DELAWARE GEOLOGICAL SURVEY
University of Delaware, Newark
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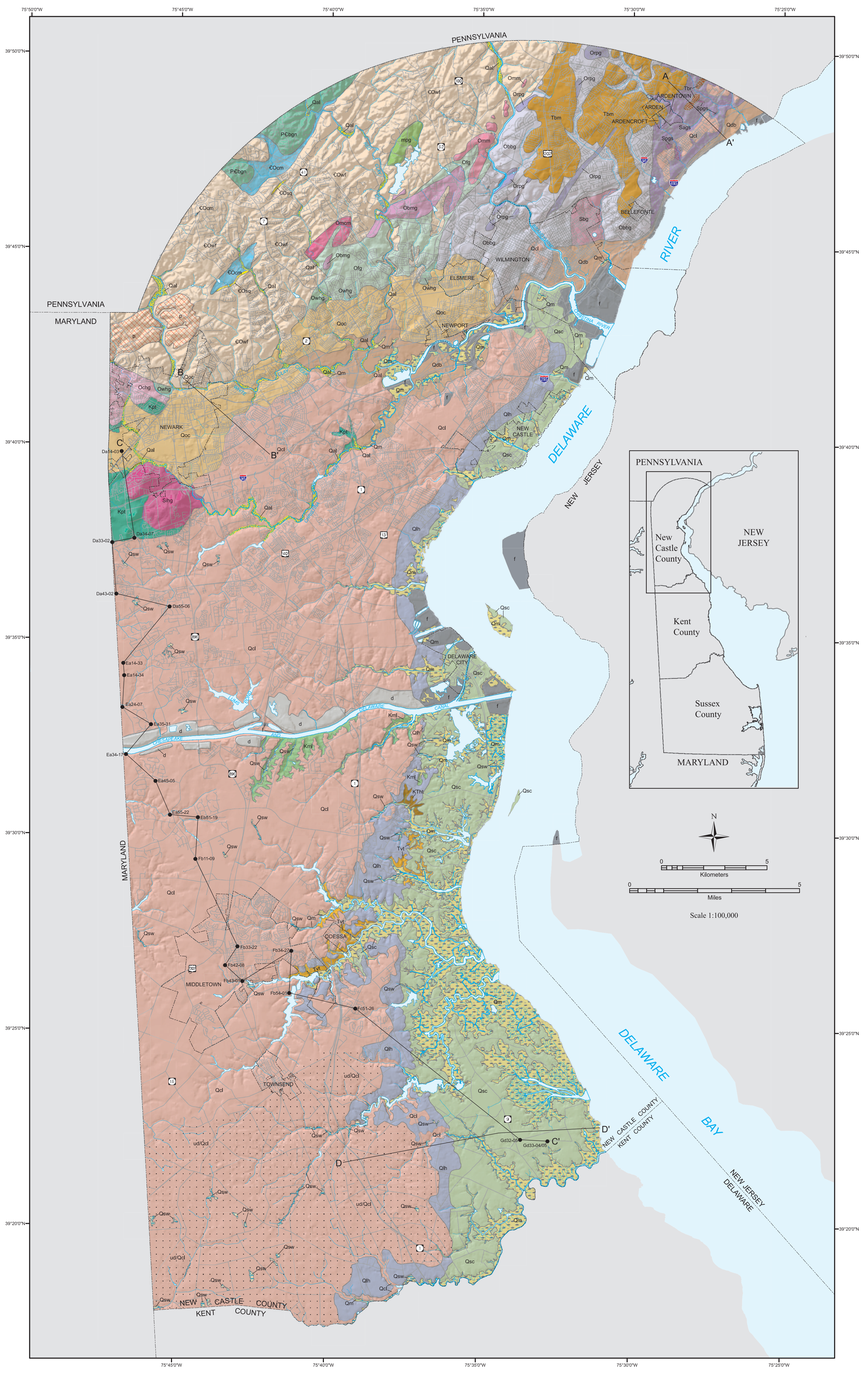

