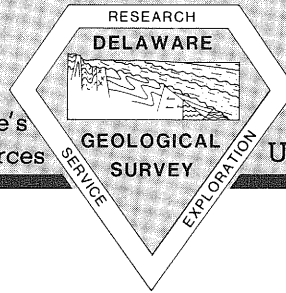


First State Geology

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



Published twice yearly
by the Delaware Geological Survey,
University of Delaware, Newark, DE 19716

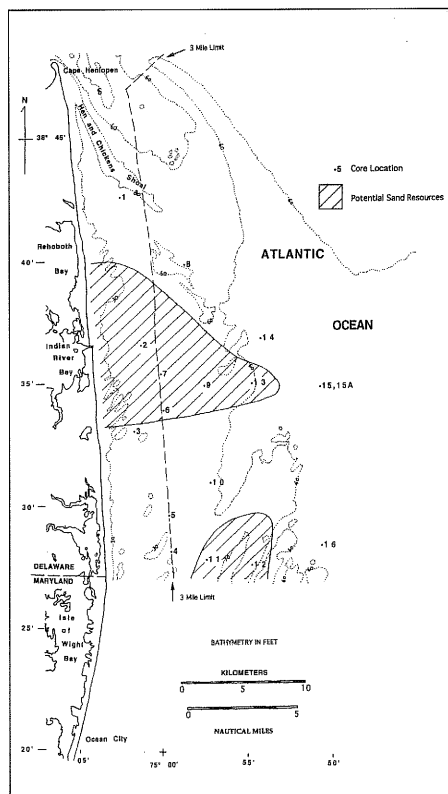
Vol. 13, No. 1

Winter 1995

Offshore Sand Resources

By Kelvin W. Ramsey

Two areas of potential sand resources offshore Delaware have been identified from analysis of seismic reflection profiles and sediment cores. The areas, shown on the accompanying map, are shoals 4-8 miles offshore the community of Fenwick Island and sands extending several miles offshore from Indian River inlet. The seismic profiles and cores were acquired through funding under the cooperative agreement between the Minerals Management Service of the U. S. Department of the Interior and the Maryland and Delaware geological surveys. The purpose is to identify sand resources



Areas identified as potential offshore sand resources for beach nourishment.

beyond the three-mile limit offshore the two states. As nearshore sand resources for beach nourishment and other uses are depleted, there will be an increasing need for additional resources from areas under federal jurisdiction.

The cooperative study is now in its third year. The DGS effort will focus on refining the known distribution of the potential resources and determining the age and origin of the sand bodies. This will provide a model for exploration for additional offshore sand resources that may have similar ages or modes of origin.

Sea Level Rise Lags Behind Climate Change

By Johan J. Groot

A systematic study of fossil pollen and spores obtained from sediment cores collected offshore Delaware is in progress as part of the Maryland Geological Survey/Delaware Geological Survey Cooperative Offshore Sand Resources Study. Analysis of core samples from water depths between 39 and 76 feet indicates that a temperate to warm temperate climate prevailed at a time when sea level was about 70 feet lower than at present. This relatively low sea level occurred about 8000 to 9000 years ago; therefore, the rate of sea level rise owing to the melting of continental glaciers is much less than the rate of change from a cold glacial continental climate to a temperate one.

Sediments containing fossil pollen indicating a cold climate and a boreal forest occur in a present water depth of more than 75 feet. The age of these deposits remains to be determined.

As an integral part of the offshore sand resources study, the fossil pollen and spore record will provide important information leading to understanding the age and origin of sand bodies identified as potential resources.

OCS Sand and Gravel Bill Passes

House of Representatives bill H. R. 3678 authorizing the Secretary of Interior to negotiate agreements for the use of Outer Continental Shelf (OCS) sand, gravel, and shell resources was passed by Congress in October and signed by President Clinton in early November. The new law amends the OCS Lands Act to permit access to certain "hard mineral" resources under federal waters without using cumbersome bidding procedures designed for oil and gas exploration. The change is of interest to Delaware because of potential use of sand from the OCS for beach nourishment.

