First State Geology

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

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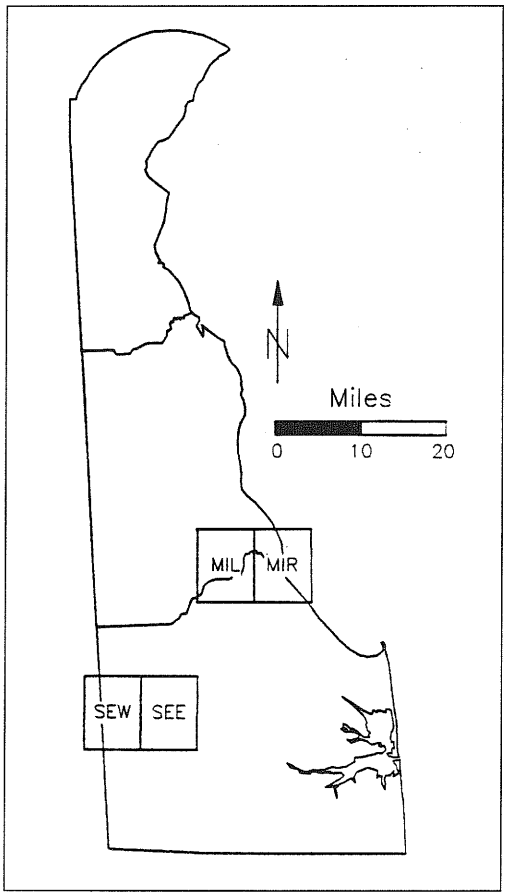
Geologic Mapping

STATEMAP - Funded Seaford East and West Quadrangles

The Delaware Geological Survey was awarded a contract under the STATEMAP component of the National Geologic Mapping Act of 1992 to complete geologic maps of the Seaford East (SEE) and Seaford West (SEW) quadrangles (see previous issue of *First State Geology*). The Survey's proposal was one of 37 funded through the U. S. Geological Survey from 54 submittals. The funding supports field and laboratory work and requires that the Survey complete a draft geologic map by the end of the contract period in June 1994.



Locations of quadrangles, geologic mapping projects.

Since June, project staff have completed about 35 boreholes with a truck-mounted auger and 75 hand-auger boreholes. This adds to the existing database of nearly 400 borehole and borrow pit descriptions. Over 500 samples have been processed for mineralogic and paleontologic analyses. Work by the DGS matches the federal funding.

Co-principal investigators for the project are A. Scott Andres and Kelvin W. Ramsey.

Milford and Mispillion River Quadrangles

A new geologic map of the Milford (MIL) and Mispillion River (MIR) quadrangles has been completed and will be available early 1994. Delaware Geological Survey Geologic Map No. 8 by Kelvin W. Ramsey shows the surficial geology of the area from just east of Houston to and including a portion of Delaware Bay offshore from the Mispillion Inlet and Slaughter Beach.

The map shows the geologic units (formations) at the land surface as well as the distribution of marsh, swamp, and shoreline deposits. It also includes the distribution of bottom sediment types for the portion of the map area in Delaware Bay. Two new geologic units are recognized, the Lynch Heights and Scotts Corners formations. These units represent deposition by an ancestral Delaware Bay at two different times during the last 500,000 years when sea level was higher than at present.

Update on 1993 Earthquakes

By Charles T. Smith

The small local earthquakes that were reported in the previous issue of *First State Geology* continue in the mid-Atlantic region. Between May 20 and October 28, the DGS seismographs have recorded eight additional tremors. Two had epicenters in Reading, Pennsylvania, one in Virginia, one off the Atlantic coast, and four more were recorded from the Columbia, Maryland, area. Since February 1993, 30 earthquakes in the region have been recorded to date.

The (Richter) magnitudes recorded for the four most recent Maryland quakes were in the 1.8-2.1 range. The largest previously recorded recent tremor in that area had a magnitude of 2.7. Numerous small unrecorded events have been reported in the Columbia area. Noise local to the DGS stations may have interfered with recording some of the smaller events, and the smallest-magnitude events probably were missed owing to the distance between the epicenters and the Delaware stations.

