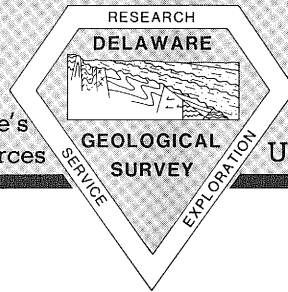


First State Geology

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Damaging March Coastal Storm

A major storm that passed along the Delaware coast on March 28-29, 1984 caused considerable road flooding and damage in the State. Roads were flooded along both the Atlantic coast and in communities fronting Delaware Bay. Along the Atlantic coast there was moderate to severe beach and dune erosion. As in previous storms, areas where dunes were breached and washovers occurred were located in highly developed and heavily used beach areas where dunes, even if present, have narrow bases and are relatively low in elevation. Damage from the storm ranged from water damage caused by tidal flooding to structural and road damage caused by wave action.

Heavy precipitation and constant 30-40 knot easterly, northeasterly, and northerly winds with gusts up to 84 miles per hour characterized the storm. In the storm's center the storm-duration low barometric pressure of 28.54 inches of mercury was recorded at 10:00 a.m. on March 29 at Indian River Coast Guard Station. The low pressure, strong winds, and overland runoff

combined to produce above normal tides, ranging from 6.97 feet above mean sea level (MSL) at Breakwater Harbor in Lewes to 5.36 feet above MSL at Indian River Inlet.

Maximum heights of tides recorded at four tidal crest-stage partial record stations indicated that water levels reached during the storm approached or exceeded those of record since the stations were installed in 1966. Record high levels were reached on Cedar Creek near Slaughter Beach and on Duck Creek at Smyrna. The 5.23 feet above MSL recorded at Oak Orchard on the Indian River is comparable to the 5.34 foot recording of March 12, 1968 but was well below the record of 8.25 feet set during the devastating coastal storm of March 6-7, 1962.

More Earthquakes

Earthquakes continued to be felt in the Wilmington and surrounding areas during the first half of 1984. The third event in as many months occurred on January 19 at 6:03 p.m. EST and was centered again along Brandywine Creek, just north of Wilmington. It registered a 2.5 on the Richter scale according to calculations by Kenneth D. Woodruff, DGS Associate Director. A smaller aftershock (magnitude 1.8) was recorded about 70 minutes after the main shock, and some residents reported feeling both the main shock and aftershock. The aftershock helped to better locate the main epicenter.

A fourth earthquake, the smallest of the four events, occurred at 5:17 p.m. on February 15. Only a few felt reports were received, again from just north of Wilmington. The small magnitude (1.5) and the time of occurrence during the peak of commuter traffic were probably the reasons it went largely unnoticed. Those reports that were received described the event as a "boom" or "explosion-like" noise.

Since the February 15 event the DGS seismic network has recorded, in the Wilmington area, several probable



View of Ocean Drive in South Bethany showing damage caused by wave action.



Tidal flooding west of Route 1 in Dewey Beach.

microearthquakes of extremely small magnitude.

Seismic activity has continued in the region, culminating, for the time being, in the earthquake of Easter Sunday evening (April 22) centered just south of Lancaster, Pennsylvania. A magnitude 4.0 event shook much of the Atlantic seaboard from Washington to New York City at about 8:36 p.m. The quake was well recorded on all three stations of the Delaware network, and DGS staff, along with investigators from other subnetworks of the Northeastern U.S. Seismic Network, worked much of that night gathering data and providing information. Over the next several days data continued to be refined, and aftershocks were monitored in the Lancaster area by scientists from Lamont-Doherty Geological Observatory and Pennsylvania State University. Millersville State College coordinated much of the effort, including the intensity study based on information provided by persons who felt the earthquake in the area. Several aftershocks occurred over a period of approximately the next two weeks, including at least two that were felt. Other aftershocks were detected only instrumentally. This earthquake was probably the largest to occur in the immediate area since at least the Wilmington event of 1871. A magnitude 3.8 earthquake centered along the Delaware River in northeast Delaware shook the east coast on February 28, 1973.

The Lancaster quake continues to provide a great deal of thought-provoking data and has stimulated renewed interest in the geologic history of this entire region. Initial indications are that the epicenters of successive aftershocks migrated along a north-south line and cut across regional structural trends. Of fundamental importance is the question of whether all of the recent seismicity in this part of the east is directly related to the same set of stresses and whether or not a pattern is now emerging.

