Geologic Map of Prince George's County, Maryland

by John D. Glaser, 2003

And Silt- Loam Soils with Hardpan in Upland Deposits from Hack (1977)

Scale 1:62,500

Contour Interval 10 Meters

(State Plane Grid North)

Correlation of Map Units

Qal	Holocene	Quaternary
Qt	Pleistocene	Quaternary
Tu	upper Miocene - Pliocene	Tertiary
Tc	lower and middle Miocene	Tertiary
Tn	lower Eocene	Tertiary
Tm	upper Paleocene	Tertiary
Ta	lower Paleocene	Tertiary
TKbs	Upper Cretaceous	Cretaceous
Kps / Kpc	Lower Cretaceous	Cretaceous
Cla		Cambrian

Qal — **ALLUVIUM** -- Interbedded sand, silt-clay, and subordinate gravel. Light- to dark-gray, tan, or brown; weathers pale-gray, yellow, or brown.

Alluvium includes very heterogeneous, commonly poorly stratified sediments, with muddy sand and silt the dominant lithology. Organic matter, including leaves, branches, and logs, is a common component. Thin peats occur in places. Dark gray organic muds are prevalent in tidal marsh areas. This unit underlies the channels and flanking valley floors of all major streams and many minor ones in the County. Much of this sediment is soft and water-saturated due to perennially high water tables. The composition of the alluvium in any given stream valley reflects the source sediments; thus, alluvial sand contains considerable glauconite where the source is the Aquia, Nanjemoy, or Severn Formations. Small areas of tidal marsh are found bordering the Patuxent and Potomac Rivers. Alluvial sediment thickness ranges from less than 5 feet (1.5 m) to as much as 40 feet (12.2 m), although the average is closer to 15 feet (4.6 m). Sediments mapped under this heading are geologically young, deposited mostly within the past 10,000 years.

Qt — **TERRACE DEPOSITS** -- Interbedded sand, gravel, and silt-clay. Typically tan, brown, or shades of gray; weathers to yellow, orange, or brown hues, commonly limonitic.

Included under Terrace deposits are heterogeneous lithologies such as medium to coarse sand, pebbly sand, and subordinate silt-clay. These sediments are contained in a series of disjunct bodies flanking the major streams in Prince George's County, reaching as high as 160 feet in elevation across some portions of the county, but declining to near sea level along the Patuxent River. A few such deposits are as thick as 50 feet (15.2 m), but the average is much less. Bedding within these deposits is mostly lenticular, but ranges to massive and unstructured. The Terrace deposits are the product of stream erosion during the early Quaternary, and are now isolated on the valley walls above the modern floodplain by renewed downcutting. Major terraces are associated with Western Branch, Piscataway Creek, and Mattawoman Creek, as well as the Patuxent and Potomac Rivers. Deposits flanking the Patuxent River tend to be more laterally extensive than those along the smaller watercourses, averaging 20 to 25 feet (6.1 to 7.6 m) in thickness, and have been utilized as a source of construction sand and gravel in the past.

Tu — **UPLAND DEPOSITS** -- Sand, pebbly sand, and gravel, capped by sandy pebbly loam in places. Pale-gray, tan, or buff in color; weathering to yellow, orange, and shades of brown.

The Upland deposits (or Brandywine Formation of earlier workers) consist largely of poorly sorted, medium to coarse sand interbedded with pebbly sand and medium to coarse gravel. The sand is predominantly quartz, and the pebbles quartzite, sandstone, and chert. The basal beds of the deposit include scattered boulders ranging to several feet in diameter. Bedding is chiefly lenticular, and cross-bedded to massive. Where least dissected, the uppermost portion of the deposit consists of as much as 15 feet (4.6 m) of compact yellowish to reddish-brown pebbly loam. Total thickness of the unit reaches a maximum 40 feet (12.2 m). The Upland deposits are fluvial sediments, presumably laid down by the ancestral Potomac River as it swept southward across southern Maryland in late Miocene and Pliocene time (McCartan, 1989a, 1989b).

Silt loam soils with hardpan in Upland deposits (Hack, 1977) -- Silt-loam surface soils containing thick hardpan as mapped by Hack (1977) within the Upland deposits (Tu) (geologic unit). The hardpan is described as 3 to 4 feet thick (0.9 to 1.2 m) and approximately 2 feet (0.6 m) below the ground surface. Hack indicates that the hardpan is moderately impermeable so "the surface soil is wet in winter months and may be excessively dry in summer."

