

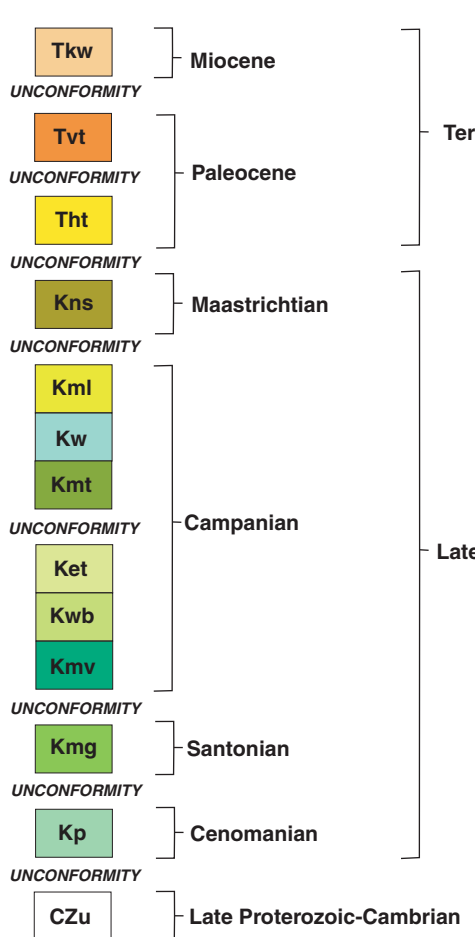
INTRODUCTION

Bedrock of the Woodbury quadrangle includes unconsolidated Coastal Plain formations that overlie metamorphic basement rocks. The Coastal Plain formations include sand, clay, and glauconite clay laid down in coastal, nearshore marine, and continental shelf settings between 95 and 20 million years ago. The underlying metamorphic rocks are much older and were originally laid down as sediments between 700 and 550 million years ago and 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*. Section 'AA' shows the subsurface geometry of the formations along the line of section. Surficial deposits of Pliocene and Quaternary age overlie the Coastal Plain formations in much of the quadrangle. The surficial deposits are mapped by Stanford (2004).