State Geologist Robert R. Jordan testified in favor of the bill. He serves on the Hard Minerals Subcommittee of the OCS Policy Committee which will advise the Department of the Interior on the implementation of the new measure.

OCS 5-year Oil and Gas Leasing Program

The Department of the Interior's Minerals Management Service (MMS) has begun preparation of the next 5-year OCS (Outer Continental Shelf) oil and gas leasing program for the period 1997-2002. The OCS Lands Act requires that Interior (MMS) develop a plan well in advance of leasing so that all parties will be informed of intended actions and have opportunities for comment. The long lead time is necessary because of several notice and comment periods and the preparation of the environmental impact statement (EIS) for the proposed action. The 5-year program is subject to congressional review, and each proposed sale requires the notice, comment, and EIS procedures.

The area offshore Delaware in the OCS Mid-Atlantic Planning Area is currently under a moratorium that prevents oil and gas lease sales, and there is little known

industry interest in further exploration there. However, because the world energy situation is always changing and much can happen in statute and policy before 1997, the DGS will continue to review information and provide advice throughout the process of developing the 5-year program.

Opportunities for Geologic Research in Delaware

In preparing for a Department of Geology seminar on the subject, Kelvin W. Ramsey compiled a list of problems for geologic research in or relevant to Delaware that the DGS staff members submitted to him at his request. Some of the items have surfaced as a result of recent geologic and hydrologic investigations, whereas others are of long-standing interest since the beginnings of the DGS or to the geologic community at large. Some are of only academic interest at this time, but many have bearing on immediate applications in serving the needs of the state. The list is not exhaustive as Ramsey only asked for a few geologic problems that immediately came to mind from each person.

The DGS sample collections and databases are important resources that can be used for investigating many of the problems listed under the following broad categories.

Geologic history/geomorphology

- The geologic and geomorphic history of Iron Hill and Chestnut Hill.
- The geologic history of the Cypress swamp area.
- The internal stratigraphy and paleoenvironmental history of the undrained depressions in the Blackbird area.
- Hydrology of fresh water wetlands and comparison with wetland mitigation sites.
- The origin and development of the Delamarter Peninsula.
- Ages of soils in the Piedmont and Coastal Plain.

Structure and tectonics

- The structural configuration and identification of rock units of the pre-Mesozoic Coastal Plain basement - is it a fragment of Africa left behind after breakup of Pangea?
- Confirmation, by means of deep drilling, of the existence of Mesozoic rift basins buried beneath the Coastal Plain, as interpreted from seismic reflection profiles.
- Confirmation of faults offsetting Coastal Plain rocks.
- Is there a connection between the geographic and stratigraphic distribution of palynomorph exines of differing colors, possibly the result of localized heating events, and the occurrence of faults in the Coastal Plain?

- Is the Fall Zone a fault zone? If so, how long has it been active and is it still active? Is it the locus of some of our local seismicity?
- What is the relationship between local seismicity and structures in the Piedmont, the Coastal Plain, and Coastal Plain basement?

Stratigraphy/sedimentology

- What is the configuration of sands (potential aquifers) within the Potomac Formation in New Castle County?
- The paleontology and paleoecology of the marine Cretaceous formations of Delaware.
- What is the origin and stratigraphic position of the silicified wood occurrences in Delaware?
- What is the age and origin of the Bryn Mawr Formation?
- What are the stratigraphic boundaries of the Columbia Formation and the volume of sediment contained within the unit?

Paleoclimatology

- What is the nature of the late Eocene to early Oligocene climate change as recorded in the rocks of the Coastal Plain?
- Was the mid-Pliocene climate (about 3 million years ago) in Delaware and adjacent areas a warm period or not?