Tc — **CALVERT FORMATION** -- Sand, quartz silt, and diatomaceous silt. Olive-green to olive-gray where unweathered; pale-gray, tan, brown, yellow or orange in weathered sections.

The Calvert Formation consists largely of variably clayey, very fine- to fine-grained sand and silt, as well as diatomaceous silt, and minor amounts of clay. Near the base of the unit is a bed of diatomaceous silt, as thick as 10 feet (3 m), consisting of as much as 40 percent diatoms. The diatomaceous bed thins and feathers out both northward and westward. The upper part of the unit is relatively homogeneous sand and silty sand with obscure bedding, laced with pervasive burrow-mottling. Much of this upper Calvert has been weathered to loosely textured, yellow to orange sand, which makes up the surface sediment over the southeastern part of the county. Most of the Calvert sediments in the county belong to the lower or Fairhaven Member of the formation. The upper member, the Plum Point Marls, is confined to the southeastern portion (Benedict quadrangle) of the map area, as are intact molluscan fossils. Here, the Calvert also attains its maximum thickness of about 100 feet (30.5 m). The Calvert is a lower to middle Miocene marine unit, with most of the Fairhaven having accumulated in relatively deep water in a restricted basin. The Plum Point Marls unit is an open shelf deposit laid down in shallower waters.

Tn — **NANJEMOY FORMATION** -- Sand, glauconitic, variably clayey; and silt-clay. Glauconitic sand, medium-gray to dark greenish gray, where unweathered; silt-clay, dark-gray to chocolate-brown. Mottled yellow and pale-brown in weathered outcrops.

The Nanjemoy consists mostly of quartz sand, fine- to coarse-grained, with a variable amount of interstitial silt-clay and as much as 50 percent of green glauconite, imparting a "salt and pepper" aspect to the sediments. Darker silt-clay interbeds are common. Bedding generally appears massive with conspicuous burrow-mottling. Fossils, mostly *Venericardia*, are moderately common. Indurated beds and concretionary bodies occur in places. The sand fraction coarsens upward within the unit. Nanjemoy outcrops are largely restricted to the eastern edge of the county adjacent to the Patuxent River where the unit reaches a maximum 60 feet (18.3 m) thick. Poorer outcrops are found in the southwestern part of the county, especially along Piscataway Creek. The unit is a marine shelf deposit of early Eocene age.

Tm — **MARLBORO CLAY** -- Clay, pale-red to silvery-gray, and minor interbedded silt, yellowish gray to pale- gray.

The Marlboro Clay is a thin but highly distinctive unit composed of dense, brittle clay, ranging from thickly-bedded to finely laminated, lenticular or hummocky in part, containing partings and thin lenses of micaceous and lignitic laminated silt. The lowest part of the clay contains thin interbeds of glauconitic sand. Marlboro Clay exposures can be found in the same portions of the county as the Nanjemoy Formation. The Marlboro reaches 20 feet (6.1 m) in thickness in some places.

The contact with the overlying Nanjemoy Formation is typically sharp but highly burrowed. Regionally, burrows infilled with Nanjemoy sediments are reported to extend up to a foot or more into the Marlboro Clay (Glaser, 1971; Gibson et al., 2000; Gibson and Bybell, 1994). In some areas, Marlboro sediments appear to be reworked into the lower part of the overlying Nanjemoy Formation (McCartan, 1989a; Gibson et al., 2000). The lower contact of the Marlboro with the underlying Aquia Formation is sharp in some outcrops (particularly in updip sections) but the transition appears gradational over a vertical distance of several inches to feet in other outcrops and cores (e.g., Glaser, 1971; Gibson et al., 2000). The depositional environment and precise age of this unit have been debated. Based on recent studies focusing on microfossils (foraminifera, calcareous nannoplankton, dinoflagellates) and clay mineralogy, the unit is believed to represent deposition in an inner to middle marine shelf area that received sediments from river drainage systems (e.g., Gibson et al., 2000). Regional microfossil studies indicate that the Marlboro Clay ranges in age from latest Paleocene to earliest Eocene (calcareous nannoplankton upper Zone 9 and lower Zone 10) (e.g., Gibson et al., 2000).