DESCRIPTION OF MAP UNITS

- Tkw** KIRKWOOD FORMATION—Quartz sand, fine to very fine-grained, micaceous, with thin beds of silt and clay. Yellow, reddish-yellow, white, light gray. As much as 50 feet thick. The Kirkwood in the Woodbury quadrangle is correlative with the downdip Kirsholm Marl member of the Kirkwood Formation, which is of lower Miocene age (20-21 Ma) based on strontium stable-isotope ratios (Sugarman and others, 1993). In the Woodbury quadrangle, the Kirkwood unconformably overlies the Vincentown, Homerstown, and Navesink formations.
- Tvt** VINCENTOWN FORMATION—Quartz-glaucous sand, medium to coarse-grained. Locally clayey, calcareous, and fossiliferous, with foraminifera and bryozoan detritus. Yellow, olive, light gray. As much as 40 feet thick in quadrangle. Late Paleocene in age, based on foraminifera (Olsson and Wise, 1987). The Vincentown unconformably overlies the Homerstown Formation.
- Tht** HORNERSTOWN FORMATION—Glaucous clay. Olive, green, black where unweathered, olive-brown with brown to reddish-brown mottles where weathered. As much as 30 feet thick. Glaucous occurs primarily in soft grains of fine-to medium sand size, with botryoidal and acordon shape. Quartz, mica, feldspar, and phosphatic material also occur as minor constituents. The underlying contact with the Navesink Formation is unconformable and bioturbated. Early Paleocene in age based on foraminifera (Olsson and others, 1997).
- Kns** NAVESINK FORMATION—Glaucous clayey sand. Locally fossiliferous, with calcareous shell beds. Olive, green, black where unweathered, olive brown to olive yellow where weathered. As much as 25 feet thick. Glaucous occurs primarily in soft grains of medium-to-coarse sand size, with botryoidal form. Quartz sand, medium grained, is the principal accessory. Pyrite, mica and phosphatic fragments are minor constituents. The contact with the underlying Mount Laurel Sand is unconformable. The basal few feet of the Navesink contain a glauconitic quartz sand with granules and black phosphate pebbles. This contact is easily distinguished in the subsurface by the sharp positive gamma-ray response. Late Cretaceous (Maestrichtian) in age based on foraminifera (Olsson, 1964). Strontium stable-isotope age estimates for the Navesink range between 69-67 Ma (Sugarman and others, 1995).
- Kml** MOUNT LAUREL FORMATION—Quartz sand, slightly glauconitic, medium grained. Yellowish brown to reddish yellow where weathered, gray where unweathered. As much as 100 feet thick. Contains traces of feldspar, mica, and phosphate pellets. The upper several feet are a coarse sand with granules and pebbles; this interval also contains glauconite from the overlying Navesink, concentrated in burrows. Late Cretaceous (late Campanian) in age based on nanoplankton (Sugarman and others, 1995). Grades downward into the Wenonah Formation.
- Kw** WENONAH FORMATION—Quartz sand, micaceous, slightly glauconitic, fine to very fine grained. Yellow to very pale brown where weathered, gray to pale olive where unweathered. As much as 50 feet thick. Contains traces of carbonaceous material. Late Cretaceous (late Campanian) in age based on pollen (Wolfe, 1976) and ammonite fossils (Kennedy and Cobban, 1994). Grades downward into the Marshalltown Formation.
- Kmt** MARSHALLTOWN FORMATION—Quartz-glaucous clayey sand, fine- to medium-grained. Olive to dark gray where unweathered, brown to olive brown where weathered. As much as 20 feet thick. Contains traces of feldspar, mica, finely disseminated pyrite, and phosphatic fragments. Late Cretaceous (middle Campanian) in age, based on nanoplankton (Sugarman and others, 1995). Unconformably overlies the Englishtown Formation.
- Ket** ENGLISHTOWN FORMATION—Quartz sand, fine to coarse grained, 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. As much as 70 feet thick. Sand contains some lignite and mica and minor amounts of glauconite, mica, carbonaceous matter and pyrite are common in the clays. 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 40 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.
- Kmv** MERCHANTVILLE FORMATION—Glaucous sandy clay. Olive, dark gray, black where unweathered, olive brown to yellowish brown where weathered. As much as 40 feet thick. Glaucous 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). The Merchantville-Magothy contact between Westville and Verga in the northeastern corner of the quadrangle is from well data in Jengo (1999). Unconformably overlies the Magothy Formation.

CORRELATION OF MAP UNITS



- Kmg** MAGOTHY FORMATION—Quartz sand, fine to very coarse grained, with thin beds of clay and silt. Sand is white, yellow, light gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish yellow where weathered, less commonly gray to black where unweathered. As much as 220 feet thick. 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). Pollen in the Magothy in the Woodbury quadrangle in the Westville area confirms the age and correlation (Jengo, 1999). Unconformably overlies the Potomac Formation.
- Kp** POTOMAC FORMATION—Quartz sand, fine to very coarse grained, and clay and silt, thin- to thick-bedded; minor granule 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, less commonly gray to black where unweathered. As much as 220 feet thick. Sand includes some lignite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. The Potomac Formation in the Woodbury quadrangle is equivalent to the Potomac Formation, unit 3 (Doyle and Robbins, 1977), based on pollen (Owens and others, 1998), and is Late Cretaceous (early Cenomanian) in age. Outcrop belt in the Woodbury quadrangle is entirely covered by surficial deposits but unit is penetrated by boreholes (Jengo, 1999). Unconformably overlies Cambrian and Late Proterozoic bedrock.
- CZu** PRE-CRETACEOUS METAMORPHIC ROCKS—Chiefly schist. Upper 10-150 feet is commonly weathered to a micaceous clayey saprolite (Jengo, 1999). Of Late Proterozoic and Cambrian age. Includes the Wissahick Formation and related rocks of the Potomac-Philadelphia-Hartland terrane (Volkert and others, 1996). In subsurface only (section AA).

MAP SYMBOLS

- Contact—Approximately located. Triangle indicates contact observed in outcrop.
- Formation observed in outcrop, excavation, or hand-auger hole.

