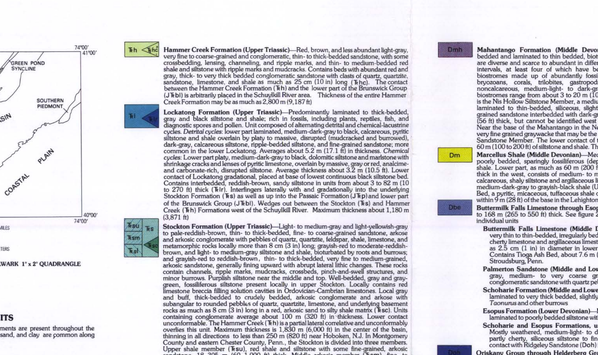


STRUCTURAL AND PHYSIOGRAPHIC REGIONS OF THE NEWARK 1° x 2° QUADRANGLE

## COASTAL PLAIN

The Coastal Plain is a gently seaward-dipping surface on poorly consolidated sediments of Tertiary and Cretaceous age. These rocks form a southeastward-thickening wedge with gently-filled prism of strata which exceeds 915 m (2,480 ft) in thickness along Atlantic seacoast. The Coastal Plain is bounded on its inland surface where they unconformably overlap the Southern Piedmont and Newark Basin. Whereas the oldest Coastal Plain sediments are marine, the overlying younger units are mostly nonmarine, consisting of:

**DESCRIPTION OF MAP UNITS**

Note: A variety of Holocene alluvial deposits and Pleistocene glacial sediments are present throughout the quadrangle, and Pleistocene and Tertiary terrace deposits of gravel, sand, and clay are common along the area of the Fall Line. None of the units shown are shown on the map.


**Tch** — **Cohansey Sand (Pliocene (?) and Miocene)**—Well-sorted, crossbedded, medium-grained, partly arkosic quartz sand; some dark, massive, carbonaceous, kaolinitic, and illitic silty clay; crossbedded gravel in channels; weathers to yellowish-orange to orange soil; prefix of metamorphic rock fragments which are less than 5 cm (2 in) in diameter. As much as 46 m (150 ft) thick, thinning toward the Fall Line

**Tkc** — **Kirkwood Formation (Miocene)**—Moderately well sorted, fine-grained, micaceous quartz sand, locally glauconitic with local thin beds of dark, lignitic silty clay. Lower contact unconformable. 30–76 m (100–250 ft) thick

**Tmsg** — **Manasquan Formation (Eocene)**—Thick-bedded to massive, silty and clayey glauconitic and quartose sand; interbedded silty clay and clayey silt. Apatite pellets and siderite fragments locally abundant. 15–61 m (50–175 ft) thick

**Tvt** — **Vincentown Formation (Paleocene)**—Partly clayey, glauconitic quartz sand. 15–30 m (50–100 ft) thick

**Tht** — **Hornerstown Sand (Paleocene)**—Massive, poorly sorted, fine- to medium-grained, locally very dark glauconitic quartz sand with some phosphatic pellets, coprolites, and bone fragments. Lower contact unconformable. About 6 m (20 ft) thick

**Krb** — **Red Bank Sand (Upper Cretaceous)**—Very fine to coarse-grained, fairly indurated, quartzose, feldspar, and glauconite sand and fossiliferous sandy silt. As much as 37 m (120 ft) thick

**Kmn** — **Navesink Formation (Upper Cretaceous)**—Dark-gray, thick-bedded, clayey and silty, glauconite sand, with organic matter, pyrite, and local thick shell beds. As much as 43 m (145 ft) thick

**Kml** — **Mount Laurel Sand (Upper Cretaceous)**—Medium-grained, poorly to moderately sorted, feldspathic quartz sand. Abundant borings filled with glauconite sand and thin-bedded, dark, micaceous and carbonaceous silt and clay alternating with massive quartz, sandy silt, and colored, micaceous, glauconitic quartz sand with discontinuous layers of gray siltstone concretions. As much as 15 m (50 ft) thick

**Kw** — **Wenonah Formation (Upper Cretaceous)**—Generally dark, thick-bedded, fine- to medium-grained, poorly to moderately sorted, carbonaceous, micaceous, sandy, silty and clayey quartzose glauconite sand. 21–30 m (70–100 ft) thick

