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BEDROCK GEOLOGIC MAP OF THE NEW JERSEY PART OF THE
TRENTON WEST AND TRENTON EAST QUADRANGLES
MERCER AND BURLINGTON COUNTIES, NEW JERSEY
OPEN FILE MAP OFM 122
pamphlet containing table 1 accompanies map

INTRODUCTION

Bedrock in the New Jersey parts of the Trenton East and Trenton West quadrangles is present in two physiographic provinces, the Piedmont and the New Jersey Coastal Plain. The Fall Line forms the contact between bedrock of the Piedmont and the more easily eroded sediments of the Coastal Plain to the south. Coastal Plain formations are unconsolidated sediments of Upper Cretaceous age. Rocks of the Piedmont extend through the northwestern part of the map area, where they are divided into unmetamorphosed sedimentary rocks of Mesozoic age of the Newark Basin and metamorphosed pre-Mesozoic crystalline rocks of the Trenton Prong. The latter are divisible into northern, central, and southern structural blocks. The Huntingdon Valley fault forms the boundary between the northern and central blocks and the Morrisville fault is the boundary between the central and southern blocks.

Pre-Mesozoic bedrock crops out mainly along the Delaware River, in tributary streams such as Assunpink Creek, and in other minor drainages. It is also encountered in excavations, and in boreholes drilled for environmental investigations or for water wells. Geologic relationships of the pre-Mesozoic rocks have remained poorly understood, in part because of the poor bedrock exposure, and also because of the complexity of the rocks due to their heterogeneity and evidence for multiple episodes of deformation. Early studies were by Bascom and others (1909) and more recent studies on the pre-Mesozoic rocks include that of Owens and Minard (1964), Owens and others (1998), and Monteverde and others (2012). However, these maps provide no information on the age or lithologic characteristics of bedrock, the structural relationships, or joint and fracture data, and the bedrock units are lumped under generic names. The current bedrock mapping provides new information and interpretations on the lithology, stratigraphy, structure, and tectonic framework of the pre-Mesozoic rocks. The mapping of Cretaceous sediments in Owens and Minard (1964) is also updated here. The updates include 1) refinement of contacts, based on additional fieldwork, 2) the addition of cross sections, based on logs of 395 water wells and test borings selected from N. J. Geological and Water Survey files (Table 1), and 3) revision of stratigraphic nomenclature and correlations, based on palynologic and lithologic studies completed in the Coastal Plain since the 1970s.

The Cretaceous formations, and pre-Cretaceous bedrock, are overlain in most of the map area by fluvial and estuarine deposits of Pliocene and Quaternary age. These deposits are shown and described on a separate surficial geologic map (Stanford, 2014).

STRATIGRAPHY

Cretaceous Sediments

Cretaceous sediments overlie pre-Mesozoic bedrock southeast of the Assunpink Creek valley. They dip to the southeast at between 30 and 50 feet per mile and thicken from a feather edge at their northwest limit to about 800 feet thick in the southeast corner of the Trenton East quadrangle. The sediments include sand, silt, clay, and glauconite laid down in fluvial, nearshore marine, and continental shelf settings between 95 and 75 Ma (million years ago).

The basal Cretaceous unit is the Potomac Formation, which unconformably overlies weathered pre-Mesozoic metamorphic bedrock. The Potomac consists of interbedded quartz sand and clay deposited in fluvial and, possibly, shallow marine settings. The clays were subaerially exposed in floodplains during their deposition and so are commonly oxidized to white, yellow, and red colors (fig. 1). While Owens and Minard (1964) mapped these deposits as the Raritan Formation, they are now known from palynologic studies to be part of the older Potomac Formation. The Raritan overlies the Potomac northeast of the Trenton area but does not extend to the Trenton East and West quadrangles (Owens and others, 1998). Thick beds of coarse sand in the Potomac are productive aquifers and are tapped by several public supply wells in the map area (wells 136, 150, 154, 192, 264-267, 318, and 319 in Table 1), and numerous domestic wells.

The Potomac is unconformably overlain by the Magothy Formation, which consists of lignitic, micaceous quartz sand, silt, and clay, commonly interlaminated or in thin interbeds (fig. 2). The Magothy was laid down in tidally influenced shallow-shelf and estuarine settings. The uppermost 10 to 30 feet of the Magothy is generally more silty and clayey than the rest of the formation, and is distinguished from the overlying Merchantville Formation by the absence of glauconite. Owens and Minard (1964) mapped this upper silty-clayey section as part of the Merchantville; thus, their Merchantville is thicker, and their Magothy is thinner, than shown here. Sand beds in the Magothy yield water to numerous domestic wells, particularly downdip from the outcrop belt where wells were drilled through the overlying clayey Merchantville and Woodbury formations.

The Magothy is unconformably overlain by the Merchantville Formation, which is a glauconitic clayey silt deposited in mid-shelf settings (fig. 3). The Merchantville is the basal unit of a shallowing-upward marine sequence that includes the overlying Woodbury and Englishtown formations. The Merchantville transitions upsection to the Woodbury, which is non-glauconitic clay deposited in prodelta to inner-shelf environments. The Merchantville-Woodbury contact is placed at the highest occurrence of glauconite. The Woodbury is about 30 feet thicker on this map than on Owens and Minard (1964) based on this criterion and on field observations in the Crosswicks-Edgebrook area. The Woodbury transitions upsection to the Englishtown Formation, which is predominantly quartz sand with some interbeds of silt and clay deposited in delta-front to inner-shelf environments. The Woodbury-Englishtown contact is placed at the first occurrence of sand. The Merchantville and Woodbury formations are of low permeability and form a confining unit. The Englishtown yields water to a few domestic wells but is too thin and shallow in the map area for extensive use as an aquifer.

Mesozoic Rocks

The northern part of the map area is underlain by Mesozoic rocks that were deposited in the Newark Basin, a northeast-trending rift basin that contains interbedded sedimentary and igneous rocks. These consist of Upper Triassic to Lower Jurassic conglomerate, sandstone, siltstone, and shale of fluvial and lacustrine origin, three tholeiitic basalt formations, and intrusive bodies of diabase. Only the lowest part of this succession, the sedimentary Stockton Formation, crops out in the map area.

The Upper Triassic Stockton Formation was deposited directly on the eroded surface of the pre-Mesozoic crystalline rocks but nowhere is the contact between them presently exposed. Much of the lower part of the Stockton is arkosic sandstone that contains 50 to 70 percent quartz and 15 to 40 percent feldspar (Van Houten, 1980), which was derived from the underlying crystalline basement. Core samples from a depth of 20 to 27 ft. below ground surface from a monitor well drilled in 1994 along Spruce Street, in Ewing Township (not shown on map), penetrated Stockton Formation containing clasts as much as one inch long of Cambrian-age Chickies Quartzite.

Paleozoic Rocks

Rocks that are here correlated with the Wissahickon Formation do not crop out in the map area, but are present beneath a cover of Cretaceous to recent sediments and extend as far south as Gloucester and Salem Counties (Volkert and others, 1996). They include mainly schist and gneiss and minor amounts of interlayered amphibolite. Drill core samples of Wissahickon schist recovered beneath the New Jersey Coastal Plain in Gloucester County contain plagioclase + quartz + biotite ± garnet ± sillimanite. They are spatially associated with amphibolites composed of plagioclase + hornblende ± biotite ± garnet. Mineral assemblages of both lithologies are consistent with metamorphism to amphibolite-facies conditions (Volkert and others, 1996). Recent geochronology of felsic metavolcanic rocks in the Wissahickon Formation in the Piedmont of Pennsylvania and Delaware yields a crystallization age of 481 Ma, indicating that the Wissahickon Formation may be as young as Ordovician in age (Bosbyshell and others, 2001; Aleinikoff and others, 2006).

Chickies Quartzite crops out in the northwestern part of the Trenton Prong where it is in unconformable contact with Mesoproterozoic rocks. Lithologies representative of the Chickies include: quartz-sericite schist with disseminated, fine grains of black tourmaline; conglomerate and pebbly sandstone; and thin-bedded quartzite (fig. 4). At Morrisville, Pennsylvania, we estimate a thickness of about 730 feet for the Chickies. Outcrops of Chickies extend east from Morrisville part way across the Delaware River, but in New Jersey the unit is covered by overburden. However, it is known to be present from drill-hole data.

The Chickies Quartzite was formed from a sedimentary protolith. Locally, the unit displays graded beds and tabular cross-beds that indicate bedding is right-side-up and further substantiates a sedimentary origin. The presence of *Skolithus linearis* burrows in the Chickies suggest that it is Cambrian in age (Bascom and others, 1909). If correct, then it may correlate with the Lower Cambrian Hardyston Quartzite in the New Jersey Highlands and Reading Prong in southeastern Pennsylvania.