Ta — **AQUIA FORMATION** -- Sand, variably glauconitic, and minor calcareous or ferruginous sandstone. Dark greenish gray to medium-gray; weathering "salt and pepper" speckled to rusty brown.

The Aquia is composed of sand, fine- to medium-grained, poorly sorted to well sorted, containing as much as 40 percent glauconite. Thin layers and concretionary zones of calcareous shelly sandstone are scattered through the unit. Outcrop sections contain "rusty" ferruginous sandstones in places. Bedding is massive for the most part, with burrow mottling common. Molluscan fossils, chiefly large *Turritella* and *Ostrea*, are present in some beds. The Aquia reaches a maximum 150 feet (45.7 m) in thickness in Prince George's County. Aquia sands accumulated on the marginal marine shelf in less than 200 feet (61 m) of water during late Paleocene time.

TKbs — **BRIGHTSEAT-SEVERN FORMATIONS, undivided**

BRIGHTSEAT FORMATION -- Sand and silt, clayey in part, variably glauconitic. Dark-gray to dark greenish gray; weathering pale-gray to brownish gray.

The Brightseat consists of mostly fine-grained, poorly sorted sand, with up to 30 percent glauconite, but generally much less. In places, the basal Brightseat contains some medium to coarse sand with quartz granules, small pebbles, phosphatic clasts, and shark teeth. The unit is essentially a fining-upward sequence, with the relatively coarse lower portion grading rapidly upward to fine-grained clayey sand and finally dense clayey micaceous silt. The abundance of mica is characteristic of the upper Brightseat, as is a decided purplish cast in unweathered sediment. The Brightseat is both thin and lithologically similar to the underlying Severn Formation; thus, the two units are mapped together at this scale. It thickens southwestward across the county, reaching a maximum of about 60 feet (18.3 m) south of the District of Columbia. The Brightseat is a marine shelf unit of early Paleocene age.

SEVERN FORMATION -- Sand, fine-grained, variably glauconitic. Pale-gray to medium-gray; weathering mottled pale-gray and yellow.

The Severn is composed almost entirely of very fine- to fine-grained glauconitic sand, which is moderately to well sorted. The sand grades in places to dense clayey micaceous sand and silt. Glauconite may comprise as much as 40 percent of the sand fraction. The basal few feet of the unit is fine- to medium-grained with scattered granules and pebbles, siderite concretions, and shark teeth. Along the Patuxent River and its tributaries in the vicinity of Bowie, a zone of large lobate or ellipsoidal ferruginous concretions marks the top of the formation. Moreover, outcrops along the Potomac may contain considerable selenite. Like the Brightseat, the Severn Formation is a thin unit, 40 feet (12.2 m) thick at most along the Patuxent, and reducing to about 13 feet (4.0 m) in outcrop at the Potomac River. It is mapped with the Brightseat as a single map unit. The Severn was deposited on the inner marine shelf in Late Cretaceous time.

POTOMAC GROUP (Patapsco, Arundel, Patuxent Formations)

The Potomac Group includes the Patapsco, Arundel and Patuxent Formations. In Prince George's County these units have not been mapped separately at the county scale; instead sediments of the Potomac Group have been mapped according to dominant lithology: sand-gravel facies (Kps) or silt-clay facies (Kpc). Potomac Group strata are Early Cretaceous in age, and record floodplain deposition. A maximum thickness of about 1000 feet (about 305 m) is known in the outcrop belt.

Kps — **Sand-gravel facies:**

Interbedded quartz sand, pebbly sand, gravel, and subordinate silt-clay. Sands and gravels typically white, buff, yellow to brown; weathered zone commonly limonitic with ironstone pods and layers. Silt-clay is white, pale gray, or variegated; dark-gray, where highly organic.

The sand-gravel facies is largely the lower Potomac Group (Patuxent Formation), but the upper portion (Patapsco Formation) also contains considerable sand and some gravel, which is included in this map unit. This coarse facies lies mostly west of Indian Creek in the north and northwestern area of the county. The lithology is essentially fine- to coarse-grained sand, grading to pebbly sand and gravel, coarse to very coarse in places, arranged in thin to very thick lenticular beds. Conspicuous cross-bedding is common, as are clay clasts, channel fills, and fining-upward sequences. Interbedded with these coarser clastics are scattered thin lenticular bodies of tough massive silt-clay. As is typical of fluvial sediments, few beds are laterally continuous for any great distance; consequently, great variability in outcrop lithology is the rule.