**Kmt** — **Marshalltown Formation (Upper Cretaceous)**—Dark, fine-grained, massive, fossiliferous, very silty and clayey, quartzose glauconite sand with common mica, feldspar, pyrite, and carbonaceous matter. 5–6 m (15–20 ft) thick

**Ke** — **Englishtown Formation (Upper Cretaceous)**—Light-colored, well-sorted, fine- to medium-grained, crossbedded, quartzose sand; local thin beds of carbonaceous quartz sand, and interbedded clayey silt and sand with numerous siderite concretions. 6–46 m (20–150 ft) thick

**Kwb** — **Woodbury Clay (Upper Cretaceous)**—Dark-gray, massive to crudely laminated, carbonaceous, jointed, partly glauconitic and micaceous silty clay (commonly illitic) 18 m (60 ft) thick

**Kmw** — **Merchantville Formation (Upper Cretaceous)**—Dark, clayey, micaceous, quartzose, carbonaceous silt with interbedded gravel containing reworked siderite concretions; thick-bedded glauconitic sand. 7.5–20 m (25–70 ft) thick

**Kmg** — **Magothy Formation (Upper Cretaceous)**—Dark, micaceous, pyritic, kaolinitic, clayey silt and light-colored quartz sand with large lignitized logs. Lower contact is unconformable and is marked by lignitized deposits and precise location is poorly known on Staten Island and in Brooklyn. 21–37 m (70–120 ft) thick

**Kr** — **Raritan Formation (Upper Cretaceous)**—Massive, crossbedded quartz sand, thick-bedded clayey silt, laminated clay and silt, and some gravel. About 61 m (200 ft) thick

**Kpt** — **Potomac Formation (Upper Cretaceous)**—Moderately well sorted, crossbedded, quartzose, medium- and coarse-grained quartz sand; pebbles as much as 13 cm (5 in) long; and black, red, white, and yellow, massive, kaolinitic and illitic, cracked, jointed, lenticular clay. 76–244 m (250–800 ft) thick. Lower contact is unknown

**All Coastal Plain sediments (Tertiary and Cretaceous)**—Shown in cross section only. Includes units Tbd and Kbd


## NEWARK AND GETTYSBURG BASINS

The Newark basin, and west of the Schuylkill River, the Gettysburg basin, form a rolling lowland underlain by a thick succession of sedimentary rocks and basalt flows of Early Jurassic and Late Triassic age. Jurassic diabase dikes, sills, and stocks cut and metamorphosed older rocks in the basin. The rocks generally dip gently toward the north toward a large fault zone that forms the basin boundary, although many minor faults and local folds complicate the structure. The rocks are cut by numerous diabase dikes that weed-shaped wedge with exposure widths of 30 m (100 ft) or less to more than 150 m (500 ft). Some are, not all of the units are preserved in one area. Several generations of folds may affect the rocks of the basin, but do not appear to affect the oldest rocks of the Stockton Formation. The basin may have formed as a pull-apart structure with significant strike-slip movement along the larger faults. This could account for local horsts and grabens within the basin, possible abrupt lateral changes of different parts of the basin, the compressional regime that produced the folds and local thrust faults, as well as decoupling of the folds within the basin from structures outside the basin. Some of the geologic features now present may represent reactivated segments of Paleozoic thrust faults, but with the opposite sense of movement. Limestone conglomerate (Ŧrl), quartzite conglomerate, and conchoidal fracturing are common to the parts Jurassic in age. Figure 1 shows stratigraphic and intrusive relationships.


**Jd** — **Diabase (Lower Jurassic)**—Dikes, sills, and sill-like intrusives. Dark-gray to black, fine- to coarse-grained, massive diabase; weathers to brown to reddish-brown. Diabase composed largely of calcic plagioclase and augite. Some of the dikes are several miles long and as much as 0.8 km (0.5 mi) wide; some may have been intruded along faults. Generally deeply weathered. Larger bodies, as much as 520 m (1,700 ft) thick, interpreted as sills or discordant sheets with oval or ringlike outcrop patterns. Shales and siltstones surrounding these bodies have been thermally metamorphosed to a purplish-red, light-gray, and dark-gray, textured, brittle, and fine-grained hornfels with quartz, plagioclase, sericite, biotite, cordierite, epidote, chlorite, magnetite, hornblende, pyroxene, tourmaline, staurolite, andalusite, and sandite in a zone averaging about 150 m (2,000 ft) wide. The width of this zone depends on the thickness of the intrusive, its topographic expression, and its inclination