Neoproterozoic Rocks

The Mesoproterozoic rocks locally are intruded by thin, discordant diabase dikes interpreted to be Neoproterozoic. Dikes are hard, dense, unfoliated, and are unmetamorphosed. They are poorly exposed and known mainly through recovery of drill core or rotary cuttings. One dike was encountered in an excavation in the Trenton East quadrangle during current mapping (fig. 5). Others were identified in the Princeton quadrangle in excavations, and in core from a well drilled at Mercer County Park (Monteverde and others, 2012). The dikes are confined to areas underlain by Mesoproterozoic rocks and do not intrude the Chickies Quartzite, Wissahickon schist or gneiss, or Mesozoic rocks. Trenton Prong dikes have geochemical compositions that are similar to alkalic basalt and that closely overlap the compositions of dikes in the New Jersey Highlands (Volkert, 2004).

Mesoproterozoic Rocks

Mesoproterozoic rocks consist of a heterogeneous assemblage of gneisses that contain the mineral assemblage hornblende + clinopyroxene + plagioclase + quartz ± orthopyroxene ± garnet in rocks of felsic to intermediate composition, and hornblende + clinopyroxene + plagioclase in mafic rocks, that are representative of metamorphism to granulite-facies conditions. All lithologies are foliated and/or layered. They are divisible into distinct sequences based on their mineralogical and geochemical compositions. These include: 1) thin sheets of the newly-named Assunpink Creek Granite; 2) supracrustal rocks formed from sedimentary and igneous protoliths; and 3) orthogneisses formed from igneous protoliths of felsic, intermediate and mafic composition of the newly-named Colonial Lake Suite. Mesoproterozoic rocks are locally intruded discordantly by thin bodies of unfoliated granite pegmatite composed of quartz + K-feldspar + plagioclase (fig. 6) too small to be shown on the map. Similar pegmatites in the New Jersey Highlands are dated at 1004 to 986 Ma (Volkert and others, 2005) consistent with emplacement well after the metamorphic peak.

The Assunpink Creek Granite is medium to coarse grained, pinkish gray to pinkish white, and weakly foliated to unfoliated potassic granitic rock (fig. 7). It is composed mainly of quartz, K-feldspar, plagioclase, and biotite. Augen of K-feldspar as much as several inches long are common where the rock has been deformed. Assunpink Creek Granite has generally conformable contacts with the gneisses, but locally displays slightly discordant or embayed contacts into the gneisses, thus indicating that it is younger. The granite falls in the field of syenogranite on a classification diagram of plutonic rocks (not shown).

Supracrustal rocks include lithologies formed from sedimentary protoliths that are mapped as quartzofeldspathic gneisses, calc-silicate gneiss (fig. 8, 9), minor quartzite and marble. They are spatially associated with mafic gneisses mapped as amphibolite formed from an igneous protolith. Amphibolite is medium-grained and foliated gneiss composed of plagioclase, hornblende and clinopyroxene (fig. 10). The geochemical composition of amphibolite that is interlayered with metasedimentary gneisses has an affinity to tholeiitic basalt formed in an island arc tectonic setting. Quartzofeldspathic gneiss is pinkish-gray, medium-grained, foliated and locally layered rock composed of quartz, K-feldspar, plagioclase, biotite, and local garnet and graphite. Calc-silicate gneiss is greenish-gray, medium-grained, foliated and locally layered rock composed of plagioclase, clinopyroxene and local quartz, hornblende, and titanite. The geochemical composition of quartzofeldspathic and calc-silicate gneisses is consistent with protoliths that were mainly sandstone or shale. Quartzite is light gray to pinkish-gray, medium-grained, foliated and locally layered rock composed mainly of quartz and varied amounts of K-feldspar and biotite. It is intercalated with garnet-bearing quartzofeldspathic gneiss, but occurs in layers too thin to be shown separately on the map. The geochemical composition of quartzite is consistent with a quartz-rich sedimentary protolith. Carbonate rock is not exposed in the map area but was encountered in drill-holes emplaced in 1960 near downtown Trenton. The rock penetrated in three of the borings is described as "limestone" without any accompanying description of the texture or mineralogy. Bedrock drilled in adjacent borings is described as gneiss or granite, suggesting that the carbonate rock in these borings may be marble. Because of uncertainty in the age or lithic description of this rock, it is not shown on the map.

The supracrustal rocks are spatially associated with the Colonial Lake Suite, an assemblage of calc-alkaline magmatic arc rocks comprised of tonalite gneiss, diorite gneiss, gabbro gneiss, and amphibolite. Tonalite gneiss is medium grained, well foliated, and composed of quartz, plagioclase, hornblende, clinopyroxene, biotite, and garnet (fig. 11). Diorite gneiss is medium grained, well foliated, and composed of plagioclase, hornblende, clinopyroxene, orthopyroxene, and biotite. Quartz, garnet and sulfide minerals occur locally. Gabbro gneiss is medium grained, moderately foliated, and composed of plagioclase, hornblende, and clinopyroxene. Quartz and sulfide minerals occur locally. Amphibolite of the Colonial Lake Suite is a medium-grained and foliated gneiss composed of plagioclase, hornblende and clinopyroxene. It differs from supracrustal amphibolite in that it has a tholeiitic geochemical composition and an affinity to basalt formed in a mid-ocean ridge tectonic setting.

STRUCTURE

Bedding

Bedding in the Stockton Formation strikes uniformly northeast at an average of N55°E. Beds dip northwest at 5° to 19° and average 11°. Bedrock exposure in the map area is insufficient to permit a more detailed directional analysis of bedding data.

Crystallization Foliation

Crystallization foliation, formed by the parallel alignment of mineral grains in the pre-Mesozoic metamorphic rocks, defines the strike of the bedrock. It is an inherited feature from compressional stresses during high-grade metamorphism that penetratively deformed the rocks. Foliations strike uniformly northeast and average N65°E (fig. 12). They dip mainly southeast, and very locally northwest, at an average of 74°. The structural concordance of metamorphic foliations in rocks of the northern, central and southern blocks is likely due to tectonic transposition (reorientation) of original Proterozoic foliations during the Paleozoic Taconian Orogeny and possibly the Alleghanian Orogeny as well.

Folds

Metamorphic foliations in Mesoproterozoic rocks are folded by northeast-plunging, northwest-overturned isoclinal antiforms and synforms. Mineral lineations are parallel to the axes of minor folds and range from 6° to 49° toward N56°E to N82°E.

Faults

Pre-Mesozoic metamorphic rocks are deformed by three main faults that are, north to south, the Huntingdon Valley, Morrisville, and an unnamed fault. All three strike about N60°E and dip steeply southeast at 70 to 75°. The Morrisville fault merges with, or is cut off by, the Huntingdon Valley fault northeast of the map area. The Huntingdon Valley and Morrisville faults are characterized by an early ductile deformation fabric parallel to metamorphic foliations that is overprinted by brittle deformation fabric. South of the Morrisville fault, the Wissahickon Formation was thrust northwestward against Mesoproterozoic rocks along an unnamed fault. Unfortunately, a more precise interpretation of the structural relationships is not possible because neither the fault nor the Wissahickon are exposed in the map area.

Deformed outcrops of Chickies Quartzite along the Huntingdon Valley fault display a slip lineation on bedding surfaces that plunges an average of 62° to S44°E and displays reverse movement sense involving transport to the northwest. Right-lateral strike-slip movement has also been observed on the fault in the map area, as well as from the Pennsylvania Piedmont (e.g., Hill, 1991; Valentino, 1999). The reverse movement likely accompanied the Taconian Orogeny at circa 450 Ma. The right-lateral strike-slip movement may be much younger, and possibly related to the Alleghanian Orogeny, as proposed by Kroll and others (1999), based on $^{40}Ar/^{39}Ar$ ages of 311 Ma from white mica formed at greenschist-facies metamorphic conditions along the Huntingdon Valley-Pleasant Grove fault in Maryland.

Joints

Joints in bedrock units are characteristically planar, moderately well formed, moderately to widely spaced, and moderately to steeply dipping. Surfaces are smooth and, less commonly, slightly irregular. Joints are spaced from 1 foot to tens of feet apart, although those developed in massive rocks are spaced wider, more irregularly formed and less continuous than joints in well-foliated gneisses. Joints in the Stockton Formation form two sets that have an average strike and dip of N15°W 86° southwest and N68°E 87° southeast. Bedrock exposure is insufficient to permit a more detailed directional analysis. The strike of the dominant joint set in pre-Mesozoic rocks ranges from N70°W to N10°W and averages N31°W (fig. 13). They dip northeast and, less commonly, southwest at an average of 80°.

DESCRIPTION OF MAP UNITS

COASTAL PLAIN

Ket **Englishtown Formation** (Upper Cretaceous) – Quartz sand, fine- to medium-grained, minor coarse sand, with thin interbeds of clay and silt. Sand is white, yellow, reddish-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 60 feet thick in the map area; full thickness in the adjacent Allentown quadrangle is 90 feet (Owens and Minard, 1966). Sand and clay contain some lignite and mica, and trace amounts of glauconite. Late Cretaceous (early Campanian) in age based on pollen (Wolfe, 1976), strontium stable-isotope ratios, and calcareous nannofossils (Sugarman and others, 2010). Contact with the underlying Woodbury Formation is gradational.