Geologic Map of New Castle County, Delaware

by

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2005

MAP CREDITS

Base Map
Projection: Universal Transverse Mercator, Zone 18
North American Datum of 1983 (NAD83)
USGS Delaware Hydrography Lines 2002, http://maps.udel.edu/metadata
USGS Delaware Hydrography Areas 2002, http://maps.udel.edu/metadata
USGS Delaware State Boundary Lines 2002, http://maps.udel.edu/metadata
USGS Delaware Boundaries - County Boundary Lines 2002, http://maps.udel.edu/metadata
The Delaware Office of State Planning Coordination Delaware Municipal Boundaries, 2005
New Castle County, Department of Land Use, Centerline for New Castle County, Delaware, 2005
New Castle DEM 30-meter resolution, http://www.udel.edu/FERC/spatlab/dems/co_dems.html

Other
Cartography by Lillian T. Wang, Delaware Geological Survey
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Descriptions of Map Units

PIEDMONT (from Schenck, Plank, and Srogi, 2000)

Iron Hill Gabbro (Silurian)
Black to very dark green, coarse- to very coarse-grained, uralitized olivine-hypersthene gabbronorite and pyroxenite with subophitic textures. Primary minerals are calcic plagioclase, orthopyroxene, clinopyroxene, and olivine. Amphibole is secondary, a pale blue-green actinolite. Olivine, when present, is surrounded by coronas similar to those in the Bringhurst Gabbro. The gabbronorite is deeply weathered leaving a layer of iron oxides, limonite, goethite, and hematite, mixed with ferruginous jasper. The jasper contains thin seams lined with druse quartz. Contacts with the Christiansted Gneiss are covered with sediments of the Coastal Plain.

Bringhurst Gabbro (Silurian)
Coarse- to very coarse-grained gabbronoite with subophitic textures. Primary minerals are plagioclase, olivine, clinopyroxene and orthopyroxene. Olivine, where present, is surrounded by an inner corona of orthopyroxene and an outer corona of pargasitic hornblende, both with spinel symplectites. The gabbronorites locally contain abundant xenoliths of mafic Brandywine Blue Gneiss.

Ardentown Granitic Suite (Silurian)
Medium- to coarse-grained granitic rocks containing primary orthopyroxene and clinopyroxene; includes quartz norites, quartz monzonorites, opdalites, and charnockites. Feldspar phenocrysts common. Mafic enclaves locally abundant in proximity to gabbronorites.

Perkins Run Gabbronorite Suite (Silurian)
Fine- to coarse-grained gabbronorite and minor diorite with subophitic to ophitic textures, variably foliated or lineated. Plagioclase, orthopyroxene, clinopyroxene, and hornblende are major minerals; biotite and olivine locally present. Olivine typically surrounded by corona structures as described for the Bringhurst Gabbro. Contemporaneous with the Ardentown Granitic Suite.

Brandywine Blue Gneiss (Ordovician)
Medium to coarse grained granulites and gneisses composed of plagioclase, quartz, orthopyroxene, clinopyroxene, brown-green hornblende, magnetite, and ilmenite. Mafic minerals vary from < 5-30 modal percent. A lineation due to a preferred orientation of quartz and mafic minerals is obvious on weathered surfaces. Unit contains thin, discontinuous fine-grained mafic layers.

Rockford Park Gneiss (Ordovician)
Fine-grained mafic and fine- to medium-grained felsic gneisses interlayered on the decimeter scale. Layers are laterally continuous, but mafic layers commonly show boudinage. Felsic layers are composed of quartz and plagioclase with < 10 modal percent pyroxene. Mafic layers contain subequal amounts of plagioclase, pyroxene, and hornblende. Penetrative deformation and granulite facies metamorphism have obscured igneous fabrics and contact relationships.

Mill Creek Metagabbro (Ordovician)
Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary minerals are hornblende and plagioclase.

Montchanin Metagabbro (Ordovician)
Coarse-grained gabbroic and metagabbroic rocks, variably metamorphosed and deformed. Primary igneous minerals include olivine, clinopyroxene, orthopyroxene, and plagioclase.

Barley Mill Gneiss (Ordovician)
Coarse-grained, foliated tonalite gneiss. Major minerals are biotite, hornblende, plagioclase, and quartz. Includes mafic enclaves or layers composed of subequal amounts of hornblende and plagioclase. Also includes a coarse-grained granitic lithology composed of biotite, microcline, plagioclase, and quartz.