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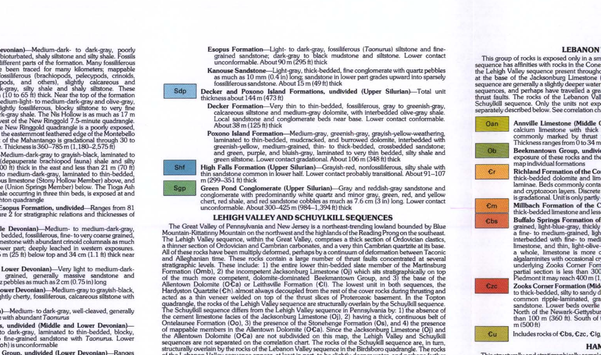



**Ŧh** — **Hammer Creek Formation (Upper Triassic)**—Red, brown, and less abundant light-gray, very fine to coarse-grained and conglomeratic, thin- to thick-bedded sandstone, with some crossbedding, laminations, channeling, and ripple marks, and thin- to medium-bedded red shale and siltstone with ripple marks and mudcracks. Contains beds with abundant red and gray, thick- to very thick bedded conglomeratic sandstone with clasts of quartz, quartzite, sandstone, limestone, and shale as much as 25 cm (10 in) long (Ŧ3ŧc). The contact between the Hammer Creek Formation (Ŧh) and the lower part of the Brunswick Group (Ŧ1ŧb) is arbitrarily placed in the Schuylkill River area. Thickness of the entire Hammer Creek Formation may be as much as 1,600 m (5,000 ft)

**Ŧl** — **Lockatong Formation (Upper Triassic)**—Predominantly laminated to thick-bedded, gray and black argillite, silty argillite, and fine-grained sandstone; local thin beds of tuff and diagnostic spores and pollen. Unit composed of alternating detrital and chemical-lacustrine cycles. Detrital phase lower part of medium- medium-dark-gray to black, calcareous, pyritic siltstone and shale overlain by platy to massive, disrupted (mudcracked and burrowed), dark-gray, calcareous argillite and siltstone. Chemical phase consists of laminated argillite, commonly in the lower Lockatong. Averages about 5.2 m (17.1 ft) in thickness. Chemical cycles: Lower part black, laminated argillite, locally crosscutting, calcareous siltstone and siltstone with stringer cracks and lenses of pyritic limestone, overlain by massive, gray or red, argillite and carbonate rock. Upper part of chemical cycle is dark-gray argillite. About 21 m (70 ft) thick. Lower contact of Lockatong gradational. Upper contact of lower Lockatong is at top of last black, laminated argillite. Lockatong is traced into Stockton in units from about 6 to 12 km (4 to 7 mi) southwest of the Delaware River. Lockatong is equivalent to the upper part of the Stockton Formation (Ŧs) as well as up into the Passaic Formation (Ŧ1ŧp) and lower part of the Brunswick Group (Ŧ1ŧb). Weight-over between the Stockton (Ŧs) and Hammer Creek (Ŧh) Formations west of the Schuylkill River. Maximum thickness about 1,180 m (3,871 ft)

**Ŧs** — **Stockton Formation (Upper Triassic)**—Light- to medium-gray and light-yellowish-gray to pale reddish-brown, thin- to thick-bedded, fine- to coarse-grained sandstone, arkose, and arkosic conglomerate with pebbles of quartz, quartzite, feldspar, shale, limestone, and cherty limestone and dolomite; locally more than 25 cm (10 in) long. Sandstone weathers reddish-brown, and light- to medium-gray siltstone and shale, bioturbated by roots and burrows; and grayish-red, thin-bedded, fine-grained, micaceous, feldspathic, calcareous, arkosic sandstone, generally fining upward with abrupt lateral lithic changes. These rocks contain channels, channel fills, crossbeds, mudcracks, ripple-marks, and small-scale slumping, and minor burrows. Purplish siltstone near the middle and top. Well-bedded, gray and gray-green, fossiliferous limestone in upper Stockton. Locally contains crystal-rich limestone breccia filling solution cavities in Ordovician-Cambrian limestones. Local gray and buff, thick-bedded to massive, fine- to medium-grained sandstone and arkose with subangular to rounded pebbles of quartz, quartzite, limestone, and underlying basement rocks as much as 8 cm (3 in) long in a sandy matrix. Rock is light-gray to light-brown, cherty limestone. Thickness on average about 1,220 m (4,000 ft) in thickness. Lower contact conformable with Passaic Formation (Ŧ1ŧp). Stockton is traced into Hammer Creek (Ŧh) Formation in the Schuylkill River area. Maximum thickness about 1,180 m (3,871 ft)

