DEPARTMENT OF ENVIRONMENTAL PROTECTION
LAND USE MANAGEMENT
NEW JERSEY GEOLOGICAL SURVEY

Prepared in cooperation with the
U. S. GEOLOGICAL SURVEY
NATIONAL GEOLOGIC MAPPING PROGRAM

BEDROCK GEOLOGY OF THE BEVERLY AND FRANKFORD QUADRANGLES BURLINGTON COUNTY, NEW JERSEY

by
Scott D. Stanford and Peter J. Sugarman
2008

Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number 04HQAG0043. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U. S. Government.

INTRODUCTION

Bedrock of the Beverly and Frankford quadrangles includes unconsolidated Coastal Plain formations that overlie metamorphic basement rocks. The Coastal Plain formations are sand, clay, and glauconite clay laid down in coastal, nearshore marine, and continental shelf settings 95 to 75 million years ago. The underlying metamorphic rocks are much older and originated as sediments, laid down 700 to 420 million years ago, that were later compressed and deformed several times. The lithology and age of the formations are provided in the *Description of Map Units*. Age relations are also summarized in the *Correlation of Map Units*. Cross sections AA', BB', and CC' show the subsurface geometry of the formations along the line of section. Further detail on the regional stratigraphy of the Coastal Plain formations is provided by Owens and others (1998). Surficial deposits of Pliocene and Quaternary age overlie the Coastal Plain formations in most of the map area. The surficial deposits are mapped by Stanford (2008).

DESCRIPTION OF MAP UNITS

Ket ENGLISHTOWN FORMATION--Quartz sand, fine- to medium-grained, minor coarse sand, with thin beds of clay and silt. Sand is white, yellow, and light gray where weathered, gray where unweathered. Silt and clay are light gray to brown where weathered, dark gray to black where unweathered. The Englishtown is as much as 20 feet thick in the map area; full thickness in the adjacent Moorestown and Bristol quadrangles is 70-80 feet (Owens and Minard, 1964; Stanford and Sugarman, 2005). Sand contains some lignite, mica and minor amounts of glauconite; mica, carbonaceous matter and pyrite are common in the clay. Late Cretaceous (early Campanian) in age, based on pollen (Wolfe, 1976). Grades downward into the Woodbury Formation.

Kwb WOODBURY FORMATION--Clay, with minor thin beds of very fine quartz sand. Dark gray and black where unweathered, yellowish-brown to brown where weathered. As much as 80 feet thick. Clay is micaceous with some pyrite and carbonaceous material and traces of glauconite. Late Cretaceous (early Campanian) in age, based on pollen (Wolfe, 1976). Grades downward into the Merchantville Formation. In wells, contact with Merchantville placed at change from gray or black clay to green clay or marl.

Kmv MERCHANTVILLE FORMATION--Glauconite clay with some fine sand and silt. Olive, dark gray, black where unweathered, olive-brown to yellowish-brown where weathered. As much as 50 feet thick. Glauconite occurs primarily in soft grains of fine-to-medium-sand size. Sand fraction is chiefly quartz; feldspar, mica, and pyrite are minor constituents. Iron cementation is common. Late Cretaceous (early Campanian) in age, based on ammonite fossils (Owens and others, 1977). Unconformably overlies the Magothy Formation. In wells, contact with Magothy placed at change from green clay or marl to gray clay and white or gray sand. On geophysical logs, contact with Magothy is marked by transition to increased resistance and decreased gamma-ray intensity.

Kmg MAGOTHY FORMATION--Quartz sand, fine- to very coarse-grained, clay and silt, thin-bedded. Sand is white, yellow, light gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, gray to black where unweathered. Unweathered beds are more common than in the underlying Potomac Formation. As much as 100 feet thick in the southwestern part of the map, in the New Albany-Cinnaminson area; thins to 40-50 feet thick at the eastern edge of the map area, near Orchard View. Sand includes some lignite, pyrite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. Late Cretaceous (Santonian) in age, based on pollen (Christopher, 1977). Unconformably overlies the Potomac Formation. In wells, contact with Potomac placed at change from white and gray clay and sand to red clay and yellow, brown, or white coarse sand. On geophysical logs, contact with Potomac is marked by a transition to generally increased resistance and increased gamma-ray intensity on most but not all logs.

Kp3 POTOMAC FORMATION--Quartz sand, fine- to very coarse-grained, and clay and silt, thin- to thick-bedded; minor pebble-to-cobble gravel. Sand is white, yellow, light gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, gray to black where unweathered. Unweathered beds are less common than in the overlying Magothy Formation. As much as 350 feet thick. Sand includes some lignite, minor feldspar, and minor mica. Clay and silt beds include abundant mica and carbonaceous material. The Potomac Formation in the map area is equivalent to the Potomac Formation, unit 3 (Doyle and Robbins, 1977), based on pollen (Owens and others, 1998), and is of Late Cretaceous (early Cenomanian) age. Owens and Minard (1964) mapped these deposits in the adjacent Bristol quadrangle as Raritan Formation, but subsequent palynologic studies indicated recorrelation to the Potomac Formation (Owens and others, 1998). Unconformably overlies Late Proterozoic and early Paleozoic bedrock. In wells, contact with bedrock placed at change from red, yellow, or white clay and sand to saprolite, decomposed bedrock, weathered rock, schist, or granite.

OCZu LATE PROTEROZOIC AND EARLY PALEOZOIC METAMORPHIC ROCKS--Chiefly schist, minor gneiss and quartzite. Upper 10-100 feet are commonly weathered to a grayish-brown to gray micaceous sandy clayey saprolite. Of Late Proterozoic, Cambrian, and Ordovician age. Includes the Wissahickon Formation and related rocks of the Potomac-Philadelphia-Hartland terrane (Volkert and others, 1996). Outcrop belt in the map area along the Delaware River is entirely covered by surficial deposits.