Delaware's most recent earthquake occurred on November 8 at 1:47 p.m. local time and had a magnitude of 1.7. Wilmington residents in the area between 7th and 9th streets near the intersection of Broom and Harrison streets reported hearing a loud rumbling sound beneath their basements and feeling a little vibration. The three seismic stations operated by the DGS recorded the quake which had a signature somewhat different from those previously recorded in the area. Although the signature was of an earthquake, it closely resembled that of a construction blast. A thorough investigation of the surface site at the epicenter, the local geology, and aid in signature identification from staff at the Lamont-Doherty Earth Observatory indicate that the earthquake was a relatively shallow event.

Aberdeen Proving Ground Blast Detection

By Charles T. Smith

Aberdeen Proving Grounds located near the shore of Chesapeake Bay in neighboring Maryland is the site of routine weapons testing. Rumbles from the noise of some explosions carry for tens of miles.

There have been complaints that damage to home foundations was being caused by ground vibration from the explosions.

In a good neighbor effort, the testing facility acquired the assistance of Argonne National Laboratory to study the effect of ground motions from explosions. Argonne contacted the DGS because of our ongoing seismic studies in the region and because we operate three seismic recording stations relatively close to Aberdeen.

A demonstration by staff from Argonne and Aberdeen Proving Grounds was set up on the Eastern Shore of Maryland to show residents of Kent County, Maryland, how blast and ground study detection is performed. On September 13, blasts were set off in the air and below ground to help determine just what residents felt across the bay on the Eastern Shore.

In order to monitor the demonstration the DGS used this opportunity to set up its portable seismic station several miles due east of Argonne's site and the blast. Some weapons testing had been detected by DGS seismic stations in the past, and information on blasts is useful in time-distance velocity studies which can be used to help determine earthquake epicenters.

About noon, the ground blast was set off, but no vibrations were detected by DGS's portable or fixed instruments. Argonne personnel reported they detected the air shock waves but no ground vibration was experienced. Residents viewing the instruments at the demonstration site were pleased to see that ground vibration was not evident.

Future work by Argonne Laboratory and Aberdeen may yet yield some useful data to the DGS.

Water Conditions 1993

By Robert R. Jordan and John H. Talley

The water year 1993 (September 30, 1992-October 1, 1993) was marked by great variation in the distribution of precipitation in both time and space. Precipitation was quite high in March throughout the state but was deficient in most areas during the summer. Central Delaware suffered an agricultural drought, finishing with 6.76 inches less than the long-term average at Greenwood, for example. In contrast, precipitation was 9.53 inches above normal at Wilmington. The total departure from normal of 16.29 inches emphasizes the striking differences that may occur in rainfall distribution over short distances.

Averaged over the entire state, precipitation approximated the long-term 44-inch norm for the water year. Except for the drought area mid-year, streamflows also were near or above normal during 1993.

When precipitation is unevenly distributed, the aquifers in Delaware's Atlantic Coastal Plain Province act as large reservoirs to assure adequate ground-water supplies and baseflows of streams in all but extreme conditions. In terms of water supply, as opposed to soil moisture, Delaware commonly resists the effects of droughts to a greater degree than areas entirely dependent on surface water.

New York City's reservoirs in the upper part of the Delaware River basin were drawn down to "drought warning" levels in September, October, and November. Rains in late November and early December have since raised levels into the normal operating range.

The Delaware Geological Survey monitors water conditions in Delaware through networks of 16 stream gages, over 20 observation wells operated in cooperation with the U. S. Geological Survey and several public and private water purveyors, and six precipitation stations. The State Geologist also represents Delaware to the Delaware River Master Office, which oversees allocation of water to the four states of the basin and to the City of New York.

Cooperative Offshore Sand Resources Study

By Kelvin W. Ramsey

The Delaware Geological Survey is currently in the second year of a 5-year cooperative study with the Maryland Geological Survey (MGS) and the Minerals Management Service (MMS) of the U. S. Department of the Interior to identify offshore sources of sand suitable for beach nourishment. The study area is in the Atlantic Ocean from approximately 3 to 10 miles offshore. As sand bodies closer to shore are depleted, those farther offshore will have to be utilized to provide the sand needed to maintain current nourishment projects.

The DGS portion of the study is designed to understand the basic geologic framework of the offshore region in order to predict and determine the most likely areas of sand resources. The study is conducted by analyzing a combination of core data and shallow offshore seismic-reflection profiles in order to determine the position and distribution of sand bodies below the sea bottom (see figure). To date, 215 nautical miles of seismic coverage and 16 cores have been collected.