Kwb **Woodbury Formation** (Upper Cretaceous) – Clay, with minor thin beds of very fine quartz sand. Dark gray and black where unweathered, yellowish-brown to light gray where weathered. As much as 80 feet thick. Clay is micaceous and sparsely lignitic. Widely spaced, subvertical joints are present in places. Late Cretaceous (early Campanian) in age based on pollen (Wolfe, 1976) and calcareous nannofossils (Sugarman and others, 2010). Contact with the underlying Merchantville Formation is gradational. In wells, lower contact is placed at drillers' report of change from gray or black clay in the Woodbury to green clay or marl in the Merchantville.

Kmv **Merchantville Formation** (Upper Cretaceous) – Glauconitic, micaceous clayey silt to silty fine sand with some interbedded non-glauconitic, micaceous clayey silt. Olive, dark gray, black where unweathered, olive-brown, yellowish-brown, reddish-brown where weathered. As much as 60 feet thick. Glauconite occurs primarily in soft grains of fine-to-medium sand size. Iron cementation is common. Widely spaced, subvertical joints are present in places. Late Cretaceous (Santonian-early Campanian) in age based on calcareous nannofossils (Sugarman and others, 2010). Unconformably overlies the Magothy Formation. In wells, lower contact is placed at drillers' report of change from green clay or marl in the Merchantville to gray clay and white or gray sand in the Magothy. On geophysical well logs, lower contact is marked by decreased gamma-ray intensity in the Magothy.

Kmg **Magothy Formation** (Upper Cretaceous) – Quartz sand, very fine-, fine-, and medium-grained, and clay and silt, thin bedded. Sand is white, yellow, light gray where weathered, gray where unweathered. Sand is plane-bedded to low-angle cross-bedded in places. Sand beds are typically 3 to 6 inches thick, but may be as much as 2 feet thick. Clay and silt are white, yellow, brown, rarely reddish-yellow, where weathered, gray to black where unweathered. Clay-silt beds are typically less than 3 inches thick but may be as much as 1 foot thick. As much as 90 feet thick. Fine-to-medium sands include some lignite and minor mica. Very fine sand and silt beds include abundant mica and lignite, and minor pyrite. Late Cretaceous (Turonian-Coniacian) in age based on pollen (Christopher, 1979; Sugarman and others, 2010). Pollen from the lower part of the Magothy near Mile Hollow is within Zone Va (L. A. Sirkin, written communication, 1990) indicating a late Turonian age (Christopher, 1979). Unit unconformably overlies the Potomac Formation. In wells, lower contact is placed at change from white and gray clay and sand in the Magothy to red and white clay and yellow, brown, and white coarse sand in the Potomac. On geophysical well logs, lower contact is marked by increased gamma-ray intensity in the Potomac.

Kp **Potomac Formation** (Upper Cretaceous) – Quartz sand, fine- to very coarse-grained, locally gravelly, and clay and silt, thick- to thin-bedded. Sand is white, yellow, red, brown, or pink where weathered and light gray where unweathered. Clay and silt are white, red, yellow, brown, pink where weathered and gray to black where unweathered. Weathered beds are more common in the Potomac than in the overlying Magothy Formation. As much as 600 feet thick in the southeast corner of the map area. Medium-to-coarse sand includes some lignite and minor mica in places. Very fine sand and silt beds, and some unweathered clays, include abundant mica and, in places, lignite. 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 early Cenomanian age. Unconformably overlies pre-Mesozoic metamorphic bedrock. In wells, contact with bedrock is placed at change from red, yellow, or white clay and sand in the Potomac to saprolite, decomposed bedrock, weathered rock, schist, or gneiss.

PIEDMONT

NEWARK BASIN

TRs **Stockton Formation** (Upper Triassic) – Interbedded sequence of yellowish- to pinkish-gray, grayish-brown, or reddish-brown, medium- to coarse-grained, thin- to thick-bedded, planar to trough cross-bedded, poorly sorted to clast-imbricated conglomerate, ripple cross-laminated arkosic sandstone, reddish-brown, clayey, fine-grained, locally bioturbated sandstone, and siltstone and mudstone in fining-upward sequences. Conglomerate contains pebble-to cobble-sized clasts of subround to round quartz in matrix of coarse sand composed of quartz and feldspar. Basal part of unit is locally deeply weathered. Lower contact is an erosional unconformity. Thickness of unit is approximately 4,000 feet.

TRENTON PRONG

Ow **Wissahickon schist and gneiss** (Lower Ordovician?) – Schist is medium- to dark-gray, medium grained, well layered and foliated, and composed of oligoclase, biotite, K-feldspar, quartz, muscovite, and garnet. Gneiss is tan or pinkish-white, medium grained, foliated, and composed of quartz, K-feldspar, oligoclase, biotite, and muscovite. Schistose rocks differ from gneiss in having a higher content of biotite and less quartz. Unit is not exposed in the map area.

Ꞓc **Chickies Quartzite** (Lower Cambrian?) – Interbedded sequence of medium-grained, light gray to light greenish-gray quartz-sericite schist with disseminated, fine grains of black tourmaline, less abundant conglomerate composed of pebble-size clasts of blue quartz, and white to light gray, vitreous, thin-bedded quartzite. Locally displays graded beds and trough cross-laminated beds. Contains the trace fossil *Skolithus linearis*. Thickness is approximately 730 feet.

Zd **Diabase dikes** (Neoproterozoic) – Dark greenish-gray, unfoliated, dense, hard, medium- to fine-grained rock that forms very thin bodies enclosed within Mesoproterozoic rocks. Composed of oligoclase to andesine, altered clinopyroxene and small blebs of sulfide. Hornblende is present locally. Unit does not crop out in the map area but is known from excavations and subsurface borings.

Granitic Rocks

Yac **Assunpink Creek Granite** (Mesoproterozoic) – Pinkish-gray to pinkish-white, medium- to coarse-grained, mainly unfoliated rock composed of quartz, K-feldspar, plagioclase, and biotite. Locally contains augen of K-feldspar as much as several inches long. Unit has generally conformable contacts with adjacent gneisses, but locally preserves slightly discordant and embayed contacts into the gneiss.

Supracrustal Rocks

Ygq **Quartzofeldspathic gneiss** (Mesoproterozoic) – Tan, pinkish-white, or light gray, medium-grained, foliated gneiss composed of blue or clear quartz, K-feldspar, oligoclase, biotite, and local garnet. Graphite is present in trace amounts. Unit includes thin, conformable layers of quartzite.

Ygc **Calc-silicate gneiss** (Mesoproterozoic) – Light gray to light greenish-gray, medium-grained, foliated gneiss composed of oligoclase, clinopyroxene, hornblende, and biotite. Quartz and titanite are present locally.

Ya **Amphibolite** (Mesoproterozoic) – Grayish-black, medium-grained, foliated rock spatially associated with metasedimentary gneisses in the central block. Unit is composed of plagioclase (oligoclase to andesine), hornblende, clinopyroxene, and biotite. Accessory minerals include magnetite, epidote and sulfide.

Magmatic Arc Rocks

Colonial Lake Suite

Yclt **Tonalite gneiss** (Mesoproterozoic) – Tan, white, or light-gray weathering, light greenish-gray, medium-grained, foliated gneiss composed of blue or clear quartz, oligoclase to andesine, clinopyroxene, hornblende, biotite, and garnet.

Ycld **Diorite gneiss** (Mesoproterozoic) – Light-gray- or tan-weathering, greenish-gray or greenish-brown, medium-grained, foliated rock containing andesine or oligoclase, augite, hornblende, and local orthopyroxene. Quartz, biotite, garnet, and magnetite occur locally. May contain conformable layers of amphibolite or tonalite gneiss.

Yclg **Gabbro gneiss** (Mesoproterozoic) – Black, medium-grained, foliated, dense, rock composed of plagioclase, clinopyroxene, hornblende, and biotite. Unit is spatially associated with diorite gneiss.

Ycla **Amphibolite** (Mesoproterozoic) – Grayish-black, medium-grained, well foliated rock spatially associated with felsic and intermediate orthogneisses in the northern block. Composed of plagioclase (oligoclase to andesine), hornblende, and clinopyroxene. Accessory minerals include magnetite, epidote and sulfide. Very locally contains abundant small phenocrysts of amphibole in a matrix of plagioclase grains.

Other rocks

Yu **Crystalline rocks, undivided** (Mesoproterozoic) – Shown in cross section only.

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Figure 1. Interbedded clay and sand of the Potomac Formation (below shovel head) overlain by surficial deposit (above shovel head).


