DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
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NEW JERSEY GEOLOGICAL SURVEY

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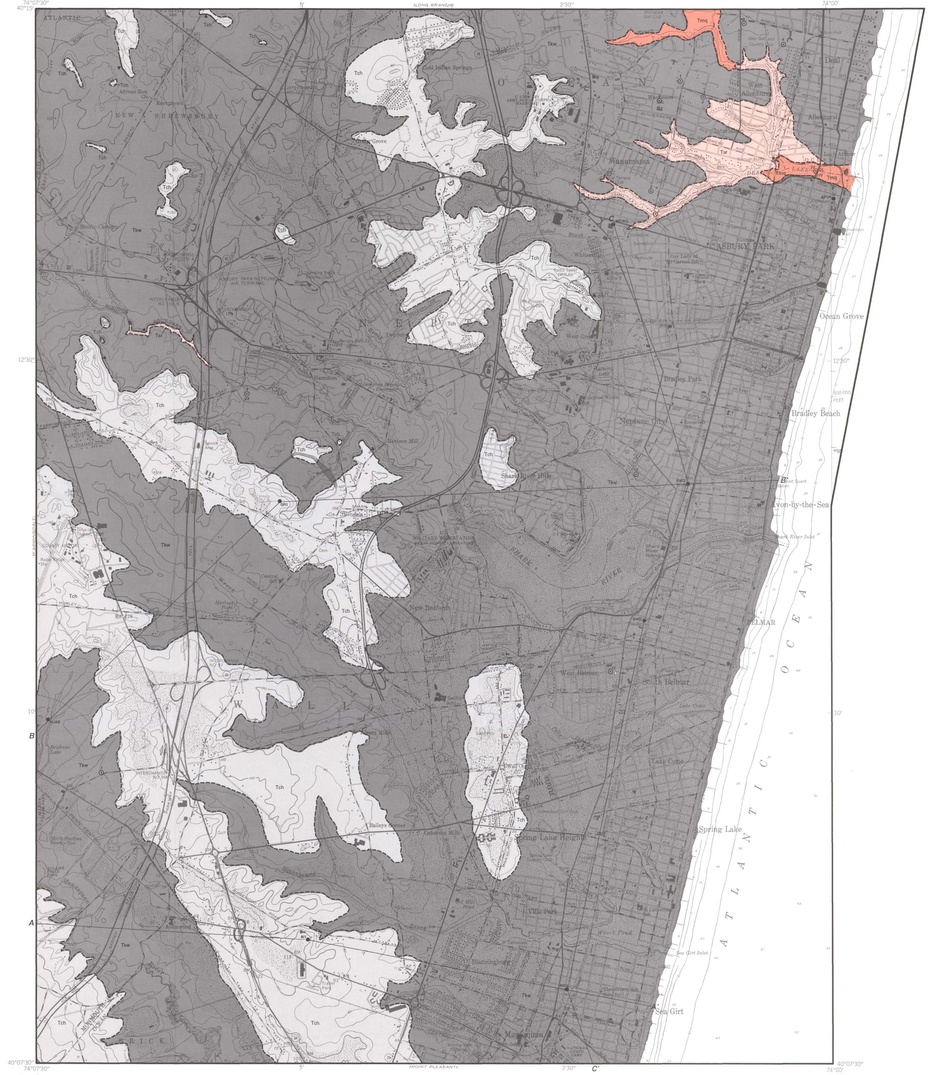
GEOLOGIC MAP OF THE ASBURY PARK QUADRANGLE
MONMOUTH AND OCEAN COUNTIES, NEW JERSEY
GEOLOGIC MAP SERIES GMS 94-2