Christianstead Gneiss (Ordovician)
Coarse-grained, foliated granodioritic gneiss. Major minerals are biotite, microcline, plagioclase, and quartz. Includes thin layers of fine-grained foliated amphibolite plus large pegmatites.

Faulkland Gneiss (Ordovician)
Predominantly fine- to coarse-grained amphibolites and quartz amphibolites with minor felsic rocks, probably metavolcanic. Major minerals are amphibole and plagioclase with or without pyroxene and/or quartz. Amphibole may be hornblende, cummingtonite, gedrite, and/or anthophyllite. Halos of plagioclase and quartz around porphyroblasts of magnetite, orthopyroxene, and garnet are common features.

Windy Hill Gneiss (Ordovician)
Thinly interlayered, fine- to medium-grained hornblende-plagioclase amphibolite, biotite gneiss, and felsic gneiss, possibly metavolcanic. Felsic gneisses contain quartz and plagioclase with or without microcline with minor pyroxene and/or hornblende and/or biotite. Metamorphic grade in this unit decreases from granulite facies in the northeast to amphibolite facies toward the southwest. Correlated with the Big Elk Member of the James Run Formation in Cecil County, Maryland.

Pegmatite (lower Paleozoic)
Coarse- to very coarse-grained granitic pegmatite with tourmaline crystals locally. Where outcrop is present, pegmatite is tabular and concordant with the regional trend of the underlying Wissahickon Formation. Lenticular xenoliths of Wissahickon gneisses occur locally in the pegmatite.

Wissahickon Formation (Cambrian to Ordovician)
Interlayered psammitic and pelitic gneiss with amphibolite. Psammitic gneiss is a medium- to fine-grained biotite-plagioclase-quartz gneiss with or without small garnets. Contacts with pelitic gneiss are gradational. Pelitic gneiss is medium- to coarse-grained garnet-sillimanite-biotite-plagioclase-quartz gneiss. Unit has a streaked or flasered appearance owing to the segregation of garnet-sillimanite-biotite stringers that surround lenses of quartz and feldspar. Throughout, layers of fine to medium-grained amphibolite composed of plagioclase and hornblende, several inches to <30 feet thick or as large massive bodies, are in sharp contact with the psammitic and pelitic gneisses. An attempt has been made to show some of the amphibolites mappable at the scale of the map. Granitic pegmatite is ubiquitous and occurs at all scales. Pyroxene bearing quartzite with garnet occurs locally near the contact with the Wilmington Complex. An ultramafic lens composed of cumulus layers of serpentinized peridotite, metapyroxenite, and metagabbro occurs near Hoopes Reservoir. The ultramafic lens may be correlative with the Baltimore Mafic Complex.

Metapyroxenite, metagabbro, and Serpentinite (undifferentiated) (Cambrian to Ordovician)
Light-colored coarse-grained rocks composed of interlocking grains of light colored, fibrous amphiboles, most likely magnesium-rich cummingtonite and/or anthophyllite with possible clinochlor. These rocks become finer grained and darker as hornblende replaces some of the Mg-rich amphiboles. Associated with the metapyroxenites are coarse-grained metamorphosed gabbros composed of hornblende and plagioclase. The metapyroxenites and metagabbros are probably cumulates.

Cockeysville Marble (Cambrian to Ordovician)
In Delaware, predominantly a pure, coarsely crystalline, blue-white dolomite marble interlayered with calc-schist. Major minerals in the marble include calcite and dolomite with phlogopite, diopside, olivine, and graphite. Major minerals in the calc-schist are calcite with phlogopite, microcline, diopside, tremolite, quartz, plagioclase, scapolite, and clinozoisite. Pegmatites and pure kaolin deposits and quartz occur locally.