Figure 2. Interbedded sand (orange, yellow, light gray beds) and clay-silt (dark gray and white beds) of the Magothy Formation.


Figure 3. Glauconitic silt-clay of the Merchantville Formation. Yellowish-brown to reddish-brown sediment (above shovel head) is weathered and iron-cemented. Dark gray sediment (below shovel head) is unweathered. Yellowish-brown sediment below shovel is slumped from above.


Figure 4. Chickies Quartzite. Contact between quartz-sericite schist (left of hammer) and quartzite (beneath hammer)


Figure 5. Dark gray diabase dike (between vertical white lines) intruding gneiss


Figure 6. Course-grained pegmatite (beneath hammer) cutting across outcrops of quartz-feldspathic gneiss. Pegmatite extends from lower left corner of photo to upper right. Gneiss runs from top to bottom of photo.


Figure 7. Assunpink Creek Granite


Figure 8. Supracrustal quartzofeldspathic gneiss. Biotite-rich layers are dark gray and more deeply weathered.


Figure 9. Contact between calc-silicate gneiss (beneath and left of hammer) and quartzofeldspathic gneiss (right of hammer).


Figure 10. Supracrustal amphibolite. Keys for scale.


Figure 11. Tonalite gneiss of the Colonial Lake Suite

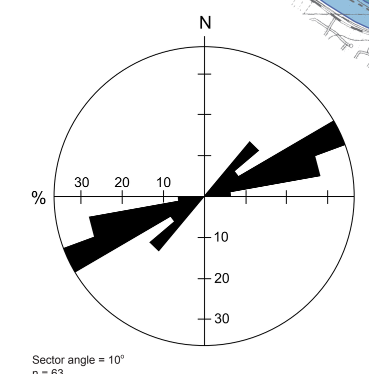


Figure 12. Rose diagram showing the orientation of crystallization foliation in pre-Mesozoic rocks.

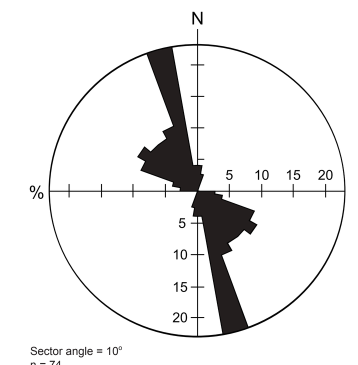
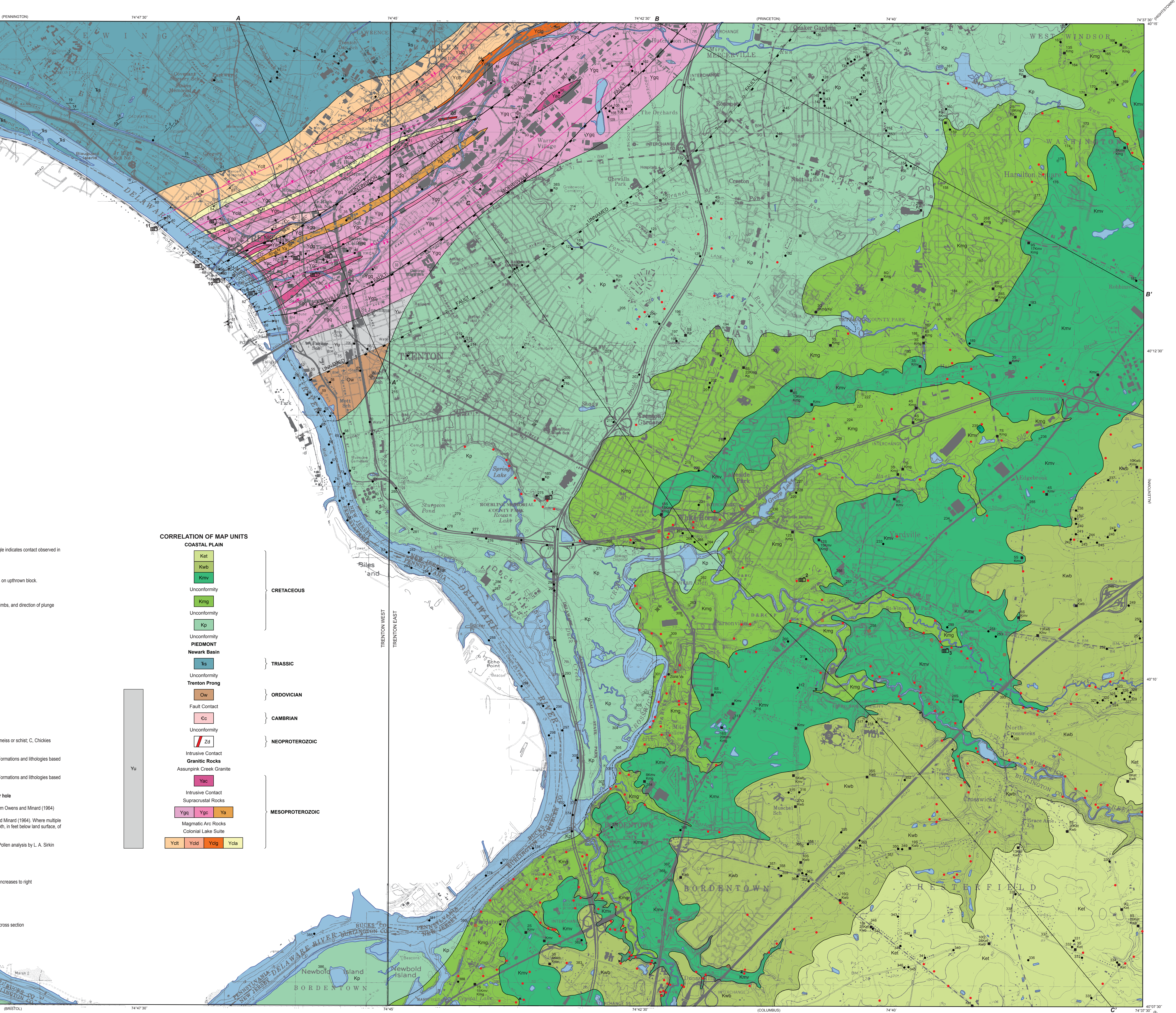


Figure 13. Rose diagram showing the orientation of joints in pre-Mesozoic rocks.



EXPLANATION OF MAP SYMBOLS

Contact – Approximately located; dashed where concealed by water. Triangle indicates contact observed in outcrop.

FAULTS

Reverse fault – Approximately located; dotted where concealed. Rectangles on upthrown block.

FOLDS

Folds in Proterozoic rocks showing trace of axial surface, direction of dip of limbs, and direction of plunge

Overturned synform

Overturned antiform

PLANAR FEATURES

Strike and dip of inclined beds

Strike and dip of crystallization foliation

Inclined

Vertical

LINEAR FEATURES

Bearing and plunge of mineral lineation

OTHER FEATURES

Boring – Rock type at bottom: M, Mesoproterozoic rocks; W, Wissahickon gneiss or schist; C, Chickies Quartzite; S, Stockton Fm.

Well or boring with log in Table 1 – Location accurate to within 200 feet. Formations and lithologies based on drillers' or loggers' descriptions.

Well or boring with log in Table 1 – Location accurate to within 500 feet. Formations and lithologies based on drillers' or loggers' descriptions.

Cretaceous formation observed in exposure, excavation, or hand-auger hole

Cretaceous formation observed in former excavation or exposure – From Owens and Minard (1964)

Cretaceous formation penetrated in power-auger hole – From Owens and Minard (1964). Where multiple formations were penetrated, number preceding formation abbreviation is depth, in feet below land surface, of base of formation. Surficial deposits indicated by 's'.

Pollen zone – Symbol indicates location of sample in Magothy Formation. Pollen analysis by L. A. Sirkin (written communication, 1990).

Location of photo

Gamma-ray log – On Cretaceous cross section C-C'. Gamma-ray intensity increases to right

Form line showing trend of bedding and foliation in pre-Cretaceous rocks in cross section

CORRELATION OF MAP UNITS

COASTAL PLAIN

Ket
Kwb
Kmv
Unconformity
Kmg
Unconformity
Kp
Unconformity
} CRETACEOUS

PIEDMONT
Newark Basin
TRs } TRIASSIC
Unconformity

Trenton Prong
Ow } ORDOVICIAN
Fault Contact
Ꞓc } CAMBRIAN
Unconformity
Zd } NEOPROTEROZOIC
Intrusive Contact

Granitic Rocks
Assunpink Creek Granite
Yac
Intrusive Contact
Supracrustal Rocks
Ygq Ygc Ya
Magmatic Arc Rocks
Colonial Lake Suite
Yclt Ycld Yclg Ycla
} MESOPROTEROZOIC

Yu

Trenton East topography compiled 1942. Planimetry derived from imagery taken 1995. Survey control current as of 1943.