FORMATION	LITHOLOGY	MAXIMUM THICKNESS (FT)	DESCRIPTION
SURFICIAL DEPOSITS		55	"Surficial" refers here to all post-Cohansey deposits. These are predominantly alluvial, colluvial, and paralic sands and gravels. They are shown on older maps as belonging to the Bridgeton, Pensauken, and Cape May Formations, but the use of these names for deposits distant from the type localities and of uncertain relationship to the type deposits is questionable. Alluvial deposits in present-day stream channels and adjacent lowlands are not shown on this map. Older alluvium forms terraces adjacent to stream channels and caps some hills. The terrace alluvium consists predominantly of quartz sand and gravel. Adjacent to the Manasquan River it is more than 20 feet (6.1 m) thick. The alluvium capping hills consists of orange and brown gravelly sand up to 10 feet (3 m) thick. The clasts are predominantly quartzite, with a maximum length of 3 inches (7.6 cm). Colluvium derived from mass wasting of the Cohansey Formation is widespread at lower elevations in river valleys and the coastal lowlands. It covers extensive areas of the eastern half of the quadrangle. Paralic deposits include Holocene beach sands and estuarine sediments. Some of the lakes adjacent to the coast previously were estuaries. In the Deal Lake Bridge boring, 55 feet (16.8 m) of Holocene material consists of fluvial, estuarine, and nearshore marine facies. Radiocarbon dating of peat and woody material yielded a date of 10,190 years for the base of this Holocene transgressive sequence, and 3,080 years for the middle of the section (Meyer Rubin, U. S. Geological Survey, written communication, 1990).
COHANSEY FORMATION		80	Quartz sand, yellowish-gray to pinkish-gray and grayish-orange to dark yellowish-orange, medium- to very coarse-grained, with occasional pebbles. Cross-stratified *trough* and *planar-tabular*). Dominantly an orthoquartzitic sand with traces of weathered feldspar and chert. Detrital heavy minerals may be abundant (2 to 3 percent) and ilmenite dominates among the opaque minerals; to a lesser extent zircon and sillimanite dominate the nonopaque minerals. Kaolinite is the dominant clay-sized mineral in the sand matrix and locally replaces feldspar clasts at the base of paleosols. *Ophiomorpha* burrows as much as 1.5 inches (3.8 cm) in diameter are common in certain beds. The map area is northeast of the main outcrop belt. The formation is extensively eroded, limited to elongate outliers only a few feet or tens of feet thick. Exposures are poor except in excavations because of the loose, sandy nature of the formation. Numerous pits offered excellent exposures of the Cohansey Formation during the mapping of the quadrangle, but many have subsequently closed. The basal contact of the formation is placed at the *unconformity* between cross-bedded, medium-to-coarse sand of the Cohansey and massive, fine-grained micaceous sand of the Kirkwood Formation. No datable material has been recovered from the Cohansey in this quadrangle. Owens and others (1988) consider the Cohansey as middle Miocene, owing to the similarity of its palynomorphs to those of the Kirkwood Formation. Recent strontium isotope age estimates for the upper part of the Kirkwood Formation (Sugarman and others, 1993) indicate that the Cohansey Formation is no older than approximately 12 m.y. (middle Miocene).
KIRKWOOD FORMATION		140	Sand, typically light-colored, interbedded with and overlying dark-gray or brown clay-silt. The sand is quartzose with small amounts of feldspar and mica (mostly muscovite). It is typically massive, orange, yellow, or gray, micaceous, burrowed, and has extensive iron oxide (Liesegang) banding. The detrital heavy minerals are dominated by the opaques, especially ilmenite, with lesser amounts of nonopaques including zircon, staurolite, garnet, tourmaline, and rutile. The lowermost clay-silt, termed the Asbury Clay (Nes and others, 1934) or Asbury Park Member of the Kirkwood Formation (isphording, 1970) is a dark, pasty, massive to laminated clay-silt with occasional interbeds of fine sand. Pyrite is common in the dark beds. Finely dispersed clay minerals include kaolinite, illite, and illite/smectite. This member is exposed in the Shark River and Manasquan River valleys. A reworked, coarse-glauconite-quartz sand with granules at the base of the Kirkwood is typically a few feet thick and rests unconformably upon the Shark River Formation. Woolman (1895) reported the diatom *Actinoptychus heliopelta* from the Kirkwood Formation in a well at Asbury Park. This places the Kirkwood within the lower Miocene East Coast Diatom Zone 1 of Andrews (1988). Sugarman and others (1993) obtained a strontium isotope age estimate of 19.2 to 22.6 Ma ±0.5 m.y. for this zone.