Pollen/Spore Reference Collection

By Ralph Orlansky

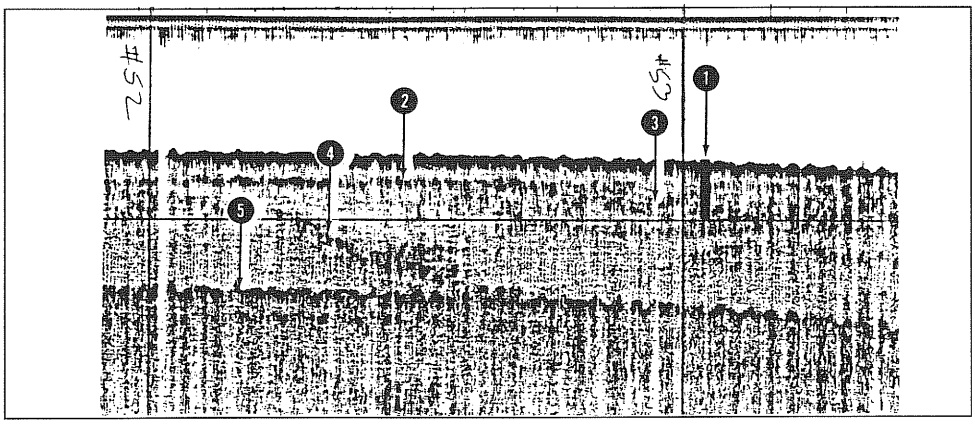
The reference-slide collection of extant pollen grains and spores processed at the DGS palynology lab comprises microscopic reproductive bodies from local and exotic trees, shrubs, flowers, ferns, and a corn smut. Currently, it contains material from 106 species, belonging to 77 genera and 53 families. The plant material came from the U. S. Geological Survey, Winterthur, and also from local gardens, Delaware state parks and preserves, and from trees on the University campus.

We thank the plants of Delaware and Pennsylvania which did not complain as their reproductive organs were torn off to advance the cause of palynology.

OCSPC Reports

The Outer Continental Shelf Policy Committee (OCSPC) of the Department of the Interior recently approved two reports of interest to Delaware.

"U. S. Outer Continental Shelf Sand and Gravel Resources" confirms the presence of abundant supplies of sand and gravel in federal offshore territory and also establishes a growing need for beach nourishment and construction materials. The report recommends policies and



A portion of a north-south seismic line located approximately two nautical miles offshore from the north end of Bethany Beach. Water depth is approximately 40 feet. The distance between the vertical lines is approximately 1200 feet. The numbered features are (1) the location of core DGS92-3 (Qj34-02) that penetrated about 17 ft below the surface, (2) a reflector at the base of a sand shoal that thins to the south (right), (3) a reflector at the base of a sand-filled channel (the core contained mud and fine sand below this reflector), (4) a reflector showing the base of a larger channel feature, and (5) a sea-floor multiple.

administrative and legislative actions to provide access to offshore mineral resources and assure environmental protection.

The Delaware Geological Survey is already engaged in research programs designed to discover and define potential resources off our State. Some of this work is conducted in cooperation with the U. S. Minerals Management Service and the Maryland Geological Survey.

A second major report of the Policy Committee is titled "The Outer Continental Shelf Oil and Gas Program - Moving Beyond Conflict to Consensus." The report provides a review of the history of the sometimes controversial oil and gas programs administered by the Department of the Interior. It recommends substituting consensus-building for moratoria, seeks resolution of lease cancellation and buyback issues, advocates impact assistance and revenue sharing, and suggests some incentives to industry.

The Outer Continental Shelf Policy Committee is advisory to the Secretary of the Interior. The coastal states, industry, environmental interests, local government, and federal agencies are represented on the committee. Approval of the reports by the committee formalizes their transmittal to the Secretary as its recommendations.

Additions to OCS Sample Repository

The Atlantic Outer Continental Shelf Core and Sample Repository was augmented in mid-1993 by significant collections of microfossil slides, rock samples, logs, and reports. The U. S. Minerals Management Service (MMS), acting through its Atlantic OCS Region, transferred the materials to be added to the repository at the Delaware Geological Survey.