Kpc — **Silt-clay facies:**

Clay, silt, and subordinate fine- to medium-grained clayey sand. Red, tan, gray, buff, or mottled; dark-gray, where heavily organic.

The silt-clay facies of the Potomac Group, comprised of the Arundel Clay and much of the lower Patapsco Formation, lies mostly east of Indian Creek. The lithology is predominantly compact red and dark-gray clay containing large and small lenses and pods of sand and minor gravel. Some of the clay is strikingly variegated in color. Dark-gray lignitic clay is most characteristic of the Arundel but occurs at other stratigraphic levels as well. Much of the clay is internally massive and weathers hackly. Silt-clay lenses in the uppermost portion of the unit tend to be whitish or pale-gray, and thinner. Rare dinosaur bones and teeth have been found in Potomac silt-clay, as have plant fossils.

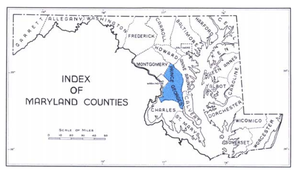
Cla — **LAUREL FORMATION** (Hopson, 1964; Fleming et al., 1995) -- Metasedimentary rock unit, which includes considerable mica gneiss and schist; a metamorphosed sedimentary mélange.

Medium- to coarse-grained, moderately to well foliated sedimentary mélange consisting of a quartzofeldspathic matrix that contains quartz "eyes" and fragments to blocks of metamorphic rocks which specifically include fragments of meta-arenite and biotite schist in the mapped area (Fleming et al., 1995). The rock weathers to a porous, spongy brown saprolite and grades upward to a sticky micaceous red and gray clay (Withington and Froelich, 1974).

Originally thought to be a metamorphosed igneous rock (e.g., gneissic granite, migmatite), the unit is now interpreted as a metamorphosed sedimentary unit that originated as a "chaotic mixture of fragmental rocks and pebbles in an unsorted matrix of sand, silt, and mud" resulting from submarine debris slide and was subsequently metamorphosed (Hopson, 1964).

Some previous workers have considered the Laurel Formation to be the same unit as the Sykesville Formation and mapped the Laurel and Sykesville Formations either as part of the boulder gneiss facies of the Wissahickon Formation (Southwick and Fisher, 1967; Cleaves et al., 1968) or simply as the Sykesville Formation (e.g., Muller et al., 1989). A preliminary geologic map of the Beltsville area (Withington and Froelich, 1974) showed areas that are identified on the current map as Laurel Formation mainly as two facies (diamictite gneiss and pelitic schist) of the Wissahickon Formation. The Laurel Formation nomenclature shown on the current map follows the most recent mapping of the unit by Fleming et al. (1995).

The Laurel Formation is considered Early Cambrian in age by Fleming et al. (1995). However, the precise age of the unit and the timing of episodes of metamorphism (and intrusives) in the region have been debated for decades (e.g., Hopson, 1964; Muller et al., 1989; Drake et al., 1989).



Explanation of Map Symbols

Geologic Symbols
- Contact, approximate, gradational, or inferred
- A — A' Line of Section

Topographic Symbols
- Topographic Contour - Index (20- m interval)
- Topographic Contour - Intermediate (10- m interval)

Cultural/Transportation Symbols
- County Boundary
- Major roads

Hydrologic Symbols
- Reservoir, treatment
- Gaging Station
- Dam/Weir, nonearthen
- Stream; Connector
- Stream, intermittent
- Shore, nonearthen
- Aqueduct; pipeline
- Dump Site, operational
- Foreshore
- Lake/Pond, intermittent
- Water body (including lakes, ponds, streams)
- Reservoir
- Swamp/Marsh

Area not mapped for loam
Military Reserve

Map References:

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Supplemental Information

Use Constraints: These data represent the results of data collection/processing for a specific Department of Natural Resources, Maryland Geological Survey activity and indicate general existing conditions. As such, they are only valid for the intended use, content, time, and accuracy specifications. The user is responsible for the results of any application of the data for other than their intended purpose. The Maryland Geological Survey makes no warranty, expressed or implied, as to the use or appropriateness of the data, and there are no warranties of merchantability or fitness for a particular purpose of use. The Maryland Geological Survey makes no representation to the accuracy or completeness of the data and may not be held liable for human error or defect. Geologic data are only valid at 1:62500 scale. Data may not be used at a scale greater than that.