Petrology

- What is the origin of the granitic pegmatites in the Piedmont? Why is their composition relatively simple, e. g., lacking topaz, uranium minerals, rare earth elements?
- What is the source rock for the sillimanite boulders found at Brandywine Springs Park? Why does the mineral occur in such atypically large masses instead of as disseminated grains?

Geochemistry

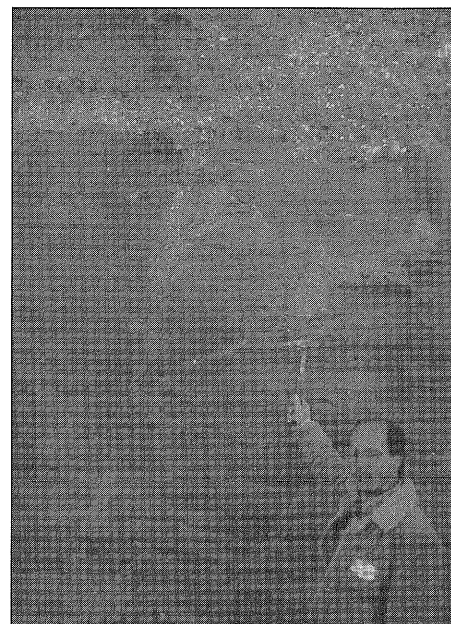
- What were the geochemical controls on the formation of jasper and gossan on Iron Hill?
- What is the geochemistry of iron in Coastal Plain rocks and of the formation of ferricrete (ironstone)?

Southeastern Friends of the Pleistocene Field Trip in Delaware

Kelvin W. Ramsey organized and led a group of 52 geologists, geomorphologists, and soil scientists on the 1994 Southeastern Friends of the Pleistocene (SEFOP) Field Trip in Delaware, November 11-12. The trip emphasized the development of landforms and sedimentary deposits during the last million years and observations of the effects of cold glacial climates on these features. Areas visited in the Piedmont were the valleys formed on the Cockeysville Formation (marble and other calcareous

rocks) and the relatively steep hill and valley topography near Ashland. In the Coastal Plain stops were made at Iron and Chestnut hills, exposures of the Columbia and Lynch Heights formations, the undrained depressions near Blackbird, Carolina bays, and exposures of ancient and modern shorelines of Delaware Bay near Milford.

In addition to the many geologists and soil scientists from Delaware, other participants came from Pennsylvania, Maryland, Virginia, West Virginia, and Tennessee. Copies of the SEFOP field trip guidebook are available for purchase. Contact Kelvin Ramsey at the DGS for details.



John Barndt, DNREC, pointing to frost wedge exposed near Middletown.

Coastal Plain Faults

By Richard N. Benson

Ongoing studies of the subsurface geology of the Coastal Plain of Delaware and adjacent states reveal that faulting may be a major factor that controlled the deposition and preservation of stratigraphic units. This finding was derived from correlation of borehole geophysical logs supported by biostratigraphic studies of foraminifers, radiolarians, and diatoms. Additional documentation is provided by seismic reflection profiles that show offset reflectors.

Preliminary results of these studies were presented in October at the annual meeting of the Geological Society of America in Seattle. Uplift and resulting extension of the U.S. Atlantic continental margin is invoked as a mechanism for the development of normal faults in the Coastal Plain, some of which may connect at depth with border faults of buried early Mesozoic

rift basins. The uplift histories of the Appalachian-Labrador Rise on land and the Bermuda Rise of the northwest Atlantic Ocean basin may be linked as volcanic activity of Eocene and Cretaceous age is documented for both. Faulting of younger Miocene rocks is related to renewed uplift of the Appalachians as revealed by a 9-fold increase in the clastic sediment accumulation rate for the mid-Atlantic continental margin during the middle Miocene.

Understanding the role of faulting in the Coastal Plain is important to other geologic studies in Delaware. These include the subsurface correlation of aquifers and the distribution of earthquake epicenters. However, there is no known relationship of faults in the Coastal Plain to earthquake epicenters recorded to date.