Well used to construct section—Numbers of the form 15-xxx are U. S. Geological Survey Ground Water Site Inventory identification numbers. Numbers of the form 30-xxx or 31-xxx are N. J. Department of Environmental Protection well permit numbers.

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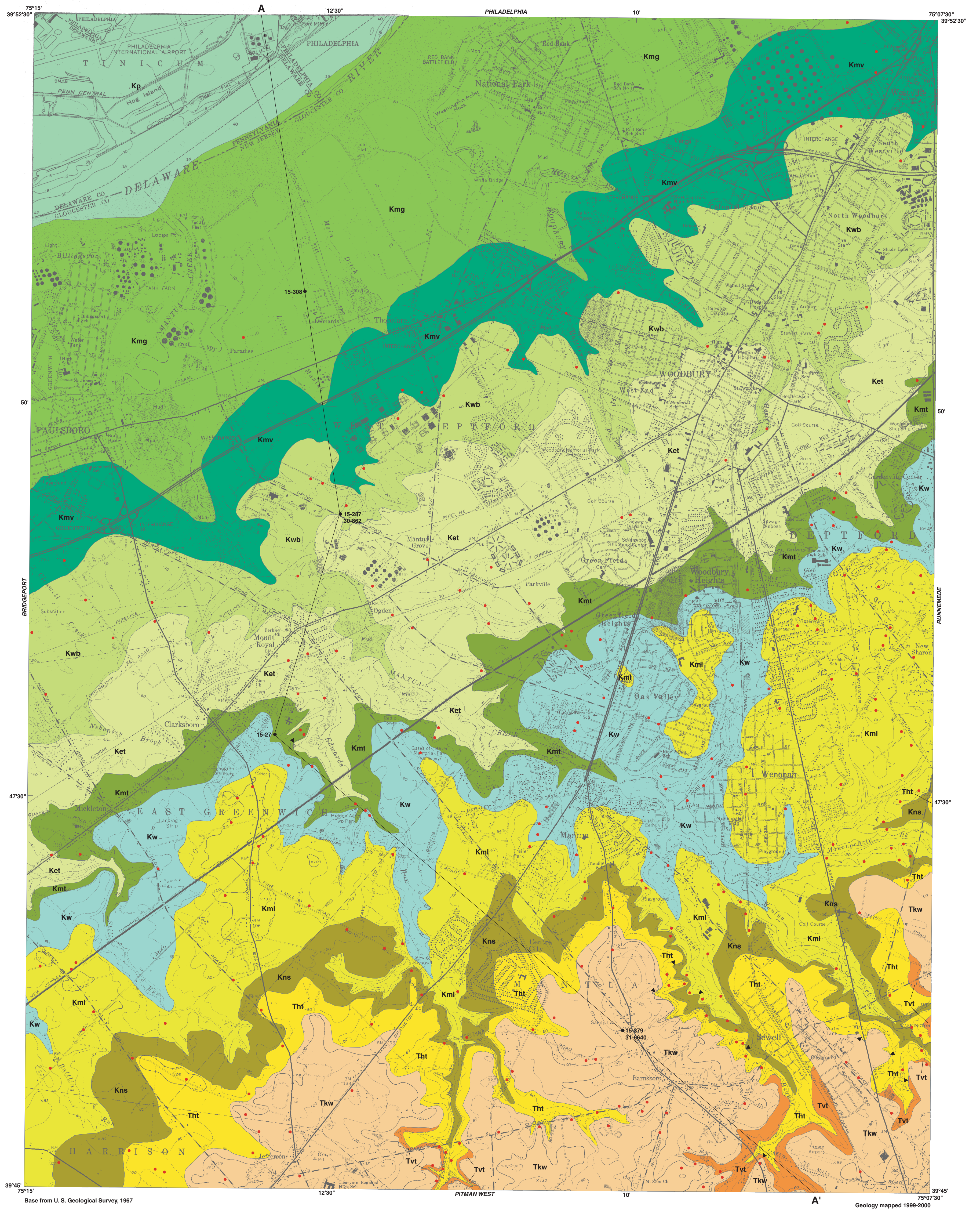
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BEDROCK GEOLOGY OF THE WOODBURY QUADRANGLE,
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