Trenton West topography compiled 1947. Planimetry derived from imagery taken 1995. Survey control current as of 1957. Selected hydrographic data compiled from NOS Chart 296 (1954)
This information is not intended for navigational purposes
Landmark buildings verified 1957

North American Datum of 1927 (NAD 27) is shown by dashed corner ticks. The values of the shift between NAD 83 and NAD 27 for 7.5-minute intersections are obtainable frm National Geodetic Survey NADCON software

Hydrography (in blue) from NJDEP Land Use/Land Cover 2012 update, edition 20150217.

SCALE 1:24,000
1 .5 2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET (TRENTON WEST QUADRANGLE)
CONTOUR INTERVAL 10 FEET (TRENTON EAST QUADRANGLE)

LOCATION IN NEW JERSEY

APPROXIMATE MEAN DECLINATION, 1994

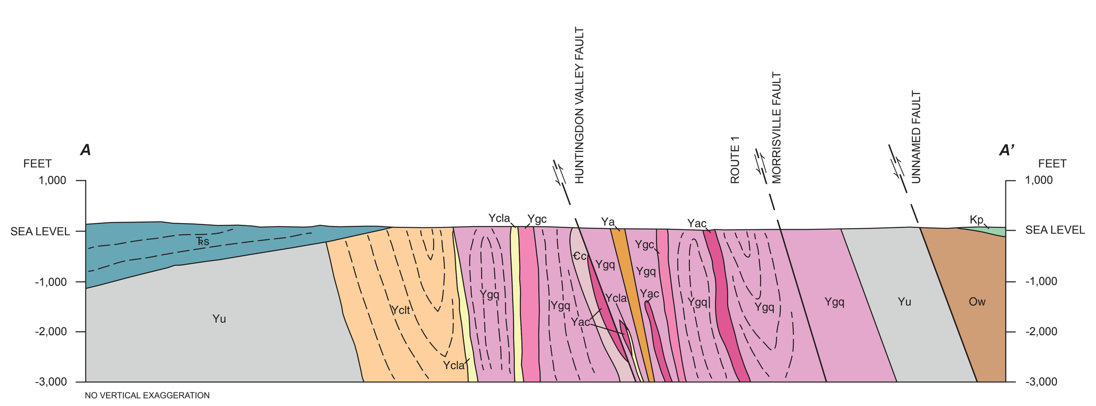
Piedmont bedrock geology mapped by R.A. Volkert, 2012
Coastal Plain bedrock geology mapped by S.D. Stanford, 2012
Digital cartography by R.S. Pristas

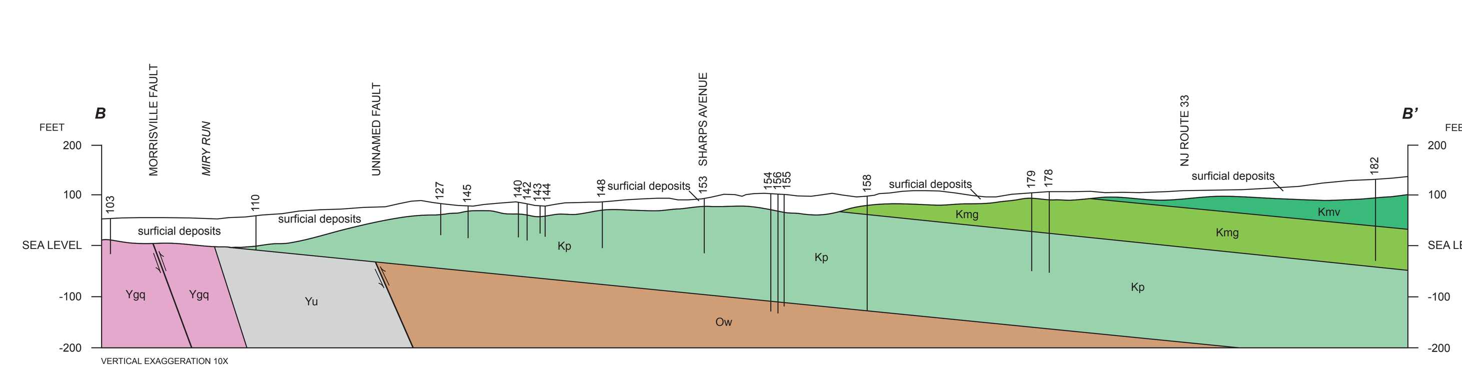
Research supported by the U. S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G12AC20227. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U. S. Government.

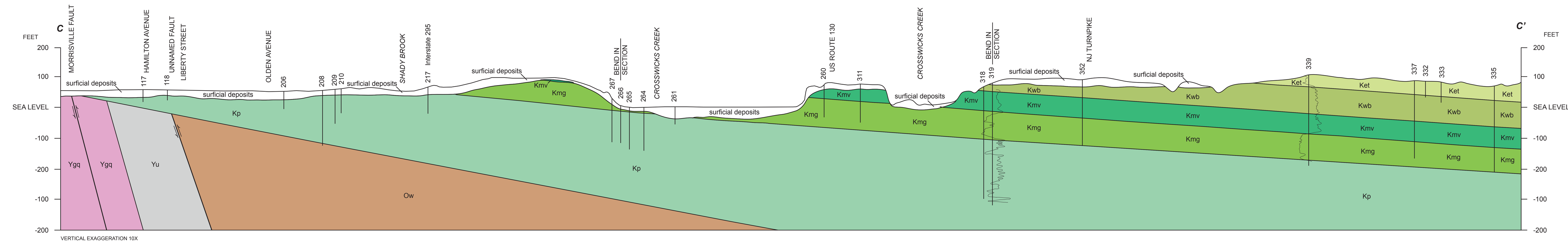
Bedrock Geologic Map of the New Jersey Part of the Trenton West and Trenton East Quadrangles Mercer and Burlington Counties, New Jersey

by
Richard A. Volkert[1] and Scott D. Stanford
2018

[1] Retired, New Jersey Geological and Water Survey







Bedrock Geologic Map of the New Jersey Part of the Trenton West and Trenton East Quadrangles Mercer and Burlington Counties, New Jersey

New Jersey Geological and Water Survey
Open File Map 122
2018

Pamphlet with table 1 to accompany map

Table 1. Selected well and boring records. Footnotes at end of table (p. 8)

Well Number	Identifier[1]	Formations Penetrated[2]
1	27-1664	34 Qwf 100 ss&sh
2	27-5896	33 Qwf, cased to 33, yield 25 gpm
3	27-2918	5 Qwf 51 sh
4	27-2751	40 Qwf 90 ss
5	27-2288	15 Tp 402 ss
6	27-8783	8 Qwf 25 wss
7	27-10012	15 Qwf 37 wss 65 ss&sh
8	28-3500	18 Tp 22 ss
9	28-5471	12 Tp 70 ss
10	27-331	25 Tp+wss 41 ss 70 sh
11	27-2550	15 Qal+wss 75 ss
12	28-28045	19 wss
13	27-2587	62 wss 200 ss
14	28-94	40 wss 201 ss
15	27-2747	28 wss 96 ss 337 gn
16	28-16103	50 wss 170 ss 290 gn
17	28-493	20 Tp+wss 48 wss 198 ss 265 gn
18	28-28456	4 Tp 35 wss
19	28-29954	20 Tp+wss 46 wss
20	27-10250	20 Tp 29 wsc 31 sc
21	27-10911	52 wss
22	27-11256	8 Qwf 12 wsc
23	27-11959	5 f 21 Qwf 25 gn
24	27-11962	13 f 33 Qwf 41 gb
25	27-10985	5 f 13 Qwf 37 wr
26	28-29900	2 f 15 wsc 20 sc
27	27-11068	15 f 42 Qwf 43 wr 60 r
28	28-31375	19 f 29 Qwf 30 wgn 35 gn
29	27-8253	13 f 22 Qwf 27 gn
30	DOT 163W-17	19 Qwf 29 sc
31	28-23426	10 f 40 Qwf 41 sc
32	28-23520	5 f 14 Qwf 24 gn&sc
33	DOT 379W-8	36 Qwf
34	28-20864	3 f 10 Qwf 17 wr
35	28-25242	6 f 22 Qwf 42 wsc
36	28-22049	5 f 14 Qwf 16 wr
37	DOT 439W-24	21 Qwf