Hydrology News

By A. Scott Andres and John H. Talley

Work continues on ground-water recharge potential maps of the Milford, Millsboro, and Harbeson quadrangles, which are scheduled for completion March 1995. Assistance for the test-drilling program by the town of Millsboro is appreciated. The Department of Natural Resources and Environmental Control is considering the need for ground-water recharge mapping of the Little Creek, Smyrna, Clayton, Millington, Sudlersville, and Bombay Hook quadrangles.

In July, work began on a project to design, develop, and operate a ground-water quality and ground-water level monitoring network for southern New Castle County. A baseline survey of existing ground-water quality is essential in the identification of temporal and spatial changes resulting from natural and anthropogenic factors. The project, funded by the Water Resources Agency for New Castle County, supplements several ongoing programs in southern New Castle County and will enable state and local officials to effectively manage ground-water development and use and to provide a database for long-term planning.

Earthquake Hazards

Data generated by the earthquake monitoring and related investigations by the DGS are being used to document that our level of seismic hazard should be consistent with that of adjacent states with similar geology. Federal agencies relegated Delaware to a relatively low rank despite the assignment of a higher level to neighboring states. This has the effect of disqualifying the Delaware Emergency Management Agency from certain support under the National Earthquake Hazard Reduction Program (NEHRP).

This unusual application of DGS data is a reminder that because state lines do not usually reflect the underlying geology they do not serve as barriers to natural hazards. Northern Delaware lies in a portion of the Appalachian Piedmont Province that extends from New Jersey to Alabama. The rest of the state is in the Atlantic Coastal Plain Province that runs along almost the entire East Coast with related geology continuing around much of the Gulf Coast. These large geologic provinces are defined by generalized geologic similarities, although differences exist at specific sites within them. Delaware geologists, therefore, benefit from information shared by scientists working elsewhere in the Piedmont and Coastal Plain.

Maryland Geological Survey's Weaver Building

The historic building housing the Maryland Geological Survey (MGS) in Baltimore was renamed the Kenneth N. Weaver Building by the Maryland Board of Public Works on September 28, 1994. This action was to honor Dr. Weaver who retired in 1992 after serving as State Geologist and director of the MGS for nearly 30 years. The building, originally named Bennett Hall, was the second Goucher College building; it was constructed in 1888 with an annex added five years later. Following renovations by the Maryland Department of Natural Resources, the building became the headquarters of the MGS in 1986.

During Dr. Weaver's tenure, productive working relationships were established between the Delaware and Maryland state geological surveys. The cooperation has extended to such diverse projects as restoration of the boundary lines between the states and investigations for offshore sand resources for beach nourishment.

Dissertation on James C. Booth

Eric Wittkopf, University of Delaware Department of History, recently completed a Ph. D. dissertation titled "James Curtis Booth: Chemist in Antebellum Pennsylvania." Thomas E. Pickett of the DGS served as an outside member of Wittkopf's dissertation committee.

Booth was Delaware's first state geologist serving from 1837 to 1841. His was the first statewide investigation of the geology of Delaware, and his publication is still useful for rock descriptions and locations of outcrops long-forgotten or those no longer available to observation.

Wittkopf provides a comprehensive analysis of Booth's life as gleaned from the

Booth Papers of the Morris Library's Special Collections at the University. Booth remained very modest about his geologic work in Delaware, even near the end of his life. Wittkopf summarized that "Booth was a transitional figure in the pre-professional era of science who contributed to the subsequent expansion of chemical occupation in business and industry, thus helping to professionalize science."

DGS on the Internet

In another step in making the resources of the Delaware Geological Survey accessible to all users, we are now on the Internet. Requests for publications and for any geologic, hydrologic, and cartographic information can be made via e-mail to DGS@MVS.UDEL.EDU.

The Delaware Geological Survey List of Publications is now available through the University of Delaware Internet Gopher service. Access is via UD Department, Program, and College Information Services on the University Gopher main menu. Publications are listed by series. About the DGS, DGS staff members, and how to order publications are also included. The List is updated at the end of each fiscal year.