MAP SYMBOLS

Contact--Approximately located. Triangle indicates contact observed in outcrop. Open triangle indicates contact formerly exposed, as reported in field notes on file at N. J. Geological Survey.

Formation observed in outcrop, excavation, or hand-auger hole.

Formation observed in former outcrop or excavation--Field notes on file at N. J. Geological Survey.

S-134
27-3012
Kp3 72
OCZu 100

Well showing formations penetrated--Location accurate to within 200 feet. Identifiers of the form 5-xxx are U. S. Geological Survey Ground-Water Site Inventory identification numbers. Identifiers of the form 27-xxxx or 31-xxxx are N. J. Department of Environmental Protection well-permit numbers. Identifiers prefixed by B are test borings for the Tacony-Palmyra bridge. Identifiers prefixed by J, CB, and TP are test borings for channel dredging, from the U. S. Army Corps of Engineers. Identifiers prefixed by JPO are auger borings recorded on unpublished field maps of J. P. Owens (U. S. Geological Survey, maps on file at the N. J. Geological Survey). Identifiers prefixed by DM are test borings made in 1958 by the Dames and Moore Co. (provided by J. A. Fischer) on file at the N. J. Geological Survey. Identifiers of the form 27-xx-xxx are N. J. Atlas Sheet coordinates of records of wells or borings in the permanent note collection of the N. J. Geological Survey. Number following formation symbol is depth, in feet below land surface, of base of unit, as inferred from driller's log. Final number is total depth of well or boring rather than base of unit. Depth of surficial deposits is shown where they are thicker than 30 feet. Units joined with a hyphen cannot be separately identified in the driller's description. Driller's logs vary in detail and accuracy. They are used in combination with outcrop data and geophysical well logs to map contacts, and so depths of some contacts inferred from the logs may not match those shown on the sections and map.

27-9542
Kp3 80
OCZu 91

5-161
27-5315

Well showing formations penetrated--Location accurate to within 500 feet. Identifiers and symbols as above.

Geophysical log--On sections. Gamma-ray log is shown by red line, intensity increasing to right. Electric log is shown by paired blue lines, with spontaneous potential shown on left-hand curve (voltage increasing to right) and resistance shown on right-hand curve (resistance increasing to right).

Surficial deposits--On sections, shown where more than 10 feet thick.

REFERENCES

Christopher, R.A., 1977, Selected Normapolles pollen genera and the age of the Raritan and Magothy Formations (upper Cretaceous) of northern New Jersey, *in* Owens, J.P., Sohl, N.F., and Minard, J.P., eds., A field guide to Cretaceous and lower Tertiary beds of the Raritan and Salisbury embayments, New Jersey, Delaware, and Maryland: American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, p. 58-68.

Doyle, J.A., and Robbins, E.I., 1977, Angiosperm pollen zonation of the Cretaceous of the Atlantic Coastal Plain and its application to deep wells in the Salisbury embayment: Palynology, v.1, p. 43-78.

Owens, J. P., and Minard, J. P., 1964, Pre-Quaternary geology of the Bristol quadrangle, New Jersey-Pennsylvania: U. S. Geological Survey Geologic Quadrangle Map GQ-342, scale 1:24,000.

Owens, J.P., Sohl, N.F., and Minard, J.P., 1977, A field guide to Cretaceous and lower Tertiary beds of the Raritan and Salisbury embayments, New Jersey, Delaware, and Maryland: American Association of Petroleum Geologists-Society of Economic Paleontologists and Mineralogists, 113 p.

Owens, J. P., Sugarman, P. J., Sohl, N. F., Parker, R. A., Houghton, H. F., Volkert, R. A., Drake, A. A., Jr., and Orndorff, R. C., 1998, Bedrock geologic map of central and southern New Jersey: U. S. Geological Survey Miscellaneous Investigations Series Map I-2540-B, scale 1:100,000.

Stanford, S. D., 2008, Surficial geology of the Beverly and Frankford quadrangles, Burlington County, New Jersey: N. J. Geological Survey Open-File Map OFM 70, scale 1:24,000.

Stanford, S. D., and Sugarman, P. J., 2005, Bedrock geology of the Moorestown quadrangle, Burlington and Camden counties, New Jersey: N. J. Geological Survey Open-File Map OFM 64, scale 1:24,000.

Volkert, R. A., Drake, A. A., Jr., and Sugarman, P. J., 1996, Geology, geochemistry, and tectonostratigraphic relations of the crystalline basement beneath the Coastal Plain of New Jersey and contiguous areas: U. S. Geological Survey Professional Paper 1565-B, 48 p.

Wolfe, J. A., 1976, Stratigraphic distribution of some pollen types from the Campanian and lower Maestrichtian rocks (upper Cretaceous) of the Middle Atlantic States: U.S. Geological Survey Professional Paper 977, 18 p.

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CORRELATION OF MAP UNITS

Ket	Campanian	Late Cretaceous
Kwb		
Kmv		
UNCONFORMITY		
Kmg	Santonian	
UNCONFORMITY		
Kp3	Cenomanian	
UNCONFORMITY		
OCZu	Late Proterozoic-early Paleozoic	

APPROXIMATE MEAN DECLINATION, 1999

LOCATION IN NEW JERSEY

Base from U. S. Geological Survey Frankford quadrangle (1997) and Beverly quadrangle (1995)

Geology mapped 2004-2005
Cartography by S. Stanford and M. Girard