**Ŧ1ŧb** — **Buttermilk Falls Limestone (Middle Devonian)**—Medium- to medium-dark-gray, very thin to thin-bedded, irregularly bedded, fossiliferous, fine- to very coarse grained, cherty limestone and dolomite; local crossbedded, pebbly limestone conglomerate; weathers yellowish-brown, and light- to medium-gray siltstone and shale, bioturbated by roots and burrows; and grayish-red, thin-bedded, fine-grained, micaceous, feldspathic, calcareous, arkosic sandstone, generally fining upward with abrupt lateral lithic changes. These rocks contain channels, channel fills, crossbeds, mudcracks, ripple-marks, and small-scale slumping, and minor burrows. Purplish siltstone near the middle and top. Well-bedded, gray and gray-green, fossiliferous limestone in upper Stockton. Locally contains crystal-rich limestone breccia filling solution cavities in Ordovician-Cambrian limestones. Local gray and buff, thick-bedded to massive, fine- to medium-grained sandstone and arkose with subangular to rounded pebbles of quartz, quartzite, limestone, and underlying basement rocks as much as 8 cm (3 in) long in a sandy matrix. Rock is light-gray to light-brown, cherty limestone. Thickness on average about 1,220 m (4,000 ft) in thickness. Lower contact conformable with Passaic Formation (Ŧ1ŧp). Stockton is traced into Hammer Creek (Ŧh) Formation in the Schuylkill River. Maximum thickness about 1,180 m (3,871 ft)

**Ŧ1ŧp** — **Passaic Formation of Olsen (1980a) of the Brunswick Group in New Jersey and lower part of the Brunswick Group in Pennsylvania (Lower Jurassic and Upper Triassic)**—Predominantly grayish-red to reddish-brown, evenly to irregularly bedded, thin- to thick-bedded shale, siltstone, very fine to coarse-grained sandstone, and red-matrix conglomerate. Generally becomes coarser in the northeastern half of the basin in New Jersey. Mudcracks, ripple marks, crossbeds, and burrows common. Contains dental cycles of medium- to dark-gray and olive- to greenish-gray, thin-bedded and laminated argillite, silty argillite, and shale. Lower contact is at top of last black argillite. Lockatong (Ŧ1ŧl). Many cycles are known near New Brunswick and northeast of Lambertville, N. J., but are not shown on the map (Olsen, unpub. data, 1983). Greenish and brownish, fine- to coarse-grained, arkosic sandstone grades in places to quartzite (ŧconglomerate ŧ1ŧcq), and contains some interbedded red beds and impure limestone or calcareous shale. Locally contains dinosaur footprints. Individual cycles as much as 76 m (250 ft) thick; some cycles are too thin to show on this map. Lower contact with the Lockatong Formation (Ŧ1ŧl) gradational through about 500 m (1,640 ft) and is mapped where thickness of red beds is dominant over thickness of gray and black beds. Interfingers laterally with the Lockatong (Ŧ1ŧl) and Hammer Creek (Ŧh) Formations. Where the unit grades laterally into the Lockatong, lower contact is either conformable and gradational to older rocks of the Newark Supergroup, or is unconformable on basement rocks. Contains reptiles, arthropods, pelecypods, plant impressions, spores, and pollen. The Passaic Formation is as much as 4,600 m (15,000 ft) in thickness in the Newark basin. The maximum thickness may exceed 6,000 m (19,685 ft) in the western part of the basin and is about 2,670 m (8,760 ft) in the northeastern part