Offshore Update

Shell spuds third deep-water well. On May 26, 1984, Shell Offshore, Inc. began drilling its third deep-water Atlantic OCS exploratory oil well, located on Wilmington Canyon Block 372 about 120 miles east of the Delaware shore. In a water depth of 6,952 feet it will break the previous world water depth record of 6,448 feet for drilling with a marine riser assembly that was set in Shell's first deep-water well completed in December 1983, about 25 miles southwest of the current attempt. The first well reached a depth of 14,500 feet. The second, located about three miles to the west, was drilled to 16,000 feet and was plugged and abandoned on May 22, 1984. Neither well encountered commercial quantities of oil or gas. The projected depth for the third well is 11,000 feet below sea level, a sedimentary rock penetration of only about 4,000 feet.

The wells are being drilled by the dynamically positioned drill ship *Discoverer Seven Seas* into potential reservoirs associated with the ancient carbonate shelf edge of Late Jurassic age. Shell is operator for the project with a 50 percent interest. Amoco Production Co. has 31.25 percent interest and Sun Exploration and Production Co. has 18.75 percent.

Block 598 unit leases cancelled. The unit exploration agreement for Hudson Canyon Blocks 598, 599, 642, and 643 expired on April 15, 1984. The blocks are over a geologic structure in which Jurassic sands tested significant quantities of gas. Each lease reverted to the original owners until the two-year suspension of production agreements expired. For Exxon's Blocks 599 and 643, this was April 21, 1984, and for the Texaco group's Block 598 and the Tenneco group's Block 642 it was May 21, 1984.

Tenneco was the operator of the unit exploration agreement. Three-dimensional seismic reflection profiling over the blocks was used to try to determine more precisely the amount of natural gas in the reservoirs. Although there was no general agreement among the nine companies involved in the unit, not enough gas reserves were estimated to justify building an offshore production platform and a pipeline to shore.

Outer Continental Shelf Policy Committee. The Outer Continental Shelf Policy Committee (OCSPC), which advises the Department of the Interior on matters relating to offshore petroleum and mineral exploration and production, met at Washington, D. C.,

January 10-12, 1984. Secretary of the Interior William P. Clark presented a major policy statement in which he indicated that the concerns of coastal States would receive increased attention. Other officials of Interior, including the newly appointed Director of the Minerals Management Service (MMS), William D. Bettenberg, echoed that theme. Department of Energy Secretary Donald Paul Hodel reviewed the world petroleum outlook for the Committee.

R. R. Jordan and R. N. Benson represented Delaware at the OCSPC meeting. Jordan presented a paper, "Mid-Atlantic Regional Perspectives."

OCSPC Chairman, W. L. Fisher, State Geologist of Texas, has announced that the Committee will meet next at Portland, Oregon on June 20-22, 1984. R. N. Benson will represent Delaware.

Governor Pierre S. du Pont, IV, has appointed Robert J. Touhey, Acting Director of the Division of Environmental Control, to serve as Delaware's Member of OCSPC. The Governor continued the appointment of State Geologist R. R. Jordan as Alternate.

Mid-Atlantic Regional Technical Working Group. The Mid-Atlantic Regional Technical Working Group of the OCS Advisory Board met at Atlantic City, New Jersey on March 28, 1984. The Group received a number of reports dealing with Congressional activities, offshore phosphorites, drilling discharges, offshore development and the environment, guyed tower production platforms, and fisheries. Much of the information and discussion will be useful in consideration of the next Mid-Atlantic Lease Sale (No. 111) scheduled for the fall of 1985. R. R. Jordan, State Co-Chairman, and Bruce Weetman, Acting Atlantic OCS Regional Manager for MMS, chaired the one-day meeting.

Mid-Atlantic Governors' Coastal Resources Council. State Representatives to the Mid-Atlantic Governors' Coastal Resources Council (MAGCRC) met with MMS Director William D. Bettenberg on March 26, 1984 in Vienna, Virginia. Bettenberg and his staff responded to MAGCRC's request for results of the Call for Information for OCS Sale No. 111. Industry's nominations concentrated on deep-water tracts far offshore, but some interest was indicated in an area closer to shore off the Delmarva Peninsula. Bettenberg announced the MMS would not consider leasing areas closer to shore than 50 miles in Sale 111. He also reviewed Interior's opposition to bills before Congress that propose to restore State authority under the consistency provisions of the Coastal

Zone Management Act. MAGCRC representatives, including R. R. Jordan and R. N. Benson for Delaware, welcomed the opportunity for discussion of these topics with the leadership of MMS and generally agreed that this was a positive reflection of the policy changes announced by Secretary Clark in January.