Setters Formation (Cambrian to Ordovician)
In Delaware, predominantly an impure quartzite and garnet-sillimanite-biotite-microcline schist. Major minerals include microcline, quartz, and biotite with minor plagioclase, and garnet. Muscovite and sillimanite vary with metamorphic grade. Accessory minerals are iron-titanium oxides, zircon, sphene, and apatite. Microcline is an essential constituent of the quartzites and schists and serves to distinguish the Setters rocks from the plagioclase-rich schists and gneisses of the Wissahickon Formation.

Baltimore Gneiss (Precambrian)
Granitic gneiss with swirling leucosomes and irregular biotite-rich restite layers is the dominant lithology and constitutes approximately 75 to 80 percent of the exposed rocks. The remaining 20 to 25 percent comprises hornblende-biotite gneiss, amphibolite with or without pyroxene, and pegmatite. Granitic gneiss is composed of quartz, plagioclase, biotite, and microcline. Minor and accessory minerals are garnet, muscovite, magnetite, ilmenite, sphene, apatite, and zircon. The hornblende gneiss contains plagioclase, quartz, hornblende, and biotite with/without orthopyroxene. Accessory minerals are garnet, muscovite, clinozoisite, perthitic orthoclase, iron-titanium oxides, sphene, and apatite. Amphibolites are composed of subequal amounts of hornblende and plagioclase with minor quartz, biotite, clinopyroxene, and orthopyroxene.

COASTAL PLAIN

Fill
Man-made deposits of natural earth material, including dredge spoil, used to extend shore land and/or to fill a low-lying area such as where a road crosses a valley or marsh. Fill areas include Cherry Island Landfill and Pigeon Point Landfill near Wilmington that were main prior to landfill construction. Some construction debris (concrete, bricks, etc.) may be incorporated in the unit.

Dredge Disposal Deposits
Located on uplands and consist of dredged material from the Chesapeake and Delaware Canal. Primarily a mixture of sand, silt, and clay from Cretaceous geologic units through which the Canal was cut.

Alluvial Deposits (Holocene)
Brown, light yellow-orange, and gray fine to coarse quartz sand, silt, clay, and fine to medium gravel. Usually less than 20 ft thick. Restricted to stream channels and adjacent flood plains. Continuous along stream valleys and depicted on the map where extensive enough to be shown at map scale.

Swamp Deposits (Holocene)
Structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand. Organic particles consist of leaves, twigs, and larger fragments of deciduous plants in stream valleys. In stream valleys, swamp deposits fine upward and grade laterally with salt marsh deposits toward the Delaware River. Defined primarily on the presence of deciduous vegetation in stream valleys (Ramsey, 1997). On uplands, consist of dark- to light-gray clayey silt and very fine to coarse sand. Characterized by areas of seasonally standing water, internal drainage, and hydrophyllic trees. From 1 to 20 ft thick.

Marsh Deposits (Holocene)
Structureless to finely laminated, black to dark-gray, organic-rich silty clay to clayey silt with discontinuous beds of peat and rare shells (Ramsey, 1997). In-place or transported fragments of marsh grasses such as Spartina are common. Includes some clayey silts of estuarine channel origin. Map area delineated on the distribution of salt-tolerant marsh grasses. Thickness ranges between 1 and 40 ft.

Undrained Depression Deposits (upper Pleistocene to lower Holocene)
A belt of upland depressions that stretches across southern New Castle County. Sometimes referred to as Delmarva Bays, are irregular in shape and have internal drainage not integrated with any stream network. Filled with organic-rich woody silts to gray medium to coarse quartz sand (Webb, 1990). Some have a sandy rim at their margins. During wet periods, many are filled with water. Because of the abundance and relative small size (< 500 ft. diameter), individual basins are not mapped; rather, a pattern indicates the extent of these units where they overlie the Columbia Formation. Largest depressions appear as areas of swamp. Radiocarbon dates (Webb, 1990) indicate ages from 11,000 B.P to Recent. Origin is considered by the author to be related to cold-climate periglacial conditions.

Delaware Bay Group (undifferentiated) (upper Pleistocene)
Grayish brown silt overlying a fine to medium silty quartz sand; lithologies from organic-rich silty clay and peat to sandy gravel common. Consists of Pleistocene alluvial, swamp, marsh, and estuarine deposits along Brandywine Creek, Christina River, White Clay Creek, Red Clay Creek, and Delaware Bay. Combination of the Lynch Heights and Scotts Corners Formations (Ramsey, 1997) where they cannot be differentiated in urbanized areas in vicinity of Wilmington. Overall thickness rarely exceeds 20 ft.