Well Number	Identifier[1]	Formations Penetrated[2]
38	28-23512	28 Qwf 30 r
39	28-21509	9 f 23 Qwf 29 wgn 30 gn
40	28-22999	4 f 32 Qwf 43 wgn 50 gn
41	28-17885	6 f 16 Qwf 50 gn&cg
42	28-22175	35 f+Qwf 60 wsc&sc (average of numerous borings in small area)
43	28-30064	18 f 34 Qwf 60 wr
44	DOT L94A	9 f 25 Qwf 40 sc
45	28-25963	42 Qwf 43 wr?
46	DOT 379W-17	23 Qwf 25 wgn 30 gn
47	28-23692	38 Qwf 39 sc
48	DOT 125W-194	46 Qwf
49	28-28263	45 Qwf
50	DOT B1001	30 f+Qwf 49 gn 58 q
51	DOT DR 1	5 w 6 Qal 11 gn
52	DOT DR 3	13 w 14 Qal 19 sc
53	DOT DR 4	4 w 22 Qal 26 sc
54	DOT DR 5	13 w 17 Qal 22 gn
55	28-19648	30 f+Qwf 98 wsc 113 sc
56	28-28324	40 Qwf
57	DOT L68	15 f 40 Qwf
58	DOT L31	9 f 28 Qwf 39 q
59	28-32138	7 f 17 Qt 27 Qwf 47 wsc
60	DOT DR 7	3 w 26 Qal 31 q&sc
61	DOT DR 9	8 w 53 Qal
62	DOT DR 10	4 w 24 Qal 30 sc
63	DOT DR 11	8 w 60 Qal
64	DOT DR 12	7 w 53 Qal 60 q
65	DOT DR 13	5 w 38 Qal 60 Kp
66	DOT DR 15	6 w 28 Qal 63 Kp
67	DOT DR 17	4 w 17 Qal 60 Kp
68	28-4078	5 f 28 Qwf 80 Tp? 200 Kp
69	DOT L53	11 f 40 Qwf
70	DOT 125W-190	9 f 45 Qwf 50 Tp?
71	DOT 125W-77	7 f 43 Qwf
72	DOT 125W-101	29 f 41 Qwf 43 Kp
73	DOT W-12	45 Qal 66 Kp
74	DOT DR 19	5 w 23 Qal 60 Kp
75	DOT DR 20	31 w 50 Qal 60 Kp
76	DOT DR 22	12 w 44 Qal 60 Kp
77	DOT DR 23	37 w 50 Qal 60 Kp
78	DOT DR 25	9 w 46 Qal 59 Kp
79	28-13021	13 f 21 Qst 30 Qwf 42 Kp
80	28-13022	22 f 41 Qwf 66 Kp
81	DOT 125W-122	32 Qwf 56 Kp
82	DOT DR 37	4 w 28 Qal 60 Kp
83	28-1600	50 Tp+wr 78 wr 194 ss
84	28-13146	4 f 17 Qwf 22 wr?
85	28-15648	6 f 19 Qwf 20 wsc
86	28-13787	27 Qwf 30 q, screened 20-30, yield 60 gpm
87	28-29354	9 f 19 Qwf 23 wgn 40 gn
88	28-10291	30 Qwf, screened 28-30, yield 12 gpm
89	28-28670	6 f 27 wsc
90	DOT 439W-15	9 f 15 wgn 20 gn
91	DOT 379W-10	19 Qwf 29 gn
92	DOT S9	3 f 32 Qwf 43 gn
93	28-575	36 Qwf, screened 26-36, yield 140 gpm
94	28-699	38 Qwf 39 r, screened 18-38, yield 72 gpm

Well Number	Identifier[1]	Formations Penetrated[2]
95	28-2711	37 Qwf 42 r, screened 22-38, yield 50 gpm
96	28-27883	25 Qwf 40 wgn 87 gn
97	28-26479	15 Qwf 16 gn
98	28-23390	48 Qwf 49 r
99	28-5502	54 Tp 55 wr?, screened 50-53, yield 10 gpm
100	28-7173	41 Qwf 45 wr
101	28-3437	24 Qwf 45 Tp?
102	28-6961	22 Qwf 41 Tp?
103	28-4896	40 Qwf 70 wsc, logged by F. J. Markewicz 10/13/64, screened 40-46, yield 10 gpm
104	28-15574	48 Qwf 53 wr
105	28-9906	46 Qwf 47 wr 50 r, screened 40-50, yield 40 gpm
106	28-7910	50 Qwf, screened 45-50, yield 28 gpm
107	28-6972	55 Qwf, screened 47-50, yield 30 gpm
108	28-8437	52 Qwf 53 r, screened 49-52, yield 25 gpm
109	28-9951	51 Qwf 55 wr, screened 45-50, yield 60 gpm
110	DOT S11	4 f 56 Qwf 63 Kp
111	DOT S19	33 Tp 61 Kp
112	DOT S26	45 Tp 71 Kp
113	28-3578	12 Qwf 52 Kp
114	28-5562	45 Qwf 61 Kp
115	28-25965	27 Qwf
116	28-4480	15 f 28 Qwf 42 wr?
117	28-15680	30 Qwf 33 Kp
118	27-1815	17 Qwf 35 Kp
119	28-1576	17 Qwf 30 Kp
120	27-1792	18 Qwf 30 KP
121	28-3694	30 Qwf 79 Kp
122	28-11247	15 Qwf 100 Kp
123	28-2356	41 Tp 134 Kp
124	DOT S36	3 f 26 Qt 35 Kp
125	DOT S219	31 Qt 51 Kp
126	28-5500	30 Qt 51 Kp
127	28-3667	20 Tp 60 Kp
128	28-9467	30 Tp 56 Kp
129	28-6643	15 Tp 73 Kp
130	28-5958	12 Tp 65 Kp
131	28-3554	18 Tp 60 Kp
132	28-12801	14 Qt 40 Tp 58 Kp
133	28-3184	6 Qt 53 Kp
134	28-3185	10 Qt 55 Kp
135	28-25629	11 Tp 44 Kp
136	28-29222	11 Tp 138 Kp
137	28-8376	25 Tp 80 Kp
138	28-5559	28 Tp 71 Kp
139	28-7130	8 Tp 71 Kp
140	27-4395	23 Tp 70 Kp
141	28-5986	15 Tp 69 Kp
142	28-6011	39 Tp 71 Kp
143	28-5699	38 Tp 61 Kp
144	28-2788	16 Tp 61 Kp
145	28-3646	18 Tp 71 Kp
146	28-6576	38 Tp 85 Kp
147	28-6418	25 Tp 100 Kp
148	28-7896	16 Tp 90 Kp
149	28-1350	11 Tp 82 Kp
150	28-2927	7 Tp 155 Kp 160 wr
151	DOT 379W-9	25 Qwf 33 gn

Well Number	Identifier[1]	Formations Penetrated[2]
152	28-2427	30 Tp 89 Kp
153	28-5201	18 Tp 101 Kp
154	28-6625	34 Tp 218 Kp 236 wr
155	28-161	40 Tp 213 Kp 220 Kp or wr
156	28-1363	40 Tp 215 Kp 235 wsc, logged by F. J. Markewicz
157	28-26569	32 Tp 55 Kp
158	28-2792	20 Tp 30 Kmg 230 Kp
159	28-4218	45 Tp 120 Kp
160	28-5306	28 Tp 113 Kp
161	28-13775	6 Qt 105 Kp
162	28-13557	48 Tp 78 Kp
163	28-10701	34 Tp 100 Kp
164	28-12799	45 Tp 56 Kmg 180 Kp
165	28-31367	25 Tp 65 Kmg 100 Kp
166	28-7380	10 Tp 65 Kmg 70 Kp
167	28-15342	50 Kmg 75 Kp
168	28-6017	7 g 8 Qt 90 Kmg
169	SC 137	8 Qt 128 Kmg
170	28-6222	10 Qt 62 Kmg
171	28-19775	15 Qt 113 Kmg 150 Kp
172	SC 138	12 Qt 125 Kmg
173	SC 139	131 Kmg
174	SC 140	6 Qt 128 Kmg
175	SC 141	143 Kmg
176	SC 142	11 Kmv 85 Kmg 149 Kp
177	SC 143	6 g 20 Tp 89 Kmg
178	SC 144	20 Tp 93 Kmg 162 Kp
179	SC 145	10 Tp 85 Kmg 150 Kp
180	SC 147	16 Tp 108 Kmg 148 Kp
181	SC 148	68 Kmg 134 Kp
182	28-31032	36 Tp 96 Kmv 160 Kmg
183	28-26539	12 Tp 50 Kmv 100 Kmg
184	SC 149	9 Qt 134 Kmg
185	SC 150	15 Qt 70 Kmg 131 Kp
186	28-7031	8 Tp 61 Kmg
187	SC 151	10 Qal 126 Kmg
188	SC 152	75 Kmg 135 Kp
189	28-9905	31 Tp 43 Kmv 117 Kmg 160 Kp
190	SC 153	28 Tp 90 Kmg 144 Kp
191	SC 154	19 Kmv 79 Kmg 143 Kp
192	28-49883	151 Kp
193	28-7667	36 Tp 140 Kp
194	28-6241	38 Tp 109 Kp
195	DOT S54	4 f 61 Kp
196	28-22497	18 Tp 52 Kp
197	28-5081	34 Tp 96 Kp
198	28-5010	18 Tp 97 Kp
199	28-30274	31 Tp 45 Kmg
200	28-12399	55 Tp 68 Kmg
201	28-17124	2 f 43 Tp
202	28-19133	2 f 35 Tp
203	DOT S63	8 f 24 Tp 81 Kp
204	28-3105	16 Tp 92 Kp
205	28-30002	20 Qwf 59 Kp
206	28-29938	40 Qwf 70 Kp
207	28-1152	4 f 8 Tp 60 Kp
208	28-1551	170 Kp 185 sc, logged by E. S. Lenker

