48, *Geologic and Hydrologic Studies of the Oligocene—Pleistocene Section near Lewes, Delaware*, the 34-page report was edited by Richard N. Benson. Chapters by the contributing authors A. Scott Andres, Richard N. Benson, Kelvin W. Ramsey, and John H. Talley cover drilling and logging operations; descriptions of sedimentary rock units; the paleontology (including three plates of microfossil photographs), ages, and depositional environments of the rocks; correlation of the rock units with those penetrated by other deep boreholes in Delaware, New Jersey, and Maryland; and water quality and water-yielding characteristics of two confined aquifers.

The initial results of the studies were first reported in the Summer 1988 issue of *First State Geology* (vol. 6, no. 2). The findings testify to the value of the information derived from deep boreholes, which are few and far between in the U. S.

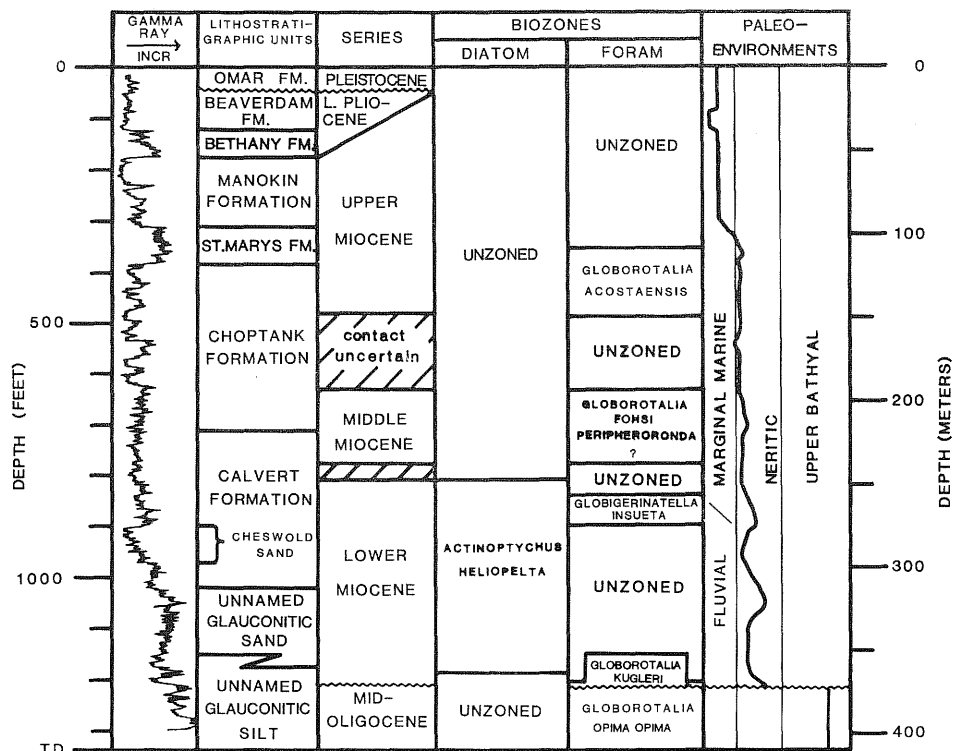


Diagram summarizing geologic studies, borehole Oh25-02 near Lewes.

Atlantic Coastal Plain. New insight gained from the study of this one near Lewes has added significantly to the DGS's understanding of the subsurface stratigraphy, hydrology, and geologic framework of coastal Delaware.

## Department of Interior Issues Draft Proposal for 1992-1997 Offshore Oil and Gas Program

By Richard N. Benson

On February 21, 1990, the Minerals Management Service (MMS) of the U. S. Department of the Interior released the Draft Proposed Comprehensive Outer Continental Shelf (OCS) Natural Gas and Oil Resource Management Program for Mid-1992 through Mid-1997. The OCS Lands Act requires Interior to prepare a 5-year program that specifies as precisely as possible, the size, timing, and location of areas to be assessed for offshore oil and natural gas leasing.