**Ŧ1ŧcq** — **Quartzite conglomerate (Upper Triassic)**—Rounded pebbles, cobbles, and boulders, as much as 30 cm (1 ft) long, of white, light-gray, and reddish quartzite, and lesser calcareous sandstone in a matrix of fine- to medium-grained, reddish-brown, arkosic sandstone. Stratigraphic position is within the Passaic Formation (Ŧ1ŧp) and is equivalent to part of the Tuscarora Sandstone of the Appalachian Basin. Thickness ranges from 1,000–2,100 m (3,280–6,900 ft)

**Ŧ1ŧl** — **Lockatong Formation (Upper Triassic)**—Gray and black, laminated to thin-bedded, fossiliferous limestone and calcareous shale

**Ŧs** — **New Scotland Formation of the Helderberg Group**—Medium- dark- to dark-gray, thin-bedded, fossiliferous, argillaceous limestone. Lower contact is at top of last black shale of the Bossardville Limestone. Thickness about 30 m (100 ft)

**Ŧb** — **Bossardville Limestone of the Helderberg Group**—Medium- dark- to dark-gray, thin-bedded, fossiliferous limestone. Lower contact is at top of last black shale of the Coeymans Formation or upper part of the Becker Formation

**Ŧc** — **Coeymans Formation of the Helderberg Group**—Medium- to dark-gray, very fine to fine-grained, laminated to thin-bedded, wavy-bedded, graded, fossiliferous (mainly crinoidal) limestone; local crossbedded, pebbly limestone conglomerate with quartz and argillite pebbles as much as 5 cm (2 in) long, and minor beds of dark-gray shale. Lower contact is at top of last black shale of the Becker Formation. Thickness about 30 m (100 ft)

**Ŧb** — **Becker Formation**—Medium- to dark-gray, calcareous, fine- to coarse-grained, thin-bedded, crossbedded, fossiliferous limestone; local pebbly limestone conglomerate. Lower contact is at top of last black shale of the Manlius Formation. Thickness about 30 m (100 ft)

**Ŧ1ŧcl** — **Buttermilk Falls Limestone through Esopus Formation, undivided**—Ranges from 81 to 168 m (265 to 550 ft) thick. See figure 2 for stratigraphic relations and thicknesses of individual units

**Ŧ1ŧbf** — **Buttermilk Falls Limestone (Middle Devonian)**—Medium- to medium-dark-gray, very thin to thin-bedded, irregularly bedded, fossiliferous, fine- to very coarse grained, cherty limestone and dolomite; local crossbedded, pebbly limestone conglomerate with quartz pebbles as much as 2.5 cm (1 in) in diameter in lower part; deeply leached in western exposures. Contains beds of black shale as much as 0.3 m (1 ft) thick. Lower contact is at top of last black shale of the Stony Hill Member. Thickness about 30 m (100 ft)

**Ŧ1ŧcs** — **Coeymans Sandstone (Middle and Lower Devonian)**—Very light to medium-dark-gray, medium- to very coarse grained, generally massive sandstone and conglomerate; local crossbedded, pebbly limestone. Lower contact is at top of last black shale of the Kalkberg Member. Thickness about 30 m (100 ft)

**Ŧ1ŧsh** — **Scholarie Formation (Middle and Lower Devonian)**—Medium-gray to greenish-black, laminated to very thin-bedded argillite and shale; local thin beds of limestone and dolomite. Tuscarora and other barrens

**Ŧ1ŧcs** — **Esopus Formation (Lower Devonian)**—Medium- to dark-gray, well-cleaved, generally laminated to poorly bedded siltstone with abundant Tuscarora

**Scharbarie and Esopus Formations (Middle and Lower Devonian)**—Mostly weathered, medium-light- to dark-gray, laminated to thin-bedded, blocky, argillaceous siltstone and shale. Lower contact with Tuscarora Sandstone is unconformable

**Oriskany Formation (Middle Devonian)**—Medium-light- to medium-dark-gray, medium- to very coarse grained, generally massive sandstone and conglomerate; local crossbedded, pebbly limestone. Lower contact is at top of last black shale of the Esopus Formation. Thickness ranges from 0–100 m (0–300 ft)