Well Number	Identifier[1]	Formations Penetrated[2]
209	28-7150	2 f 5 Qs 15 Qwf 109 Kp
210	28-6061	4 f 10 Qwf 68 Kp
211	28-30969	70 Tp
212	28-16493	35 Qwf
213	28-30994	5 f 40 Qwf
214	28-29315	32 Qwf
215	28-21-485	46 Qwf 98 Kp 179 w sc
216	28-7129	10 Qwf 59 Kp
217	DOT S69	22 Tp 86 Kp
218	28-9204	18 Tp 38 Kmv 135 Kmg 170 Kp
219	28-11690	10 Tp 35 Kmv 135 Kmg 150 Kp
220	28-5202	28 Tp 40 Kmv 66 Kmg
221	28-4964	36 Qt 115 Kmg 124 Kp
222	SC 155	16 Tp 65 Kmg 128 Kp
223	SC 156	3 Tp 124 Kmg
224	SC 157	13 Qt 112 Kmg
225	SC 158	19 Qt 112 Kmg
226	SC 159	14 Qt 80 Kmg
227	SC 160	12 Qt 84 Kmg
228	28-7663	55 Qt 75 Kmg 115 Kp
229	SC 161	17 Qt 69 Kmg 81 Kp
230	SC 162	22 Qt 52 Kmg 78 Kp
231	SC 163	36 Qt 50 Kmg 82 Kp
232	SC 164	39 Qt 75 Kmg 108 Kp
233	28-5317	18 Qt 63 Kmv+Kmg 117 Kmg 178 Kp
234	28-2025	14 Qt 90 Kmv+Kmg 105 Kmg
235	28-2458	16 Qt 23 Kmv 134 Kmg 215 Kp
236	28-17765	9 Qt 45 Kmv 178 Kmg 200 Kp
237	28-10158	34 Kwb 93 Kmv 142 Kmg
238	28-16886	15 Qt 75 Kwb 90 Kmv 150 Kmg
239	28-7144	14 Qt 81 Kwb+Kmv 143 Kmg
240	28-25995	11 Qt 88 Kmv 172 Kmg
241	28-3824	12 Qt 70 Kwb+Kmv 140 Kmv+Kmg 162 Kmg
242	28-20542	10 Qt 95 Kwb+Kmv 130 Kmg
243	28-11057	6 Qt 23 Kwb 68 Kmv 145 Kmg
244	28-15230	8 Qt 45 Kwb 81 Kmv 132 Kmg
245	28-7253	8 Qt 100 Kwb+Kmv 168 Kmg
246	28-10299	4 g 11 Qt 85 Kwb+Kmv 91 Kmv 150 Kmg
247	28-14224	3 f 10 g 25 Qt 115 Kwb+Kmv 230 Kmg 285 Kp
248	28-1671	10 Tp 178 Kwb+Kmv 207 Kmg
249	28-7497	5 Tp 155 Kwb+Kmv 213 Kmg 238 Kp
250	28-28500	60 Kwb 80 Kmv 135 Kmv+Kmg 200 Kmg
251	28-19515	10 Tp 68 Kwb 105 Kmv 181 Kmg
252	28-31081	29 Tp 54 Kwb 121 Kmv 208 Kmg
253	28-7929	28 Qt 96 Kmv 165 Kmg
254	28-8677	24 Qt 90 Kmv 149 Kmg
255	28-4280	15 Qt 90 Kmv 119 Kmg
256	28-3956	20 Qt 90 Kmg, logged by D. G. Parrillo, 11/28/60
257	28-9231	4 f 6 Qt 26 Kmv+ Kmg 90 Kmg
258	28-1729	6 Qt 34 Kmv 108 Kmg
259	28-25886	15 Qt 49 Kmv 96 Kmg
260	28-14445	20 Qt 50 Kmv 115 Kmg
261	SC165	16 Qm 35 Kmg 57 Kp
262	SC 167	36 Qm 56 Kmg
263	SC 168	19 Qt 60 Kmg
264	28-5409	9 Qm 15 Kmg 140 Kp
265	28-8769	2 f 10 Qm 20 Kmg 137 Kp

Well Number	Identifier[1]	Formations Penetrated[2]
266	28-34305	12 f over Qm 22 Kmg 122 Kp
267	29-5150	8 Qt 16 Kmg 127 Kp
268	28-31914	14 Kmg 53 Kp
269	28-104	18 Qt 30 Kmg 120 Kp
270	core 1 (Southgate, 2010)	19 Qm
271	DOT S88	17 Qm 42 Qal 120 Kp
272	DOT SB341	10 Qm 43 Qal 55 Kp
273	DOT SB119	13 Qm 69 Qal 79 Kp
274	DOT SB50	13 Qm 51 Qal
275	28-26036	30 Qwf 145 Kp
276	DOT H41	3 f 12 Qm 30 Qal
277	DOT H40	6 f 17 Qm 35 Qal
278	DOT H38	9 f 17 Qm 30 Qal
279	28-25876	21 Qm 28 Qal 60 Kp
280	DOT 125W-161	12 Qm 28 Qal 36 Kp
281	DOT 125W-76	40 Qt 43 Kp
282	DOT DR 36	3 w 17 Qal 59 Kp
283	DOT DR 37	4 w 28 Qal 60 Kp
284	DOT DR 40	7 w 14 Qal 60 Kp
285	DOT DR 41	26 w 36 Qal 60 Kp
286	28-9524	25 f 63 Qt 73 Kp
287	28-9525	25 f 63 Qt 73 Kp
288	DOT DR 55	15 w 61 Qal
289	DOT SB 190	18 Qm 40 Qal 66 Kp
290	DOT SB223	21 Qm 40 Qal 61 Kp
291	DOT SB232	17 Qm 40 Qal 66 Kp
292	DOT H14	18 Qm 28 Qal 46 Kp
293	DOT H20	18 Qm 31 Qal
294	DOT DR 64	7 w 50 Qal 60 Kp
295	DOT DR 68	30 w 43 Qal 60 Kp
296	DOT DR 69	8 w 36 Qal 59 Kp
297	DOT DR 72	7 w 30 Qal 60 Kp
298	DOT DR 73	17 w 50 Qal 61 Kp
299	DOT DR 74	25 w 45 Qal 60 Kp
300	DOT F7	40 Qt 64 Kp
301	SC 172	23 Qm 27 Qal 55 Kmg
302	SC 173	32 Qm 47 Qal 55 Kp
303	SC 174	35 Qm 42 Qal 55 Kp
304	SC 175	20 Qm 55 Qal
305	SC 176	33 Qm 55 Qal
306	SC 177	12 Qm 18 Qal 55 Kp
307	SC 178	6 f 19 Qt 62 Kp
308	SC 169	62 Qt 127 Kmg+Kp
309	SC 170	38 Qt 106 Kmg
310	SC 171	20 Qt 85 Kmg 109 Kmg+Kp
311	28-9683	10 Qt 55 Kmv 123 Kmg
312	28-15804	10 Qt 55 Kmv 125 Kmg
313	28-20500	8 Qt 32 Kmv 65 Kmg
314	28-4291	12 Qt 45 Kmv 75 Kmg
315	28-29149	32 Tp 115 Kwb+Kmv 180 Kmg
316	28-16367	40 Tp 155 Kwb+Kmv 172 Kmg
317	28-249	13 Tp 35 Kwb 75 Kmv 276 Kmg 397 Kp
318	28-5042	15 Tp 110 Kwb+Kmv 239 Kmg 372 Kp
319	28-57004, G	10 Tp 110 Kwb+Kmv 245 Kmg 397 Kp
320	28-21105	29 Qt 49 Kwb 94 Kmv 162 Kmg
321	28-16829	16 Qt 85 Kwb 160 Kmv 205 Kmg