The release of the Draft Proposed Program is the first step in a two-year process of developing a new proposed 5-year program. In late 1991 and early 1992, the Proposed Final Program will be prepared and distributed. A 60-day Congressional notification period follows that. The final step is approval of the program by mid-1992. Along with

development of the Program documents, Draft and Final Environmental Impact Statements (EIS) will be prepared. A 90-day comment period in late 1991 will follow publication of the Draft EIS.

Compared to previous 5-year programs, the Draft Proposal calls for fewer sales to be considered in fewer areas. Interior proposes to consider leasing in 15 areas, with up to 23 lease sales in portions of 12 planning areas. The current 5-year program lists 39 sales in 21 planning areas. In addition to reviews of the proposed program, each individual lease sale within it is subject to an environmental impact statement.

Sites to be considered for leasing will be more precisely delineated. For the Atlantic OCS region, studies are planned, and two sales combining parts of the Mid- and South Atlantic planning areas will be considered, one in 1994 and another in 1997. The areas have a good probability of producing natural gas. For each sale, a total of 1,000 blocks (each block approximately 9 square miles) would be considered for leasing initially, but then narrowed down to just 250 blocks. Studies are planned, but no leasing is proposed for the North Atlantic planning area. Neither leasing nor studies are proposed for the Straits of Florida.

The Delaware Geological Survey will continue to review each step in the development of Interior's 1992-1997 plans.

## Visit of Japanese Geologist

As part of his United States itinerary, Katsuyuki Terashima, chief of the Planning and Information Section of the Geological

Survey of Hokkaido (Japan), visited the DGS on February 28. His purpose was to observe operations of other geological surveys in the United States. These included the Louisiana and New Mexico surveys as well as the U. S. Geological Survey in Reston, Virginia.

We found many similarities in the organization, operations, and activities of both the Delaware and Hokkaido surveys. Mr. Terashima was interested in learning about the projects of each DGS staff member. He showed examples of the types of maps and publications (in both Japanese and English) produced by his agency. An agreement was made to exchange publications. The DGS looks forward to a continuing relationship with the Hokkaido survey.

## Delaware Geological Association

Two meetings of the Delaware Geological Association at the University of Delaware were hosted by the DGS. A panel presentation "Who's Working in Delaware Geology - Programs, Projects, and Job Opportunities" on January 24 was organized by Arthur L. Hodges of Atlantic Hydrologic, Inc., Camden, DE. On April 25, Michael A. Apgar, senior hydrologist with the Delaware Department of Natural Resources and Environmental Control, presented "Waste Disposal Impacts on Ground-Water Quality—Observations over the Past 20 Years."

## Hydrology News

### Ground-Water Recharge Area Mapping

By A. Scott Andres

The final report for a pilot study to develop and test methods for mapping ground-water recharge areas and for ranking their capability to transmit water to deeper parts of the aquifer has recently been completed. DGS Open File Report No. 34, *Methodology for Mapping Ground-Water Recharge Areas in Delaware's Coastal Plain*, documents the development of the mapping methodology and presents instructions on how to apply the method to other areas. The 1:24,000-scale recharge area maps of the pilot study area are not included in the final report but are available for inspection at the DGS offices. The pilot study was of the area covered by the Fairmount and Frankford 7.5-minute topographic maps.

The study was funded by the Department of Natural Resources and Environmental Control (DNREC). A proposal to continue recharge area mapping in the Seaford and Kenton areas is currently being considered by DNREC. Further discussion of recharge area mapping is included in the Winter 1991 edition of *First State Geology*.

## Inland Bays Estuary Program

By A. Scott Andres

The Inland Bays Estuary Program (IBEP) has recently funded a DGS proposal for a one-year project to estimate the discharge of ground-water borne nitrate into Rehoboth and Indian River bays. The project began in May. The discharge of nitrate-rich ground water may be a major contributor to the high nitrate concentrations found in the bays that are thought to be major contributors to the bays' declining environmental health.