The DGS entered into an agreement with MMS in 1992 to establish the repository, which is believed to be the largest collection of geologic samples from the Atlantic margin accessible by public scholars. As an element in the DGS data system, the repository preserves the materials in perpetuity, thus assuring their availability to scientists in the future.

Most of the samples and information held in the Atlantic OCS Repository were generated during oil and gas exploration programs in the 1970s and '80s. The new holdings are now public after being held proprietary for years during the period of petroleum exploration.

Two Fossil Finds Donated to DGS

A mastodon tooth has been donated to the Delaware Geological Survey by Jeremy Cloutier of Milford. The tooth was found in the trash belt of the clam processing plant of Seawatch, Inc., in Milford where Mr. Cloutier was working. He rescued the tooth and contacted the DGS for its identification. It is a fine specimen of a mastodon tooth measuring about 6 inches long, 3 1/2 inches wide, and 4 1/2 inches high. Mastodons are extinct relatives of the elephant family that lived throughout North America during glacial times and roamed in forested and marshy areas. Mastodon bones and teeth have been found before by offshore clam dredging, indicating that the mastodons lived in that area when sea level was lower and the shoreline a hundred or more miles farther east than it is at present. The tooth is now on display in the lobby of the Delaware Geological Survey Building.

An interesting fossil from the Chesapeake and Delaware Canal was recently donated to the DGS by John M. Kelley of South St. Georges. Mr. Kelley, who regularly collects Cretaceous fossils at the Chesapeake and Delaware Canal, provided an unusual oyster shell from the Mt. Laurel Formation. Oyster fossils are not unusual from this site, but the one discovered by Mr. Kelley is in that it has a well-developed ridge extending length-wise across the shell. We have identified it as *Ostrea tecticosta* Gabb and believe that it is the first time this species has been reported in Delaware, although it has been reported from New Jersey. It is small, only about 1 1/2 inches long. The DGS encourages anyone with unusual fossils to bring them to our attention.

DSBRG

William S. Schenck of the DGS was elected Chairman of the Delaware State Board of Registration of Geologists (DSBRG) at the board's December meeting. Schenck served almost two years as a board member before succeeding retiring Chairman Arthur L. Hodges, Jr.

Michael A. Apgar was appointed and Robert R. Jordan reappointed by Governor Carper, filling the professional seats on the board. Carmetah L. Murray and Edward C. Hermann were earlier appointed as the board's public members. Ann Anderson of the Division of Professional Regulation is now the administrative assistant to the board.

State Boundaries

By W. S. Schenck

Since 1981, the Delaware State Boundary Commission has been working with Maryland, Pennsylvania, and New Jersey on maintenance problems associated with Delaware's 179 state boundary monuments. In 1986, Delaware and Maryland signed agreements on the restored Transpeninsular Line and the Mason-Dixon Line comprising the Tangent Line, Arc Line, and North Line. Since 1986, efforts have been concentrated on replacing six missing monuments along the Delaware-Pennsylvania 12-Mile Circle and six boundary reference monuments along the Delaware-New Jersey 1934 Mean Low Water Line.

The surveying for these 12 monuments was done by a New Jersey firm, and results were submitted to the National Geodetic Survey (NGS) for acceptance into the NGS National Horizontal Control Network. Completed, checked, and accepted by the NGS, these new monuments are representative of the state's boundaries, and the Commission can now begin to formulate new agreements with adjacent states, with signing of the agreements targeted for early 1994.

Since 1981, the NGS established the North American Datum of 1983 (NAD83), a new Horizontal Datum for the country, and NAD83 (1991), a new Horizontal Datum for the State of Delaware. Amendments to the previous 1986 boundary agreements with Maryland will reflect these changes in order to bring the boundary control information up-to-date. Once new agreements are signed with Pennsylvania and New Jersey and amendments are made to the Delaware-Maryland agreements, all of Delaware's monumented boundaries will be in order for the first time in 100 years.