Well Number	Identifier[1]	Formations Penetrated[2]
322	28-17754	15 Qt 65 Kwb 115 Kmv 145 Kmv+Kmg 200 Kmg
323	28-15414	25 Qt 125 Kwb+Kmv 140 Kmv 187 Kmg
324	28-8832	18 Qt 75 Kwb 95 Kmv
325	28-16759	16 Qt 80 Kwb 140 Kmv 193 Kmg
326	28-21288	21 Qt 84 Kwb 138 Kmv 212 Kmg
327	28-9479	20 Qt 76 Kwb 99 Kmv
328	28-28512	18 Qt 138 Kmv+Kwb 195 Kmg
329	28-20443	18 Qt 82 Kwb 124 kmv 231 Kmg
330	28-8462	5 Qt 90 Kwb 110 Kmv 190 Kmg
331	28-22529	9 Qt 58 Ket 128 Kwb 158 Kmv 187 Kmv+Kmg 257 Kmg
332	28-16280	12 Qt 60 Ket
333	28-15962	75 Ket
334	28-26457	62 Ket 141 Kwb 186 Kmv 260 Kmg
335	28-16335	70 Ket 150 Kwb 215 Kmv 265 Kmg
336	28-26253	7 Qt 40 Ket 136 Kwb 188 Kmv 240 Kmg
337	28-9803	63 Ket 65 Kwb
338	28-31209	60 Ket 196 Kwb+Kmv 220 Ket
339	28-4082, G	40 Ket 120 Kwb 190 Kmv 280 Kmg 290 Kp
340	28-21188	24 Tp 49 Ket 138 Kwb 184 Kmv 240 Kmg
341	28-31351	29 Tp 57 Ket 137 Kwb 176 Kmv 247 Kmg
342	28-23147	19 Tp 34 Ket 117 Kwb 176 Kmv 240 Kmg
343	28-7997	9 Tp 35 Ket 55 Kwb
344	28-31219	20 Tp 40 Ket 120 Kwb 158 Kmv 220 Kmg
345	28-30475	16 Tp 49 Ket 123 Kwb 146 Kmv 252 Kmg
346	28-21153	20 Tp 55 Ket 120 Kwb 160 Kmv 225 Kmg 280 Kmg +Kp
347	28-7701	16 Tp 108 Kwb 122 Kmv 192 Kmg
348	28-29752	14 Tp 27 Ket 112 Kwb 178 Kmv 240 Kmg
349	28-21985	23 Tp 81 Kwb 140 Kmv 200 Kmg
350	28-20780	21 Tp 65 Kwb 103 kmv 110 kmg
351	28-8826	19 Tp 70 Kwb 155 Kmv 185 Kmg
352	28-27525	30 Tp 85 Kwb 100 Kmv 220 Kmg
353	28-16500	28 Tp 99 Kwb 119 Kmv 180 Kmg
354	28-17488	28 Tp 97 Kwb 121 Kmv 190 Kmg
355	28-7592	32 Tp 80 Kwb 90 Kmv 144 Kmv+Kmg 199 Kmg
356	28-4837	7 Tp 55 Kwb 69 Kmv 79 Kmg
357	28-29913	75 Kwb 95 Kmv 160 Kmg
358	28-30763	12 Tp 60 Kwb 100 Kmv 180 Kmg
359	28-16751	35 Tp 90 Kwb 140 Kmv 180 Kmg
360	28-31199	40 Tp 76 Kwb 134 Kmv 160 Kmg
361	28-31200	39 Tp 76 Kwb 133 Kmv 158 Kmg
362	28-29216	14 Tp 133 Kwb+Kmv 180 Kmg
363	28-31201	40 Tp 76 Kwb 134 Kmv 160 Kmg
364	28-11221	5 g 18 Tp 65 Kwb 89 Kmv 100 Kmg
365	28-4846	10 Tp 64 Kwb+Kmv 70 Kmg
366	28-23133	23 Kmv
367	28-26010	12 Tp 30 Kmv
368	28-853	7 Tp 13 Kmv 87 Kmv+Kmg 115 Kmg
369	28-1828	22 f+Tp 60 Kmv 131 Kmg
370	28-27595	8 Qt 25 Kmv 46 Kmg
371	SC 179	10 Qm 22 Kmg 53 Kp
372	DOT DR 84	13 w 21 Qm 58 Qal 60 Kp
373	DOT SB 269	25 Qm 62 Qal 86 Kp
374	DOT SB 307	26 Qm 57 Qal 81 Kp
375	DOT SB 346	37 Qal 60 Kp
376	DOT DR 92	37 w 53 Qal 60 Kp
377	DOT DR 97	12 w 51 Qal 60 Kp
378	DOT DR 100	7 w 10 Qm 30 Qal 60 Kp

Well Number	Identifier[1]	Formations Penetrated[2]
379	28-30964	20 Qt 66 Kmg
380	28-3660	41 Qal 45 Kmg 89 Kp
381	DOT DR 112	15 w 28 Qm 38 Qal 60 Kp
382	28-456	30 Tp 110 Kmv+Kmg 155 Kmg 230 Kp
383	28-7196	12 Tp 95 Kwb+Kmv 165 Kmg
384	28-5083	130 Kmg 265 Kp, logged by F. J. Markewicz, 11/18/64
385	DOT DR 130	7 w 11 Qm 60 Qal
386	28-7100	42 Qt 212 Kp
387	27-10794	17 Qwf 24 Kp
388	28-28810	24 Qt 55 Kmg 120 Kp
389	DOT SB 243	16 Qm 40 Qal 130 Kp
390	28-21-447	6 f 36 Qwf 39 sc
391	28-29302	40 Qwf
392	28-21-274	27 Qwf 59 wr? 61 r
393	28-3645	22 Qal 70 Kmv 145 Kmg 299 Kp, logged by R. Mayer, 12/14/59
394	28-1601	13 Tp 92 Kmv+Kmg 232 Kmg 397 Kp
395	28-16750	14 Qt 90 Kwb 150 Kmv 200 Kmg

[1] Identifiers of the form 27-xxxx and 28-xxxx are N. J. Department of Environmental Protection well-permit numbers. Identifiers of the form 28-xx-xxx are N. J. Atlas Sheet grid locations of wells in the state well files or the N. J. Geological and Water Survey permanent note collection that do not have permit numbers. Identifiers prefixed by "DOT" are N. J. Department of Transportation test borings available at http://www.state.nj.us/transportation/refdata/geologic/. Identifiers prefixed by "SC" are test borings made in the 1930s for a proposed ship canal that are on file at the N. J. Geological and Water Survey. The identifier "core 1 (Southgate, 2010)" is a pollen core from: Southgate, E. W. B., 2010, Herbaceous plant communities on the Delaware River floodplain, New Jersey, during the mid-Holocene: Bulletin of the Torrey Botantical Society, v. 137, p. 252-262. A "G" following the identifier indicates that a gamma-ray log is available for the well.

[2]Number is depth (in feet below land surface) of the base of the unit indicated by an abbreviation following the number. Final number is the total depth of the well rather than the base of the unit. For example, "12 Tp 34 Kmg 62 Kp" indicates Tp from 0 to 12 feet below land surface, Kmg from 12 to 34 feet, and Kp from 38 to bottom of hole at 62 feet. Formation abbreviations and the corresponding drillers' descriptive terms (in parentheses) used to infer the formation are as follows:

Surficial Deposits: w=water (for test borings drilled in the Delaware River), f=fill, g=accretion gley overlying surficial unit (brown, gray silty clay, sandy clay), Qal=alluvium (gray, brown, black, yellow sand, gravel, silty sand), Qm=tidal-marsh deposits (black, brown, dark gray silt, sand, and clay with peat or organic matter), Qs=swamp and marsh deposits (black soil), Qt=terrace deposits, undivided (includes map units Qstl, Qstu, Qtl, Qtu, TQg) (yellow, gray, tan, brown, reddish-brown sand, clayey sand, gravel, silty sand, loam), Qwf=glaciofluvial deposit (includes map units Qwf and Qif) (brown, reddish-brown, yellowish-brown sand and gravel, sand), Tp=Pensauken Formation (yellow, yellowish-brown, orange-brown, red sand and gravel, sand, clayey sand, silty sand, loamy sand).

Cretaceous Formations: Ket=Englishtown Formation (yellow, white, orange, gray sand, with clay, wood, mica), Kwb=Woodbury Formation (gray, black clay, silty clay), Kmv=Merchantville Formation (green, gray, black clay, marl, silty clay), Kmg=Magothy Formation (gray, white fine sand, fine-to-medium sand, silt, clay, with wood, lignite, mica), Kp=Potomac Formation (white, yellow, brown, red, gray clay, sand, coarse sand, gravelly sand).

Pre-Cretaceous bedrock lithologies (not assigned to formations) are: cg=conglomerate, gb=gabbro, gn=gneiss, r=rock, q=quartzite, sc=schist, sh=shale, ss=sandstone. A "w" preceding the rock identifier indicates that is reported as "weathered" or "decomposed": wgn=weathered gneiss, wr=weathered rock, wsc=weathered schist, wss=weathered sandstone.

Units joined with a "+" cannot be separately identified in the driller's description. Units joined with an "&" are interbedded or intercalated. Queried units (for example, "Tp?") are inferred from inconclusive descriptions. Units are interpreted from drillers' or geologists' lithologic descriptions on records from the sources indicated in footnote 1. Well cuttings logged by N. J. Geological and Water Survey staff are noted with the geologist's name and date, if available. Units shown for wells may not match the map and sections due to variability in drillers' descriptions. For wells tapping surficial deposits, the depth of the screened interval (in feet below land surface) and yield (in gallons per minute) are shown following the log.