The study will use existing ground-water level and quality data in simple ground-water flow and geostatistical models. The models will be used to estimate yearly and seasonal discharge of ground water and nitrate from small drainage basins adjacent to the bays. Request additional information regarding this project from Scott Andres.

## Cockeysville Study

By Kenneth D. Woodruff

Work on the Cockeysville Formation Project in northern New Castle County is nearing completion. Goals of the project are to determine the boundaries of the Cockeysville marble underlying the Hockessin-Yorklyn and Pleasant Hill valleys and the effect of increased development on the ground-water recharge to the formation. The Cockeysville is a source of ground water for domestic wells and also for a number of high-yielding public wells. Water is stored in a complex system of fractures and solution cavities and is recharged mainly through a thick weathered zone that overlies the central portions of the valleys. The effect of the adjacent rock units on the hydrologic budget of the Cockeysville is also under study. However, the adjacent formations are generally poor water producers and probably contribute little recharge to the Cockeysville by way of interformational ground-water flow. On the other hand, Mill Creek, which drains much of the Hockessin-Yorklyn Valley, loses about 20 percent of its flow when it crosses the outcrop of the Cockeysville.

Field mapping has confirmed the presence of two rock units previously unknown in Delaware, the Baltimore Gneiss and the Setters Formation, underlying the slopes adjacent to the marble. The configuration of the marble on existing geologic maps will change little as a result of the new mapping.

Water levels in the weathered overburden of the Cockeysville have gradually declined since heavy ground-water pumping began in the early 1970s and sections of the overburden have been dewatered. Currently, levels may be near equilibrium or still declining slightly. Once levels drop permanently below the weathered zone and into the solid rock, they usually continue to fall rapidly. Results of water quality sampling from wells in the area are pending.

A number of techniques being used in the investigation include drilling and coring, geophysical logging, and gravity and magnetic measurements. The study is a joint effort by the Delaware Geological Survey and the U. S. Geological Survey and is funded by New Castle County and the DNREC.

## Cartographic Corner

By William S. Schenck

■ The U. S. Geological Survey (USGS) has discontinued the 1:1,000,000-scale International Map of the World (IMW) and the USGS 1:1,000,000-scale map series (except for maps of the Antarctic). This decision was based on the recommendations of a United Nations review committee. The National Mapping Division (NMD) will retain reproducible materials for these maps for photographic copies only. The University of Delaware Morris Library has a fairly complete collection of the maps.

■ The National Geodetic Survey has announced that the new North American Vertical Datum of 1988 (NAVD88) is nearing completion. The new datum, which replaces the older National Geodetic Vertical Datum of 1929 (NGVD29), will improve the vertical control network for the United States, Canada, and Mexico.

The first phase of this general adjustment, which consisted of a least squares adjustment of the United States primary vertical control network, is now completed. Differences in elevation between the NAVD88 and the current NGVD29 are caused by many factors, such as movement of the earth's crust, datum distortion, datum definition, and leveling errors. Analyses show that in most tectonically stable areas, height differences between the two datums will be on the order of 1 centimeter or less. In other less stable areas, the height difference could be as much as 50 to 150 cm.

The next phases include computing and distributing the new NAVD88 height values; documenting and publishing final results; implementing procedures officially to replace NGVD29 with NAVD88; educating users; preparing documentation for Congress, state officials, and the private sector; and computing the bias shift between the two datums. The new datum should be in use by late summer 1991 for most of the vertical control in Delaware.

■ The Federal Emergency Management Agency (FEMA) through the National Flood Insurance Program (NFIP) has released a new Flood Insurance Rate Map for Delaware City, Delaware. The new map, dated May 2, 1991, supersedes the older map of September 2, 1982. Copies of the new edition can be obtained from the National Flood Map Distribution Center in Bethesda, Maryland.

■ Joint-Funded Topographic Agreement.