Scotts Corners Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light-yellowish-brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose with some feldspar and muscovite. Commonly capped by one to two ft of silt to fine sandy silt. Laminae of opaque heavy minerals common. Unit underlies a terrace parallel to the present Delaware River that has elevations less than 25 ft. Interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during deposition was temperate to warm temperate as interpreted from fossil pollen (Ramsey, 1997). Overall thickness rarely exceeds 15 ft.

Lynch Heights Formation (upper Pleistocene)
Heterogeneous unit of light-gray to brown to light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. Upper part of unit commonly consists of fine, well-sorted sand. Small-scale cross-bedding within sands is common. Some interbedded clayey silts and silty sands are burrowed. Beds of shell rarely encountered. Sands are quartzose, slightly feldspathic, and typically micaceous where very fine to fine grained. Unit underlies a terrace parallel to present Delaware River that has elevations between 50 and 30 ft. Interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits (Ramsey, 1997). Overall thickness rarely exceeds 20 ft at.

Columbia Formation (middle Pleistocene)
Yellowish- to reddish-brown, fine to coarse, feldspathic quartz sand with varying amounts of gravel. Typically cross-bedded with cross-sets ranging from a few inches to over three ft in thickness. Scattered beds of tan to reddish-gray clayey silt common. In places, the upper 5 to 25 ft a grayish- to reddish-brown silt to very fine sand overlying medium to coarse sand. Near base of unit, clasts of cobble to small boulder size found in gravel bed ranging from a few inches to three ft thick. Gravel fraction consists primarily of quartz with lesser amounts of chert. Clasts of sandstone, siltstone, and shale from the Valley and Ridge Province, and pegmatite, micaceous schist, and amphibolite from the Piedmont are present. The Columbia fills an eroded surface and ranges from less than 10 ft thick to over 100 ft. Primarily a body of glacial outwash sediment (Jordan, 1964; Ramsey, 1997). Pollen indicate deposition in a cold climate during middle Pleistocene (Groot and Jordan, 1999).

Old College Formation (middle Pleistocene)
Reddish-brown to brown clayey silt, silty sand to sandy silt, and medium to coarse quartz sand with pebbles (Ramsey, 2005). Rock fragments of mica or sillimanite quartzose schist are common sand fraction. At land surface, a gray to grayish-brown clayey silt is present. Sands are cross-bedded with laminae of muscovite or heavy minerals defining the cross-sets. Silty beds tend to be structureless, or in the gray clayey silt beds, heavily bioturbated by roots. No fossils other than pollen have been recovered. Pollen indicate a cold climate during deposition of the upper clayey silt unit (unpublished DGS data). Stratigraphic relationships indicate either slightly younger than or contemporaneous with the Columbia Formation. Ranges from 5 to 40 ft in thickness.

Bridgeton Formation (Miocene)
Reddish-brown to brown, medium to very coarse, poorly sorted sand to silty quartz sand containing scattered gravel beds. Less than 15 ft thick and underlies a relict terrace flat that has elevations between 170 ft and 180 ft and parallels the present Delaware River. More extensive to the north in Pennsylvania (Owens, 1999; Berg et al., 1980).

Bryn Mawr Formation (Miocene)
Reddish-brown to yellowish-brown silty quartz sand to sandy silt that interfingers with medium to coarse clayey sand with gravel. Sand fraction, where a sandy silt, is fine- to very fine-grained and angular to subangular. Iron-cemented zones are common. Gravel fraction is primarily quartz. Sands are quartzose with minor amounts of weathered feldspar. Opaque heavy minerals form up to 3 percent of the sand fraction. Unit ranges up to 70 ft thick but generally less than 30 ft thick and commonly less than 10 ft thick. Surface forms a distinctive terrace that has elevations between 350 ft and 425 ft, and it overlies saprolite of the Piedmont rocks. No macrofossils have been recovered. Fossil pollen from the York Pit in Cecil County, Maryland (Pazzaglia, 1993; unpublished DGS data) indicate a Miocene age. Owens (1999) considered the unit late Oligocene in Pennsylvania.

