DELAWARE GEOLOGICAL SURVEY
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Base maps - USGS National Mapping Division, Sudlersville, Md. 1953, Kenton, Del., 1955, Dover, Del., 1956, Little Creek, Del., 1956,

Williams & Heintz Map Corporation, Capitol Heights, Md. 20743

GEOLOGY OF THE DOVER AREA, DELAWARE

by
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DISCUSSION

GEOLOGIC HISTORY

Miocene and Quaternary age rocks are exposed at the surface in the Dover area. The geologic history is interpreted from information provided by deep water wells within the map area and by extrapolation from data outside the area.

No wells penetrate the entire coastal plain sedimentary section; therefore, the nature of basement in the area is unknown. Most likely it is a complex of metamorphic and igneous rocks of Early Paleozoic age. Regional contours show the basement dips to the southeast from depths of 2,700 to 4,700 feet below sea level.

During the Early Cretaceous the nonmarine sediments of the Potomac Formation onlapped the subsiding weathered surface of the basement complex. These sediments represent an aggrading coastal alluvial plain sequence characterized by fluvial and possibly deltaic sands encased within overbank silts and clays. Sediments were derived by erosion from the regionally uplifted Appalachian Mountain system to the west.

Following a period of erosion or nondeposition during the earliest Late Cretaceous, a major marine transgression resulted first in the deposition of the tide-dominated lagoonal or estuarine deposits of the Magothy Formation, followed by fully marine conditions that lasted throughout at least the middle Eocene. The Matawan, Monmouth, Hornerstown, and Vincentown formations represent open shelf (neritic) conditions. The predominantly fine-grained deposits of the Pamunkey Formation were deposited in the deeper waters of the outer shelf to upper slope (bathyal) during the Late Cretaceous through early Eocene. Progradation of the sands and sandy silts of the Piney Point Formation during the middle Eocene created shoaling to inner neritic water depths. This formation is a major aquifer near the city of Dover.

This first major period of marine deposition is marked by the accumulation of glauconite. Much of the sedimentary section is glauconite-rich, not only as greensand units but in the silts and clays as well. Although hiatuses representing periods of submarine erosion or nondeposition have been documented by biostratigraphic studies, there is no evidence of total withdrawal of the sea until after the deposition of the Piney Point Formation (middle Eocene).

A second marine cycle began during late Oligocene-early Miocene time, although in the Dover area no fossils of Oligocene age have been found. Rapid transgression of the eroded surface of the Piney Point Formation is indicated by early Miocene microfossils with outer shelf affinities recovered from the basal part of the Calvert Formation. This was followed by shoaling to a shallow marine or lagoonal-estuarine environment prior to the introduction of the Calvert sands as shown on the cross section. The basal sands represent inner shelf water depths, but during the transition from early to middle Miocene time outer shelf conditions were re-established during which time radiolarians and particularly diatoms were produced in great numbers. To the west, in Maryland, a diatomite named the Fairhaven Member of the Calvert Formation was deposited at this time (latest early Miocene). The later sands of the Calvert represent shallower marine environments, and probably were deposited by prograding deltas that were later reworked by marine processes. The sands of the Calvert are often shelly and in many places are cemented by silica. They are also important as aquifers in Delaware, and where so exploited, have received the names Cheswold and Frederica.

The evidence is not clear when the second cycle of marine deposition ended. In the Dover area the sands and gravels of the Columbia Formation directly overlie middle Miocene rocks. These nonmarine sediments represent the distal portions of a fluvial system that transported melt water and debris from continental glaciers in Pennsylvania and New Jersey.

Tidal marshes with up to 80 feet of organic-rich sediment of Holocene age cover the eastern map area. The deposits represent infilling of old stream valleys as sea level rose after the last glacial period ended approximately 10,000 years ago.

FOSSILS

Hard, siliceous molds and casts of pelecypods, mostly the clam *Venus mercenaria,* have been found at Blanco Ditch, Kenton School, and Masseys Mill pond in the northwest part of the map area. They are believed to be Miocene in age because of similar occurrences in Maryland and New Jersey.

Radiolarians and diatoms of early to middle Miocene age were recovered from outcrops around Garrisons Lake, pits near the St. Jones River, Masseys Mill pond, and several wells in the area. Broken pelecypods are common returns in drilling wells into Miocene silts and sands in the Dover area. An outcrop of peat dated in excess of 40,000 years was sampled in the Fork Branch behind the Terry Campus of Delaware Technical and Community College. Peat dated at about 28,500 years before present was collected at Tappahanna Ditch in the southwest part of the map area (John Talley, personal communication).

EARTH RESOURCES

Columbia Formation sand and gravel are the most important mineral resources aside from ground water. Thickness contours (isopachs) indicate over 20 feet in the map area. In many areas where the Columbia overlies a sandy zone of the Calvert, greater thickness of usable sand may be found. Gravel is not generally found. The best is the Little Creek area, east of Dover, where grayish coarse sands and gravels are found.