Field work by the USGS is nearing completion in Sussex County. Efforts are being made to complete field operations for New Castle County quadrangles by late spring 1991. Field operations will begin in Kent County and are expected to be complete by late 1991 or early 1992. After field work, the quadrangles will be sent to USGS Mid-Continent Mapping Center in Rolla, Missouri, for compiling and preparation for printing. By late 1991 the first new topographic maps will be published, and the remaining maps will appear during 1992. The DGS has provided office space for James J. P. McHugh of the Rolla center. He will be reviewing the work of the USGS field crews.

■ The Earth Science Information Center (ESIC) National Network held its annual meeting from May 7-10 at the USGS in Reston, Virginia. It was the first time that the USGS ESIC offices and the State ESIC offices met as a true national network. The theme was ESIC 2000. The meeting began with a theoretical look at where the cartographic/earth science community will be and what their needs will be in the year 2000 and ended with the implementation of a network-building strategy to meet those needs.

■ Information for earth science teachers in Delaware. The DGSCIC has teachers packets containing brochures published by the U. S. Geological Survey on mapping, map orienteering, geology, hydrology, aerial photography, space imagery, and other cartographic/earth science information. The packets are available for any teacher who needs this type of information to further the earth science needs of the public and pupils in Delaware. Contact William S. Schenck at the Delaware Geological Survey.

## Publications

### Recent DGS Publications

#### Reports of Investigations

No. 48 Geologic and Hydrologic Studies of the Oligocene-Pleistocene Section near Lewes, Delaware: R. N. Benson, editor; contributions by A. S. Andres, R. N. Benson, K. W. Ramsey, and J. H. Talley; 1990, 34 p.

#### Atlas Series

Wilmington South Quadrangle (WIS):

N. Spoljaric, editor.

Wyoming Quadrangle (WYO):

N. Spoljaric, editor.

#### Special Publications

Amendments to Delaware Geological Survey Laboratory Procedures Manual Special Publication No. 15 (revisions of "Separation of Pollen from Unconsolidated Rock" and "Preparation of Clay Slides for X-Ray Analysis; addition of "Preparation of Powders for X-Ray Analysis): C. T. Smith, 1990, 9 p.

### Forthcoming DGS Publications

Report of Investigations No. 49, Results of the Coastal Sussex County, Delaware, Ground-Water Quality Survey: A. S. Andres.

Open File Report No. 33, Basic Ground-Water Level and Chemistry Data from Coastal Sussex County, Delaware, Ground-Water Quality Survey: A. S. Andres.

Open File Report No. 34, Methodology for Mapping Ground-Water Recharge Areas in Delaware's Coastal Plain: A. S. Andres.

Marydel Quadrangle (MAR) Atlas Series: N. Spoljaric, editor.

Hydrologic Map Series No. 8, Geohydrology of the Middletown-Odessa Area: K. D. Woodruff.

## Staff Notes

**Robert R. Jordan** received a Senate Commendation of the State of Delaware in recognition of his recent professional awards and achievements, January 24. He was elected president of the Delaware Academy of Science for 1991. Jordan, who serves as Vice Chairman of the U. S. Department of the Interior's Outer Continental Shelf Policy Committee, is chair of the Subcommittee on Procedures of that committee.

**Thomas E. Pickett** was appointed treasurer of the History of Earth Sciences Society (HESS) effective March 1. HESS is an international society of earth scientists and historians that publishes the journal *Earth Science History*.

**William S. Schenck** received a Professional Bonus Award of the University of Delaware, April 30.

### Presentations

**Robert R. Jordan** presented "Stratigraphic Procedure and Ground-Water Practice" at the Northeastern-Southeastern Section meeting of the Geological Society of America in Baltimore, March 15.

**Thomas E. Pickett** was the visiting scientist at Maclary Elementary School, Newark, April 24. Under the school's "Breakfast with the Scientist" program, he discussed topics generated by the staff of the school and the science committee.

Delaware Geological Survey  
University of Delaware  
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Robert R. Jordan

State Geologist and Director

Richard N. Benson,

Editor, *First State Geology*

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