SHARK RIVER FORMATION		110	Clay-silt to very fine quartz sand, calcareous (where unweathered), grayish-olive-green and light-to-dark greenish gray, massive to thick-bedded and extensively burrowed. Bottyoidal glauconite, fine to coarse, as much as 20 percent in some intervals, is disseminated in a dominantly clay-silt matrix. Clay minerals include illite, illite/smectite, kaolinite, and minor clinoptilolite. Layers 1 to 2 feet (0.3 to 0.6 m) thick are cemented with iron oxide and contain casts and molds of *Veniacardita anticpata*. Exposures of the Shark River are sparse and very weathered. Thin, 1 to 2 foot (0.3 to 0.6 m) ledges and float blocks occur in the Shark River upstream from Schoolhouse Road; thicker exposures form banks along the upstream branches of Deal Lake. The contact with the underlying Manasquan Formation is unconformable (Sugarman and others, 1991; Owens and others, 1998; Poore and Bybell, 1988). Because of projections from contacts identified in split spoon samples from Deal Lake and the Asbury Park Wastewater Treatment Plant. The Shark River is middle Eocene (Bybell, 1992; Poore and Bybell, 1988). In the N. J. Geological Survey Allaire State Park corehole on the adjacent Farmingdale quadrangle, the unit contained calcareous nannoplankton zones NP 14 to 16 (Sugarman and others, 1991). Split spoon samples from Shark River Park and the Asbury Park Wastewater Treatment Plant contained the same zones.
MANASQUAN FORMATION		80	Clay-silt, dusky-yellow-green to pale-olive and grayish-green, extensively burrowed, calcareous (where unweathered), massive to thick-bedded, grading upward into very fine quartz sand. Clay minerals include illite, illite/smectite, and minor clinoptilolite. Fine glauconite sand is commonly dispersed throughout the dominantly clayey matrix. Porcelanite nodules occur in the clay-silt at Hog Swamp Brook; along the beaches at Deal and Allenhurst they weather out of the formation and are washed ashore. The Manasquan grades downward in some places into a quartz-glauconite sand. Enright (1969) and Olsson and Wise (1987) subdivide the Manasquan and Shark River into members. Subdivision is impracticable in this quadrangle because of the limited exposures and discontinuity of the members. The Manasquan is lower Eocene (Owens and others, 1988; Poore and Bybell, 1988; Sugarman and others, 1991). Split spoon samples from the Deal Lake Bridge borehole included calcareous nannoplankton zones NP 9 (upper part) to NP 13.
VINCENTOWN FORMATION		105	Sand, grayish-olive to dusky-yellow-green to greenish, dark-greenish, and olive-gray. Mostly quartz with minor amounts of feldspar. Glauconite composes 2 to 3 percent of the sand in the upper part; it increases to as much as 30 percent toward the base. Silt and fine sand similarly increases towards the base. Pyrite nodules, phosphate pebbles, and mica occur locally. Clay-sized minerals in the matrix include illite, illite/smectite, kaolinite, and calcite. Fossils are numerous and include bryozoan, mollusk, and echinoid fragments and microfossils. The quartz sand is an updip facies which changes sharply downdip to a grayish-olive-green, massive, micaceous, burrowed clay-silt with thin beds of very fine quartz and glauconite sand. The sand facies is thickest in the outcrop where it reaches more than 140 feet (43 m) south of Long Branch (Zapecza, 1989). Based on its foraminifera, the Vincentown in this area is upper Paleocene (Olsson and Wise, 1987).
HORNERSTOWN FORMATION		15	Glauconite sand, clayey, massive-bedded, dusky-yellowish-green to dusky-green; greenish-black where unweathered. Glauconite grains are mainly medium to coarse in size and botryoidal. Contains 1 to 2 percent fine- to very coarse-grained quartz sand, phosphate fragments, pyrite, and lignite. Based on its calcareous nannofossils, the Hornerstown is lower Paleocene (Danian) (Bybell, 1992).
NAVESINK-RED BANK FORMATION (undivided)		65	Sand, glauconite, slightly quartzose, clayey, greenish-black. Unconformably underlies the Hornerstown Formation and overlies the Mount Laurel Formation. In outcrop the Navesink Formation and the Red Bank Formation form an unconformity-bounded, coarsening-upward sedimentary sequence consisting of a basal glauconite sand (Navesink Formation), a middle silt, and an upper quartz sand (Red Bank Formation). Downdip but to the west of the Asbury Park quadrangle, the sand pinches out and the silt changes facies to a glauconite sand which is lithologically indistinguishable from the underlying Navesink Formation. The nannofossils *Nephrolithus frequens* and *Lithraphidites quadratus* indicate an upper Maastrichtian age.
MOUNT LAUREL FORMATION		50	Sand, quartz, fine- to coarse-grained, glauconite (2 to 5 percent), extensively burrowed, slightly micaceous and feldspathic, commonly interbedded with thin layers of dark clay-silt. Olive-gray to dark-greenish gray where unweathered. The transition from the Mount Laurel to the underlying Marshalltown-Wenonah Formations (undivided) is gradational and is marked by an increase in mica, a decrease in grain size, and the appearance of more massive clay-silt beds in the Marshalltown-Wenonah. Variation in the thickness of the formation is common. Based on macrofossils, the Mount Laurel is assignable to the upper *Campanian Exogyra cancellata* zone (Owens and others, 1977). Based on foraminifera, it is assigned to the lower *Maestrichtian Rugotruncana subcircumnodifer* zone (Peters, 1976).