**Ŧ1ŧbd** — **Bossardville Sandstone of the Oriskany Group**—Light- to medium-gray, fine- to very coarse grained, crossbedded, pebbly sandstone and conglomerate; local thin beds of limestone. Lower contact is at top of last black shale of the Esopus Formation. Thickness ranges from 0–100 m (0–300 ft)

**Ŧ1ŧcl** — **Limestone conglomerate (Upper Triassic)**—Subangular, medium- to dark-medium-gray limestone and dolomite clasts as much as 30 cm (1 ft) long in a matrix of reddish-brown Cambrian limestone in the immediate area) and rare gneiss pebbles and cobbles in a matrix of medium-gray, calcareous, arkosic sandstone. Generally bleached and leached southward

**Ŧ1ŧcq** — **Quartzite conglomerate (Upper Triassic)**—Rounded pebbles, cobbles, and boulders, as much as 30 cm (1 ft) long, of white, light-gray, and reddish quartzite, and lesser calcareous sandstone in a matrix of fine- to medium-grained, reddish-brown, arkosic sandstone. Stratigraphic position is within the Passaic Formation (Ŧ1ŧp) and is equivalent to part of the Tuscarora Sandstone of the Appalachian Basin. Thickness ranges from 1,000–2,100 m (3,280–6,900 ft)

**Ŧ1ŧcl** — **Lockatong Formation (Upper Triassic)**—Gray and black, laminated to thin-bedded, fossiliferous limestone and calcareous shale

**Ŧ1ŧbd** — **Bossardville Sandstone of the Helderberg Group**—Medium- dark- to dark-gray, thin-bedded, fossiliferous, argillaceous limestone. Lower contact is at top of last black shale of the Bossardville Limestone. Thickness about 30 m (100 ft)

**Ŧ1ŧc** — **Coeymans Formation of the Helderberg Group**—Medium- to dark-gray, fine- to very coarse grained, crossbedded, pebbly limestone conglomerate with quartz and argillite pebbles as much as 5 cm (2 in) long, and minor beds of dark-gray shale. Lower contact is at top of last black shale of the Becker Formation. Thickness about 30 m (100 ft)

**Ŧ1ŧb** — **Becker Formation**—Medium- to dark-gray, calcareous, fine- to coarse-grained, thin-bedded, crossbedded, fossiliferous limestone; local pebbly limestone conglomerate. Lower contact is at top of last black shale of the Manlius Formation. Thickness about 30 m (100 ft)

**Ŧ1ŧcl** — **Buttermilk Falls Limestone through Esopus Formation, undivided (Upper Devonian)**—Generally similar to Dbe and Dcs in lower part of the section but contains more shale and sandstone in upper part. Lower contact is at top of last black shale of the Esopus Formation. Thickness ranges from 81–168 m (265–550 ft) in Pennsylvania and eastward to the Clinton Township area in New Jersey, but is much greater in the Kingwood area, where it is as much as 1,000 m (3,000 ft) thick. Thickness of individual units may be directly related to blind thrusts at depths. Figure 2 shows stratigraphic and facies relations of Devonian units

**Pl** — **Llewellyn Formation (Upper and Middle Pennsylvanian)**—Very light gray to grayish-black, light-brown-weathering, fine- to very coarse grained, massive, very thick- to thick-bedded siltstone and shale with abundant plant debris; evenly bedded to lenticular, partly channeled, graded, thin- to very thick-bedded, fine- to coarse-grained sandstone and conglomerate; evenly bedded to lenticular, partly channeled, graded, crossbedded, and clinoform crossbedded, medium- to very thick-bedded sandstone; and less abundant chert and metamorphic rock fragments as much as three inches in diameter with numerous anthracite coal beds in upper part. Lower contact is at top of last black shale underlying beds of the Buck Mountain (No. 5) coal bed (not identified on the map). 275–625 m (900–2,050 ft) thick

**Pp** — **Pottsville Formation (Middle and Lower Pennsylvanian)**—Light- to dark-gray and olive-gray to yellowish-brown, fine- to very coarse grained, thick- to massive-bedded and crossbedded, tabular to lenticular conglomeratic, fine- to coarse-grained sandstone with quartz and quartzite pebbles as much as 2.5 cm (1 in) in diameter; minor amounts of chert and sedimentary rocks; less abundant shale and siltstone with plant debris; and several beds of anthracite coal. Lower contact is at top of last black shale underlying Mauch Chunk Formation (PMm). 250–450 m (820–1,475 ft) thick