Delaware State Board of Registration of Geologists

Emil Onuschak, Jr., Chairman

Despite the fact that public registration of practitioners is well established in professions such as medicine, law, and engineering, registration is a relatively new phenomenon in the geologic profession, starting in California in 1968. Beginning about 16 years ago, the State of Delaware began registering professional geologists. Building on this experience, a revised Delaware Geologists Registration Act was enacted and signed into law on July 11, 1978.

At the present time ten states provide some form of registration in the geological profession, but even the word "registration" is not used uniformly. In some states, including Delaware, geologists are "registered," and the regulated activity is the "practice of geology." Elsewhere, geologists may be "certified," and the regulated activity may be the use of the title "geologist." Sometimes professional societies are involved; more often they are not.

Given this confusing state of affairs, it should come as no surprise that laymen and geologists alike often have quite different and even conflicting views of professional registration. What indeed has been accomplished since the three-man Delaware State Board of Registration of Geologists was created?

The Board has reviewed hundreds of the 20-page application packets and supporting documents (geologist registration in Delaware is definitely not a "rubber stamp" process) from geologists all over the United States, has compiled and maintains a roster of nearly 200 active registrants, has investigated dozens of complaints alleging improprieties, and has held a number of formal and informal hearings to discover pertinent information and establish a clear

record of facts related to these complaints.

As a result of these activities, the citizens of Delaware have been provided with:

(a) The Board's roster, which represents a pool of valid professionals who are geologists, who have valid college degrees or acceptable equivalent training, who have ten years documented professional experience, and who have satisfied the Board as to their personal integrity.

(b) A public agency that is backed by the force of law, conducts its business in public view, and is charged with monitoring the "practice of geology" in the State of Delaware. This translates into an accessible public agency that, for example, responds to questions concerning the credentials of persons claiming to be geologists, that identifies geologists who develop required geologic information for projects requiring permits or official review within the State, or that helps to explain geological reports and terminology to the layman.

(c) A commitment by the State to ensure that laws, regulations and permits involving geologic data are technically valid and of high quality. The quality of geologic work performed in Delaware is improved by the Board's policy of insisting on signed professional reports naming a registered geologist as being responsible for the geologic data and interpretations in the report. This translates into improved management of Delaware's natural resources, including water, land, and minerals.

There are several misconceptions about the role of registration or other types of boards that pass on the qualifications of professionals. It is sometimes charged that registration of professionals is nothing but a device to stifle competition and establish a closed "club" for a small select group. In Delaware, at least, the reality is that a deputy attorney general is independently assigned, and frequently changed, to guide and oversee the legal aspects of how each professional registration board conducts its business. The Board members' strong ethical sense compels them to abstain from decisions when even the appearance of a possible conflict of interest arises.

Another unfounded complaint that is frequently heard has to do with examinations. "But I'm a petroleum geologist. How do I know the exam will address my field?" In Delaware, the answer to this question is both simple and complex. The simple answer is that the examination will not deliberately address your field of geologic

specialization. Such tests of academic knowledge have already been administered in college and are documented by presentation to the Board of a valid, original college transcript. The complex answer is that the professional geologists' examination developed by the Delaware State Board of Registration of Geologists is designed to quantitatively measure professional judgement in a variety of "real-life" situations. These situations are carefully arranged so that an applicant in almost any geologic specialty will find sufficient questions to answer so that he or she can achieve a passing grade, given the correct response. Three years of the ten years documented professional experience required for registration may be credited to the applicant who passes the examination.

The final misconception should be cleared up: Board members are not paid for their services, and they, and their employers, donate their time to the State. Anyone interested in learning more about the Delaware State Board of Registration of Geologists is invited to call the Board's office (302-571-3286) with their questions, or to learn the time and place of the next scheduled meeting. Attendance is strongly encouraged.