MARSHALLTOWN-WENONAH FORMATION (undivided)		85	Glauconite sand, greenish-black, massive-bedded, extensively burrowed, with fine-grained quartz sand and silt (Marshalltown), grading upward into a thick, very silty, micaceous sand (Wenonah). The Marshalltown-Wenonah is recognized in the subsurface by a small to large gamma spike at the base of the Marshalltown passing into a relatively flat, high-intensity pattern above. Undivided due to the thinness of the Marshalltown Formation (approximately 10 ft or 3 m) and its lithologic similarity to the Wenonah Formation. The Marshalltown-Wenonah Formations (undivided) have been assigned to the upper Campanian, based on the occurrence of the ammonite *Trachyscaphites pulcherrimus* in the outcropping Wenonah Formation in the Marlboro quadrangle (Cobban, 1978) and the occurrence of the *Globotruncana calcarata* zone in the Marshalltown Formation in the Woodstown quadrangle (Olsson, 1964).
ENGLISHTOWN FORMATION, UPPER		120	Clay-silt to very fine quartz sand, glauconitic, dark-greenish-gray, micaceous and lignitic. Grades upward into a fine-grained sand interbedded with thin, dark-gray, micaceous, woody, clay-silt. The sand is chiefly quartz; less than 10 percent consists of feldspar, rock fragments, and glauconite. Thin-walled *mollusks* are common in the lower clay-silt facies. Defined on the gamma-ray log by a thick, high-intensity clayey unit at its base and a thinner, low-intensity sand at its top. Gohn (1992) tentatively assigns a middle Campanian age to this formation (termed S3 cycle in Gohn, 1992) based on its ostracode content.
ENGLISHTOWN FORMATION, LOWER		100	Quartz sand, feldspathic, micaceous and lignitic, fine- to medium-grained, medium- to dark-gray, interstratified with dark-greenish-gray, carbonaceous clay-silt. Glauconite, mica, and lignite are common constituents. The top of the unit is identified on the gamma ray log as below the basal gamma spike of the upper part of the formation; the base is defined in this quadrangle as the base of the first sand above the Merchantville-Woodbury Formations (undivided). In southeastern Monmouth and northeastern Ocean counties, the Englishtown Formation had been subdivided into an upper and lower sand facies divided by a clay-silt facies (Nichols, 1977; Zapecza, 1989). The clay-silt facies and upper sand facies are shown here as the upper Englishtown Formation.
MERCHANTVILLE-WOODBURY FORMATION (undivided)		150	Clay-silt with very fine sand, dark-gray, finely micaceous, with occasional lenses of finely disseminated pyrite, lignite, and siderite. Bedding is massive to finely laminated with alternating layers of very fine sand and clay-silt, occasionally cross-bedded. Grades downward into an intercalated, thick-bedded sequence of glauconitic sand and silt and micaceous clayey silt. The glauconitic sand is grayish-olive, greenish-black, or dark greenish-gray; the clay-silt is shades of black and gray. Quartz and glauconite are the major sand components; feldspar, mica (colorless and green), and pyrite are minor constituents. Siderite-cemented layers are common. The formation is highly bioturbated and contains zones of broken calcareous mollusks. Wolfe (1976) assigned the Woodbury to the lower Campanian based on palynomorph assemblages; the Merchantville is also lower, but not lowermost, Campanian based on the ammonite *Scaphites hippocrepis III* (Owens and others, 1977).
CHEESEQUAKE FORMATION		40	Clay-silt, glauconite (20 percent maximum), brownish to dark gray, massive, burrowed, and very micaceous. Grades to light-gray, silty, very fine to fine sand at top, generally laminated where not extensively burrowed. Lower contact with the Magothy Formation and upper contact with the Merchantville Formation are irregular, extensively burrowed, and contain layers of pale-brown to grayish-brown siderite concretions as much as 1 foot (0.3 m) in diameter. The Cheesequake is a recently named formation consisting of beds formerly included in the Merchantville Formation. It contains an uppermost Santonian to lowermost Campanian pollen assemblage in the outcrop and subsurface (Litwin and others, in press). It crops out in the South Amboy quadrangle.
MAGOTHY FORMATION		240	Intercalated quartz sand and clay, thin- to thick-bedded. Sand is light- to medium-gray or brownish-gray; clay is olive-black to grayish-black. Bedding is horizontal (laminated) and cross-stratified. The sand is fine to very coarse, well sorted within each bed, predominantly quartz, and includes minor feldspar and mica. Pyrite-cemented and pyrite-coated sand concretions are common. Carbonaceous material is abundant in beds as much as 0.5 feet (0.15 m) thick. The Magothy is Upper Cretaceous (Santonian) based on Zone V pollen at the Freehold core hole (Christopher, 1977).
RARITAN FORMATION		—	Clay-silt, massive. The upper part of the formation is olive-gray to dark greenish-gray, the middle part light- to medium-gray, and the lower part reddish-brown, light- to dark-gray, reddish-purple, red, and brown. The upper part contains interbeds of fine to coarse sand, occasionally cross-bedded, with broken shell material. Mica, lignite, pyrite, and siderite are common accessories. Siderite forms layers 0.25 to 0.50 inch (0.6 to 1.3 cm) thick. The Raritan is assigned to the upper Ceronomian (Upper Cretaceous) pollen Zone IV - the *Complexiopollis-Atlantopollis* zone at the Freehold core hole and the Marlboro MUA well. The ammonite *Metoicoceras bergquisti* establishes an upper Ceronomian age at outcrops in Sayreville (Cobban and Kennedy, 1990).