**PMm** — **Mauch Chunk Formation (Upper Pennsylvanian and Upper Mississippian)**—Grayish- to pale-red, light- to dark-gray, and olive-gray, laminated to thick-bedded, plane-bedded and crossbedded, locally lenticular and channeled, fine- to very coarse grained sandstone, some shale and siltstone, and minor conglomerate with quartz and quartzite pebbles more than 6 cm (2 in) long. Numerous beds of red and yellow mottled siltstone and shale. Lower contact is gradational and placed at base of lowest red bed above gray beds of the underlying Pocono rocks (Mp). Abundant fossil plants. 150–400 m (500–1,300 ft) thick

**Mp** — **Pocono Formation (Lower Mississippian)**—Light- to medium-gray, thin- to very thick-bedded, crossbedded, lenticular and channeled, fine- to very coarse grained sandstone and chert and quartzite pebbles as much as 8 cm (3 in) long; structureless and crossbedded, medium-gray and olive-gray, thin-bedded siltstone and shale; minor amounts of coal and shale with abundant plant debris. Lower contact sharp and unconformable. 225–305 m (820–1,000 ft) thick

**Spcg** — **Spechty Kopf Formation (Lower Mississippian and Upper Devonian)**—Light-olive-gray to grayish-yellow-green, thin- to very thick-bedded, fine- to very coarse grained, polymictic conglomerate; quartzite, schist, slate, gneiss, quartz, and siltstone pebbles generally as much as 10 cm (4 in) in diameter; minor amounts of light-olive-gray, thin- to thick-bedded, laminated, light-olive-gray, shaly and pebbly siltstone and shale; white, plane-bedded, rippled, very thin to thick-bedded, well-sorted, medium- to very coarse grained, and medium-gray, poorly bedded, fine- to coarse-grained, conglomeratic sandstone with quartz and chert pebbles as much as 2.5 cm (1 in) in diameter. Lower contact is marked by an unusual unconformity with black shale underlying a red-bed member of the Spechty Kopf Formation. Thickness 183–396 m (600–1,300 ft) thick

**Dcpg** — Porter Gap Member—Popular Gap Member of Berg (1975) is here adopted for use by the U.S. Geological Survey. Medium-gray, light-olive-gray to greenish-gray, fine- to very coarse grained, very thin to very thick bedded, poorly to well sorted, pebbly sandstone and conglomerate; minor amounts of light-olive-gray, thin- to very thick-bedded, fine- to very coarse grained, poorly to well sorted, pebbly sandstone with local thin beds of gray siltstone and shale. Lower contact is placed at base of conformable, gradational, light-olive-gray siltstone and shale of the Duryea Member (Ddd). Thickness ranges from 0–100 m (0–300 ft)

**Ddd** — Catskill Formation (Upper Devonian)

Duncannon Member—Light- to medium-gray, fine- to very coarse grained, partly massive and crossbedded, very thick bedded sandstone with scattered fossils; fade to massive, very thick bedded sandstone with local thin beds of gray siltstone and shale. Thickness 0–100 m (0–300 ft). Lower contact is placed at base of lowest massive, very thick bedded, quartz and quartzite pebble conglomerate. Lower contact is gradational and is placed at base of lowest red bed. Thickness 0–100 m (0–300 ft) thick

**Dcdb** — Duncannon Member—Dark-gray to olive-gray, thin- to very thick-bedded, fine- to very coarse grained, poorly to well sorted, pebbly sandstone with local thin beds of gray siltstone and shale. Lower contact is placed at base of lowest gray siltstone and shale. Thickness 0–100 m (0–300 ft) thick

**Dcdb** — Duncannon Member—Light- to medium-gray, fine- to very coarse grained, very thin to very thick bedded, poorly to well sorted, pebbly sandstone with local thin beds of gray siltstone and shale. Lower contact is placed at base of lowest red bed. Thickness 0–100 m (0–300 ft) thick

**Dcdb** — Duncannon Member—Light- to medium-gray, fine- to very coarse grained, very thin to very thick bedded