COSUNA Chart A new regional correlation chart for the Atlantic Coastal Plain has been issued by the American Association of Petroleum Geologists (AAPG). State Geologist Robert R. Jordan and Richard V. Smith, formerly with the DGS, served as co-coordinators for the project, which included contributions from geologists representing each State between New Jersey and South Carolina. The correlation chart is the final product of a six-year effort and one of 16 such charts that will soon be available for the entire U. S. under the AAPG research project "Correlation of Stratigraphic Units of North America" (COSUNA).

In accordance with COSUNA format, the Atlantic Coastal Plain Correlation Chart is time-based. It contains 595 entries in 38 stratigraphic columns for 200 stratigraphic units. About 1,750 pages of data sheets were prepared for the Coastal Plain. These are being entered in a computerized data system at the University of Oklahoma along with data from the other COSUNA charts.

The Atlantic Coastal Plain chart is priced at \$8.00 and can be ordered from AAPG Bookstore, P. O. Box 979, Tulsa, OK 74101.

AASG Meets in Duluth

State Geologists from across the U. S. met at Duluth, Minnesota, June 3-7, 1984 for the 76th Annual Meeting of the Association of American State Geologists (AASG). Reports were received from AASG's many committees and liaison representatives that act throughout the year on technical and policy matters involving geology and earth resources. The meeting featured discussions with representatives of related organizations, including for the first time the Canadian Provincial Geologists Committee, and of corresponding agencies of the U. S. Department of the Interior.

Delaware's Robert R. Jordan completed his term as President of AASG by presiding at the Annual Meeting. James F. Davis of California was elected AASG's President for the year 1984-1985.

Publications

Recent DGS Publications

Reports of Investigations

No. 38. Hydrology of the Manokin, Ocean City, and Pocomoke aquifers of southeastern Delaware: A. L. Hodges, 1984, 60 p.

Open File Reports

No. 28. Potential for ground-water recharge in the Coastal Plain of northern New Castle County, Delaware: Petty *et al.*, K. D. Woodruff, editor, 1983, Map, scale 1:24,000, with discussion.

Delaware Geological Survey Atlas
Delaware City Quadrangle (DEC): N. Spoljaric, Editor, 1983, 10 p.

Special Publications

No. 11. Instructions for preparation of Delaware Geological Survey Base Schedules: J. H. Talley and D. C. Windish, 1984, 119 p.

Forthcoming DGS Publications

Current cartographic information in Delaware: W. S. Schenck.

Delaware Geological Survey Atlas, St. Georges Quadrangle (SAG): N. Spoljaric, editor.

Earthquakes in Delaware and nearby areas: K. D. Woodruff

Geohydrology of the Wilmington area, Delaware, Sheets 2 and 3: K. D. Woodruff.

List of publications, 1984: J. H. Talley
Structure contour map of pre-Mesozoic basement beneath Baltimore Canyon trough and adjacent Middle Atlantic Coastal Plain: R. N. Benson.

Other Publications by DGS Staff

R. R. Jordan and R. V. Smith, 1984. "Notes on the Atlantic Coastal Plain COSUNA Correlation Chart," *Southeastern Geology*, v. 24, p. 195-205.
R. R. Jordan, 1984. "Note 54, Records of the Stratigraphic Commission, 1980-1982," *American Association of Petroleum Geologists Bulletin* (in press).

Staff Notes

Robert R. Jordan and Kenneth D. Woodruff briefed Wilmington City Council on northern Delaware earthquakes on February 14, 1984. During that month they also met with officials of Aberdeen Proving Ground to discuss the differentiation of natural from man-made events and the potential for cooperative monitoring.

R. R. Jordan presented the report of the Ad Hoc Committee on Water Management, which he co-chaired with John H. Talley, to the Conservation Conference of the Delaware Association of Conservation Districts at Dover on February 27, 1984.

At the Second Annual Delaware Water Conference, March 22, 1984, sponsored by the Department of Natural Resources and Environmental Control, R. R. Jordan served as moderator for the workshop "Water Quality — How Clean is Clean?"

Papers Presented:

Robert G. Doyle (formerly with DGS) and Richard N. Benson, "Geologic framework for the development of the U.S. Mid-Atlantic continental margin" at the meeting of the Northeastern Section of the Geological Society of America, Providence, RI, March 15, 1984.

Richard N. Benson and Robert G. Doyle, "Inner margin of Baltimore Canyon trough: future exploration play" at the Annual Convention of the American Association of Petroleum Geologists, San Antonio, TX, May 23, 1984.

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