Column not to scale

EXPLANATION

Sand · Gravel · Glauconite · Clay-Silt · Mica · Sandy Silt · F Fossils · Unconformity



Base map from U.S. Geological Survey, 1954
Photorevised 1970

[1]New Jersey Geological Survey
[2]United States Geological Survey

SCALE 1:24000
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 2 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER

LOW GRID AND TRUE MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

Geology mapped 1987-1991
Calcareous nannoplankton zones (NP) are from Martini, 1971
Laurel Bybell of the U.S. Geological Survey provided calcareous nannoplankton biostratigraphy
Color terms from Goddard and others, 1948

Reviewed by O.S. Zapecza

Cartography by Z. Allen-Lafayette

GEOLOGIC MAP OF THE ASBURY PARK QUADRANGLE, MONMOUTH AND OCEAN COUNTIES, NEW JERSEY

by
Peter J. Sugarman[1] and James P. Owens[2]
1994

EXPLANATION OF MAP UNITS

Pattern indicates formation concealed by surficial deposits at least 5 feet thick.

TERTIARY
- MIOCENE
  - Tsh — Cohansey Formation
  - UNCONFORMITY
  - Tkw — Kirkwood Formation
  - UNCONFORMITY
- EOCENE
  - Tsr — Shark River Formation
  - Tmq — Manasquan Formation
  - UNCONFORMITY
- PALEOCENE
  - Tvt — Vincentown Formation *(shown in subsurface only)*
  - UNCONFORMITY
  - Tht — Hornerstown Formation *(shown in subsurface only)*
  - UNCONFORMITY

MAESTRICHTIAN
- Knvb — Navesink-Red Bank Formation (undivided) *(shown in subsurface only)*
- UNCONFORMITY

CAMPANIAN
- Kmt — Mount Laurel Formation *(shown in subsurface only)*
- Kmte — Marshaltown-Wenonah Formation (undivided)
- UNCONFORMITY
- Kaku — Englishtown Formation, upper *(shown in subsurface only)*
- UNCONFORMITY
- Kakl — Englishtown Formation, lower *(shown in subsurface only)*

UPPER CRETACEOUS
- Kmwb — Merchantville-Woodbury Formation (undivided) *(shown in subsurface only)*
- UNCONFORMITY
- Kcq — Cheesequake Formation *(shown in subsurface only)*
- UNCONFORMITY

SANTONIAN
- Km — Magothy Formation *(shown in subsurface only)*

CENOMANIAN-TURONIAN
- Kr — Raritan Formation *(shown in subsurface only)*

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DESCRIPTION OF MAP SYMBOLS

Contact - dashed where approximately located. Triangle indicates exposed contact.

Auger hole - number above indicates thickness of surficial deposits (ft); number below indicates depth to base of pre-Quaternary formation (ft).

Test boring or well

Gamma-ray log (shown in cross section) - radiation increases to right.

TABLE 1. Geologic test boring or well

Map ID	Name	Permit No.[1]
APTP	Asbury Park Treatment Plant Boring 2	--
DL	Deal Lake Bridge Boring	--
MCWO	Monmouth Consolidated Water Co. Whitesville Observation	--
AWD	Allaire State Park Well 14	29-07461
BWD	Belmar Water Dept. 1	--
BSG	Borough of Sea Girt	--
Art	Wall Twp. Water Dept. Arbutus Well A	29-02869
NJAB	NJ Arthur Brisbane Child Treatment Center 2	29-11703
GR1	Monmouth Consolidated Water Co. Glendola Reservoir 1	29-15170

[1]NJDEPE Bureau of Water Allocation water well drilling permit