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Geologic field mapping for the original county geologic map was completed by J.D. Glaser in 1996. The geologic map was compiled in digital form and edited by Heather Quinn, Maryland Geological Survey. Additional digital support provided by Catherine Luckhardt, Towson University, Center for Geographic Information Sciences.

Revisions, corrections and updates to the original geologic map will be completed periodically as needed and as additional data becomes available. The July 2006 release includes an updated county boundary, updated hydrographic features and corresponding changes and corrections to the map layout. The geologic layer has been updated to reflect these changes in the base layers and, in the southeastern corner of the county, the geology has been modified to reflect the digital geologic data available for the Benedict quadrangle (mapped at a more detailed, larger, 1:24,000 scale) (Glaser, 2002). Corrections to cross-sections have also been made.

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Original digital release April 2003
Version: PGGEO2003.2, release July 2006

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DEPARTMENT OF NATURAL RESOURCES
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Emery T. Cleaves
Director

Base map compiled and extracted from:

U.S. Geological Survey (USGS):
National Hydrologic Dataset (NHD), high resolution, for hydrographic features
NHD high resolution dataset generally developed at 1:24,000/1:12,000 scale
Topographic 30 x 60-minute series (1:100,000 scale) digital line graphs (DLGs) for topography
Portions of Washington West, Washington East, Frederick and Baltimore sheets
As shown, topographic features are an enlargement from 1:100,000 to 1:62,500 scale
Geographic Names Information System (GNIS) database for cultural features/place names shown

Maryland State Highway Administration (MD-SHA):
MD Cooperative Centerline Program, Prince George's County excerpt (2006) for transportation features
Original dataset developed at 1:12,000 scale

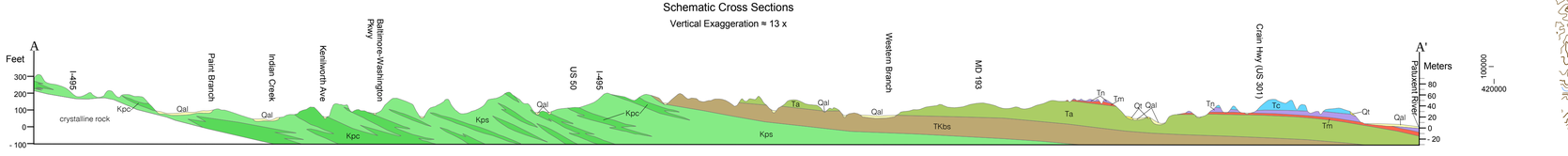
Estimated 2006 magnetic north declination (center of county): 10 degrees 47 minutes west
(To determine current magnetic declination see: http://www.ngdc.noaa.gov/seg/geomag/jsp/Declination.jsp)

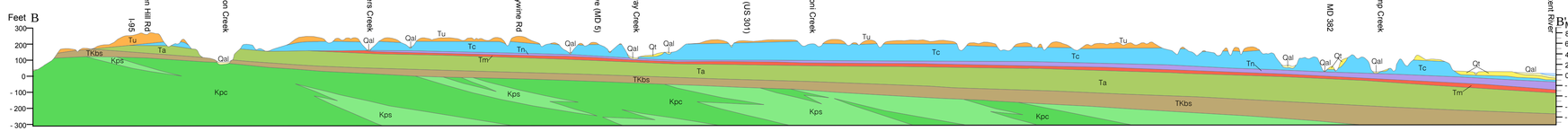
Current map projection:
Maryland State Plane Coordinate System 1987
(Projection: Lambert Conformal Conic, 1980 geodetic reference system)
(Horizontal Datum: North American Datum 1983)

State Plane 2000-meter grid tics and coordinates shown in black
Geographic coordinates (latitude-longitude) shown near corners and 2.5' intervals also shown in black with larger font

Schematic Cross Sections

Vertical Exaggeration ≈ 13 x





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MARYLAND GEOLOGICAL SURVEY
2300 Saint Paul Street
Baltimore, MD 21218
Ph: 410- 554- 5500
Fax: 410- 554- 5502
http://www.mgs.md.gov/