Cartographic Corner

By William S. Schenck

- Digital line graph (DLG) hypsography (topographic contour lines) data on CD-ROM for each quadrangle in Sussex County are now available. These plus the CD-ROM digital hypsography data for the Elkton, Maryland, Quadrangle may be checked out from the DGSCIC for transfer to users' systems. The files are available in two formats, standard DLG format importable into software designed to handle straight DLG configurations such as ARC INFO, and USGS optional format which is 80-column records for import into software such as ATLAS GIS. Digital hypsography layers for Kent and New Castle counties are being gathered by contractors for USGS and are expected to be available during the latter half of 1995. For more information or to check out CD-ROMs call 831-8262.
- Fifty-four of the 57 7.5-minute quadrangles covering Delaware are available for \$2.50 each. Request an index and order form from the DGSCIC.
- A CD-ROM containing the vertical control database for the United States is available for purchase (\$50.00) from the National Geodetic Survey. These data are based on the new North American Vertical Datum of 1988 (NAVD88); however, each record includes the appropriate factors to convert from NAVD88 to the NGVD29 datum.

Publications

- R. N. Benson, 1993, Earthquakes 1993: Pennsylvania Geology, v.24, no. 4, p. 9-13.
- R. N. Benson, 1994, Mesozoic Rift Basins of the U. S. Middle Atlantic Continental Margin, in Dellagiario, G., Masterson, A. R., and Miller, L. A. eds., Proceedings of the Third Symposium on Studies Related to Continental Margins: Bureau of Economic Geology, The University of Texas at Austin, p. 99-105.
- K. W. Ramsey, 1994, Geomorphology and Stratigraphy of the Quaternary of Delaware: 1994 Southeastern Friends of the Pleistocene Field Trip Guidebook, 66 p.

Staff Notes

Presentations

- Richard N. Benson**, "Mid-Oligocene Unconformity and Faulting in the Atlantic Coastal Plain of Delaware Correlated with Uplift History of Appalachian-Labrador and Bermuda Rises," at annual meeting of the Geological Society of America, Seattle, October 24.
- Narender Pendkar and **Robert R. Jordan**, "Porosity Variations in Clastic Rocks, Baltimore Canyon Trough, Mid-Atlantic Continental Margin," at annual meeting

of the Geological Society of America, Seattle, October 25.

Service and Awards

- A. Scott Andres** completed 10 years of service to the DGS in October.
- Richard N. Benson** elected to Fellowship in the Geological Society of America by the GSA Council, October 25; appointed an Associate Editor for the *Environmental Geosciences Journal* published by the Division of Environmental Geosciences of the American Association of Petroleum Geologists for the 1994-1995 term.
- Robert R. Jordan** appointed for another three-year term to the North American Commission on Stratigraphic Nomenclature as chair of the American Association of Petroleum Geologists delegation to the commission; also appointed chairman of the Subcommittee on the Oil Pollution Act of the U. S. Department of the Interior's Outer Continental Shelf Policy Committee; Jordan recently received a "Certificate of Appreciation for Outstanding Service" from the National Research Council's Board of Environmental Studies and Toxicology.
- Thomas E. Pickett** completed a 5.5-year term as treasurer of the History of Earth Sciences Society.
- Kelvin W. Ramsey** has been promoted to the rank of Scientist with the DGS.

Externally Assisted Projects

- Kelvin W. Ramsey** from U. S. Department of the Interior, Minerals Management Service, for "Maryland Geological Survey/Delaware Geological Survey Cooperative Offshore Sand Resources Study;" from Minerals Management Service-University of Texas at Austin Continental Margins Program for "Stratigraphic Correlation, Onshore to Offshore, Delaware."
- John H. Talley** from the Water Resources Agency for New Castle County for a ground-water quality and ground-water level monitoring network for southern New Castle County.

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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