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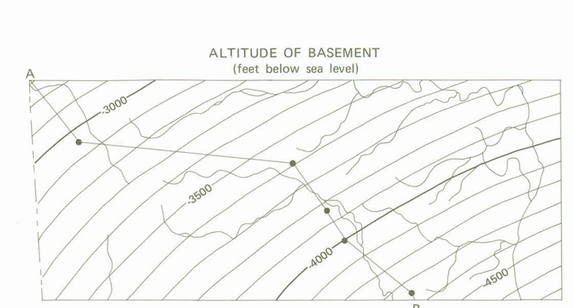
APPROXIMATE MEAN DECLINATION, 1983

ALTITUDE OF BASEMENT
(feet below sea level)

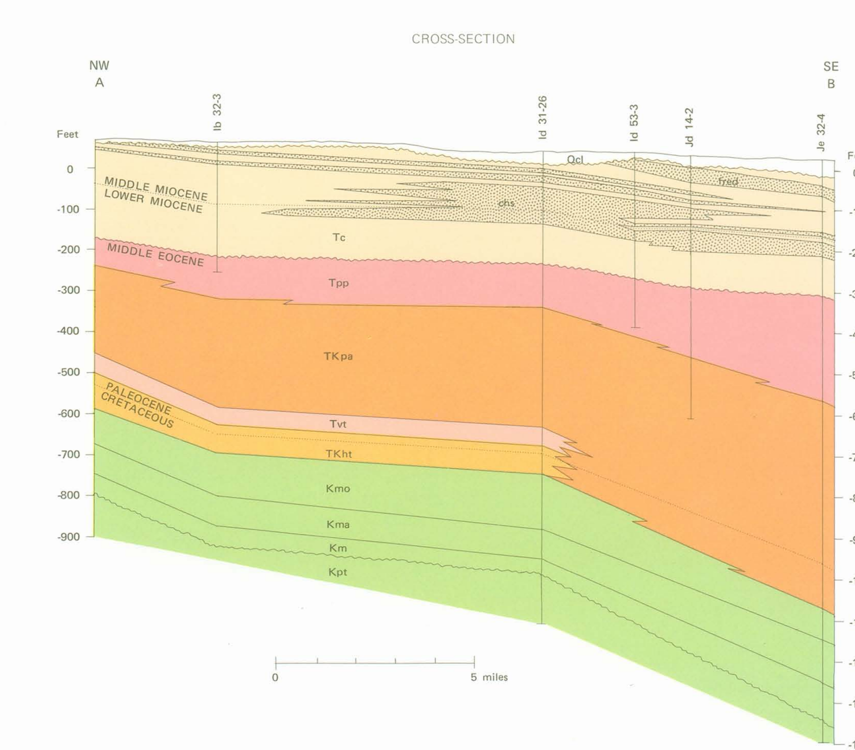


AB: line of cross section

SCALE 1:24000

CONTOUR INTERVAL 10 FEET (APPROX. 3 METERS)

CROSS-SECTION



QUADRANGLE LOCATION

EXPLANATION

CENOZOIC — QUATERNARY — HOLOCENE

TIDAL MARSH (Qtm)
(thickness contour in feet) (Richter, 1974)
Organic-rich silts, clays and fine sands. Deposited in tidal marshes.

CENOZOIC — QUATERNARY — PLEISTOCENE

COLUMBIA FORMATION (Qcl)
(thickness contour in feet)
Reddish-orange brown to tan, medium to coarse sand and minor gravel.

CENOZOIC — TERTIARY — MIOCENE — Chesapeake Group

Tc: sandy silt; Tc: sands; Tc: Siliceous sandstone outcrop

CALVERT FORMATION
Predominantly sandy silt, gray to bluish and greenish gray; diatomaceous, particularly in the lower Miocene. Subordinate sands are quartzose, medium to coarse grained, often shelly, where well-developed used as aquifers, e.g., Cheswold (chs) and Frederica (fred) aquifers. Hard fossiliferous, silica-cemented sandstones are discontinuous both in outcrop and subsurface.

OLDER FORMATIONS ONLY ON CROSS SECTION:

CENOZOIC — TERTIARY — PALEOCENE-EOCENE

PINEY POINT FORMATION (Tpp)
Greenish, fine to coarse, glauconitic sand and sandy silt

PAMUNKEY FORMATION (TKpa)
Greenish to dark gray, glauconitic silts and clays with minor fine sand

VINCENTOWN FORMATION (Tvt)
Greenish-gray, very fine to medium, glauconitic sand

MESOZOIC — UPPER CRETACEOUS

HORNERSTOWN FORMATION (TKht)
Greenish-gray, glauconitic silts and clays

MONMOUTH FORMATION (Kmo)
Dark gray to dark brown, fine to very fine, glauconitic, clayey, shelly sand and glauconitic silt

MATAWAN FORMATION (Kma)
Gray, glauconitic, slightly micaceous silty clay and dark gray, very fine, glauconitic, slightly micaceous sand

MAGOTHY FORMATION (Km)
Dark gray and black clayey and lignitic silt interbedded with light gray, fine to very fine, well-sorted, micaceous sand

MESOZOIC — LOWER CRETACEOUS

POTOMAC FORMATION (Kpt)
Variegated red, orange, and dark green clays and medium grained, white and brown sand; rare pyrite nodules and lignite

SYMBOLS

- Geologic contact (dashed where concealed)
- BM × Usable benchmark (Elevations available from DGS)
- △ Microfossils collected from outcrop
- ⚒ Sand pit, active and inactive
- Unconformity on cross section