Vincentown Formation (Paleocene)
Glauconitic sand that ranges from slightly silty to moderately silty and slightly to moderately clayey. Dominant constituent is subrounded to subangular clear quartz sand that ranges from medium to fine grained. Fine-grained glauconite is a secondary constituent, which ranges from 5 percent in the clayey zones to 15 percent where cleaner. Towards bottom of unit, glauconite percentages increase to about 50 percent of the sand fraction. Silty and clayey zones are thin to thick laminae ranging from 0.01 to 0.5 ft thick. Olive gray to dark-yellowish-brown in zones where iron cement is present. Interpreted to be marine in origin. Rarely occurs in outcrop and is covered by colluvium along the stream valley bluffs where shown on the map. Ranges from 50 to 100 ft in thickness in the subsurface and less than 50 ft thick where it is cut by younger deposits updip.

COASTAL PLAIN (cont.)

Hornerstown Formation (Upper Cretaceous and Paleocene)
Glauconite sand that is silty and slightly to moderately clayey and contains scattered shell beds. Glauconite approximately 90 percent to 95 percent of the sand fraction and quartz 5 percent to 10 percent. Near the top of unit, silt-filled burrows are present. Lower, the unit is commonly laminated with silty sand and moderately clayey sand. Silt and clay matrix is calcareous. Uniformly a dark-greenish-gray. Interpreted to be marine in origin. The Cretaceous-Tertiary boundary is considered to lie within the formation. Rarely occurs in outcrop and where shown on the map is covered by colluvium along the stream valley bluffs. Ranges between 10 and 50 feet in thickness.

Mt. Laurel Formation (Upper Cretaceous)
Slightly calcareous, glauconitic, quartz sand that is medium to fine grained. Contains about 3 to 5 percent glauconite. Sand is subrounded to subangular and slightly silty with a few moderately silty zones. Scattered belemnites are present as well as a few scattered shell fragments or thin shell beds. Uniform dark olive gray or yellowish-brown where weathered. In outcrop, reported to be extensively burrowed (Owens, et al., 1970). Where it is the surficial deposit south of the Chesapeake and Delaware Canal, the Mt. Laurel can be confused with the Columbia Formation, especially where the color is similar. Can be differentiated by ubiquitous presence of glauconite and generally better sorted sands of the Mt. Laurel. Marine in origin. Ranges from 30 to 100 ft in thickness.

Potomac Formation (Cretaceous)
Dark-red, gray, pink, and white silty clay to clayey silt and very fine to medium sand beds. Beds of gray clayey silt to very fine sand that contain pieces of charcoal and lignite are common. Deposited in a fluvial setting in a tropical to subtropical environment as indicated by abundant paleosol horizons. Ranges from 20 ft updip to over 1600 ft thick in southern New Castle County.

CROSS-SECTION UNITS (not shown on map)

Quaternary (undifferentiated) *shown on cross-section C-C' only*
Includes the Quaternary surficial units of the Columbia Formation, Lynch Heights Formation, and Scotts Corners Formation. Primarily Sand.

Calvert Formation (Miocene) *subsurface only*
Gray to gray/ish-brown clayey silt to silty clay interbedded with gray to light-gray silty to fine to coarse quartz sands. Discontinuous beds of shell are common in the sands and in the clayey silts. The unit ranges up to 100 ft in thickness.

Shark River Formation (Eocene) *subsurface only*
Glauconite clayey silt and clay, with some glauconite sand and fine glauconitic quartz sand. Deposited in the middle Eocene (Benson and Spoljaric, 1996), and is generally 60 to 70 ft thick. Based on the microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Manasquan Formation (Paleocene to Eocene) *subsurface only*
Consists of 30 ft of silty, shelly, fine sands that are commonly glauconitic (Benson and Spoljaric, 1996). Deposited during the latest Paleocene to early Eocene (Benson and Spoljaric, 1996). Based on microfossils (unpublished DGS file data), it can be characterized as an open shelf deposit.