Cartographic Corner

By W. S. Schenck

- The U. S. Geological Survey continues to publish new 7.5-minute topographic maps of Delaware. The 1992-93 quadrangles now available are Mispillion River, Greenwood, Ellendale, Milton, Lewes, Cape Henlopen, Seaford West, Seaford East, Georgetown, Harbeson, Fairmount, Rehoboth Beach, Sharptown, Laurel, Trap Pond, Frankford, Bethany Beach, Hebron, Delmar, Pittsville, Whaleysville, Selbyville, Assawoman Bay, Newark West, Elkton, Cecilton, Millington, Sudlersville, Kenton, Marydel, Burrsville, and Harrington. The digital hypsography layers have been collected for the quadrangles in Sussex County and are expected to be available early 1994.
- USGS 100k DLG data are now available from the DGSCIC on CD-ROM. Two CD-ROMS, one with DLG format and one with optional DLG format, contain transportation and hydrography layers for Delaware as well as all layers for the 100k maps of New Jersey, Pennsylvania, Maryland, West Virginia, Virginia, and Ohio. These data can be used in GIS systems as geographic bases only and have no text attributes associated with them. CDs can be borrowed from the DGSCIC for data transfer/import into your system by contacting W. S. Schenck at 302-831-8262.

Publications

Recent DGS Publications

Reports of Investigations

No. 51 Herbicides in Shallow Ground Water at Two Agricultural Sites in Delaware: J. M. Denver, 28 p.

Forthcoming DGS Publications

Geologic Map Series No. 8, Geologic Map of the Milford and Mispillion River Quadrangles: Kelvin W. Ramsey, scale 1:24,000.

Other Publications by DGS Staff

A. Scott Andres, 1993, Nitrate Contamination of Ground and Surface Waters,Coastal Sussex County, Delaware: Hydrological Science and Technology, v. 9, 1993, Additional Proceedings for the 1993 Joint USA/CIS Conference on Environmental Hydrology and Hydrogeology.

Robert R. Jordan, 1993, Stratigraphic Regulations and Guidance: A Critique of Current Tendencies in Stratigraphic Codes and Guides: Discussion: Geological Society of America Bulletin, v. 105, p. 1135-1136, with R. M. Easton, L. E. Edwards, and D. E. Owen.

Staff Notes

Robert R. Jordan received two awards from the American Geological Institute "In Appreciation of Outstanding Service" at Boston on October 26, 1993. The awards recognize his contribution as treasurer of the Institute 1992-93 and chairman of its finance committee in 1993. Also, Jordan was renominated by Governor Carper and has been reappointed to the Outer Continental Shelf Policy Committee by Secretary of the Interior Bruce Babbitt. Jordan has been a member of the committee since 1985 and its chairman since 1992.

Presentations

Several members of the Delaware Geological Survey presented papers at the Geological Society of America annual meeting in Boston, October 24-28: **Richard N. Benson,** "Radiolarian and Diatom Biostratigraphic Correlation of a Diverse Land and Marine Vertebrate Fossil Assemblage from Lower Miocene Shell Beds, Delaware;" **Kelvin W. Ramsey** and **Johan J. Groot,** "Quaternary Evolution of the Coastal Plain of Delaware;" and University of Delaware doctoral student Narender Pendkar with **Robert R. Jordan,** "Diagenesis of Siliciclastic Reservoir Rocks, Baltimore Canyon Trough, Mid-Atlantic Continental Margin."

A. Scott Andres, "Nitrate Contamination of Ground and Surface Waters, Coastal Sussex County, Delaware," at the Delaware Department of Agriculture, July 16.

Robert R. Jordan, "Shoreline Migration in Delaware," at the Eighth Symposium on Coastal and Ocean Management, New Orleans, Louisiana, July 21.

W. S. Schenck, "History of Maps and How Topographic Maps are Made" at Redding Middle School, October 5, and P. S. du Pont Elementary School, October 9.

John H. Talley, "The Integration and Management of Ground and Surface Water Resources for Drought Response in New Castle County, Delaware," at the ASCE National Conference on Irrigation and Drainage Engineering, July 20, Park City, Utah, with Bernard L. Dworsky and Martin W. Wollaston, Water Resources Agency for New Castle County.

Externally Supported Projects

A. Scott Andres from the Delaware Department of Natural Resources and Environmental Control for ground-water recharge mapping in the Millsboro, Milford, and Harbeson areas.

Kelvin W. Ramsey from the Minerals Management Service of the U. S. Department of Interior for the second year of the Delaware Geological Survey-Maryland Geological Survey-Minerals Management Service Cooperative Offshore Sand Resources Study.

First State Geology is published by the Delaware Geological Survey, a State agency established by an Act of the Delaware General Assembly in 1951 and organized as a unit of the University of Delaware.
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