Navesink Formation (Upper Cretaceous) *subsurface only*
Generally a calcareous silt that is slightly to moderately sandy and slightly to moderately clayey. Sand is fine to very fine grained composed of about 50 percent glauconite, 40 percent peloids, and 10 percent quartz. Sediment is laminated, marked by varying amounts of clay and sand. Peloids are yellow to yellowish-brown flat to ovoid pellets that are calcareous and may contain flakes of chitin and grains of glauconite or quartz. Scattered shell fragments are present but form a minor constituent of the sediment. Uniformly dark-greenish-gray, slightly lighter in color than the overlying Hornerstown Formation. 10 to 20 ft thick.

Marshalltown Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Greenish-gray, slightly silty, fine-grained glauconitic quartz sand. Glauconite comprises 30 to 40 percent of the sand fraction. Ranges from 10 to 50 ft in thickness. Extensively burrowed. Interpreted to be marine in origin.

Englishtown Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only at the Chesapeake and Delaware Canal*
Light-gray to white, micaceous, slightly silty to silty, fine-grained, slightly glauconitic quartz sand. In outcrop, it is extensively burrowed with Ophiomorpha burrows. Ranges from 20 to 50 ft in thickness. On the cross-section, the Englishtown is shown only where the sands are well developed. Interpreted to be nearshore marine to tidal flat in origin.

Merchantville Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Light- to dark-gray, very micaceous, glauconitic, very silty fine- to very fine-grained sand to fine sandy silt. Ranges from 20 to 120 ft in thickness. Marine in origin.

Magothy Formation (Upper Cretaceous) *mainly in subsurface; in outcrop only in areas too small to be represented on the map and at the Chesapeake and Delaware Canal*
Dark-gray to gray silty clay to clayey silt that contains abundant fragments of lignite; grades downward into a very fine to fine sand with scattered and discontinuous thin beds of clayey silt with lignite fragments. Thickness ranges from 20 to 50 ft. Updip in the vicinity of the Chesapeake and Delaware Canal, the Magothy fills channels incised into the Potomac Formation and is discontinuous in its extent. Interpreted to have been deposited in coastal to nearshore environments.

DISCUSSION

This map shows the surficial geology of New Castle County, Delaware, at a scale of 1:100,000. Maps at this scale are useful for viewing general geologic framework on a county-wide basis, determining the geology of watersheds, and recognizing the relationship of geology to regional or county-wide environmental or land-use issues. This map, when combined with subsurface geologic information, provides a basis for locating water supplies, mapping ground-water recharge areas, and protecting ground and surface water. Geologic maps are also used to identify geologic hazards such as sinkholes and flood prone areas, to identify sand and gravel resources, and for supporting state, county, and local land-use and planning decisions.

The map was compiled from topographic and geologic maps, aerial photographs, geologists' and drillers' logs, geophysical logs, soils maps, and sample descriptions. Samples from drill holes and outcrops were examined for comparison with previous descriptions. Other than the Old College (Ramsey, 2005) and Bridgeton Formations (Owens, 1999; Owens et al., 1970), all geologic units were previously mapped or described in Delaware. Descriptions of geologic units, unless otherwise referenced, were generated by the author after examination of cores, outcrops, and samples from the DGS Core and Sample Repository.

New Castle County encompasses two geologic provinces; the Piedmont, composed of structurally complex bodies of metamorphic and igneous rocks, and the Coastal Plain, composed of seaward-dipping strata of sand, silt, and clay. The boundary between the two provinces is known as the Fall Zone, which, in Delaware, extends from north of Newark to north of the Christina River in Wilmington.

The Piedmont portion of the map not overlapped by Coastal Plain sediments was taken from the previously published map of Schenck, et al. (2000). Some geologic units of limited areal extent and all symbology related to structural geology shown on the Piedmont map do not appear on this map.

The Coastal Plain portion of the map shows the distribution of surficial units that range from the Cretaceous Potomac Formation to modern alluvial deposits in stream valleys. Also shown are large areas of fill where marsh or stream valleys have been covered and where dredge spoil has been placed on uplands along the Chesapeake and Delaware Canal. Coastal Plain deposits along the margins of the Delaware River, such as the Scotts Corners and Lynch Heights Formations, were traced from southern Delaware where they had been previously recognized (Ramsey, 1997). The Delaware Bay Group (undifferentiated) comprises both the Lynch Heights and Scotts Corners Formations where more detailed work is needed to differentiate the two formations in the vicinity of Wilmington.

DISCUSSION (cont.)

The area of the Bryn Mawr Formation on this map is more extensive than that of Woodruff and Thompson (1975). The Bridgeton Formation, of limited extent in Delaware, was traced from Pennsylvania where it had been previously recognized (Owens, 1999; Owens et al., 1970). The Old College Formation (Ramsey, 2005) comprises a significant part of the updip limit of the Coastal Plain along the Fall Zone.

South of the Chesapeake and Delaware Canal, the Cretaceous Mt. Laurel Formation crops out in several broad stream valleys. Other Cretaceous units occur along the Chesapeake and Delaware Canal and in stream valleys both south and north of the canal, but are of limited extent and cannot be depicted on a map of this scale. The Vincentown and Hornerstown Formations are shown where they crop out along tributaries to the Delaware River. These deposits are commonly covered by colluvium but are nevertheless significant enough in extent to be included on the map.

The Columbia Formation, in the southernmost portion of New Castle County, is commonly overlain by scattered, small basins or depressions that have no organized drainage network (undrained). These undrained depressions are commonly filled with water for much of the year and contain organic-rich deposits. Because many of the individual basins are too small to be shown, a dotted pattern on the Columbia Formation indicates the overall distribution of the basins. Basins large enough to be shown on the map appear as swamp (Qsw).

DISCUSSION OF CROSS SECTIONS

A series of four cross sections has been constructed to illustrate the relationship between Piedmont and Coastal Plain units (A-A' and B-B') and the stratigraphic correlations among the Coastal Plain units (C-C' and D-D') in New Castle County. Vertical scale on all cross sections is in feet. Datum on all cross sections is sea level.

Cross Section A-A' is a schematic drawing showing Teritary and Quaternary fluvial terraces inset into the Piedmont adjacent to the Delaware River. These terraces were created as the Delaware River progressively incised the rocks of the Piedmont over millions of years.

Cross Section B-B' is a schematic drawing showing the relationship of Quaternary surficial deposits in the Newark area. The Old College Formation (Qoc) represents alluvial fan deposits that spread out from the Piedmont onto the Coastal Plain during the Pleistocene and has subsequently been incised by the White Clay Creek (Ramsey, 2005).

Cross section C-C' shows the Cretaceous Potomac stratigraphy to basement along a northwest to southeast trending line. This cross section was developed by R. N. Benson as part of an on-going project to understand the aquifers of the Potomac Formation. The framework for this cross section is based on a geophysical well-log correlation datum that approximates the boundary between the Upper and Lower Cretaceous sediments. The boundary is defined by studies of fossil pollen and spores in samples of sediment cores from two wells near Delaware City and a well near New Castle (McKenna, T. E., et al., 2004). Post-Potomac stratigraphic framework is from Benson and Spoljaric (1996). In this cross section, sedimentary sequences onlap basement in a landward direction. The top of the Potomac Formation is truncated by an erosional unconformity. In updip areas, undifferentiated Quaternary deposits (Qus) overlie the Potomac. Downdip, either the Magothy Formation or the Merchantville Formation overlies the Potomac. Borehole depths are in feet. With the exception of Du55-06, geophysical logs shown are gamma logs; Du55-06 is a spontaneous potential log. Basement identified by boreholes is crosshatched; otherwise, it is inferred and depth is estimated.

Cross Section D-D' is a schematic drawing showing the relationship of the Columbia, Lynch Heights, and Scotts Corners Formations in New Castle County. These units, exclusive of the Old College Formation, form the majority of the surficial geologic units of the Coastal Plain. The Columbia Formation is a widespread fluvial sand deposit that was the result of deposition by glacial melt water. The Lynch Heights and Scotts Corners Formations represent deposition in an estuarine environment during high stands of sea level during the late Pleistocene; the highstand for the Scotts Corners being lower than that of the Lynch Heights.

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