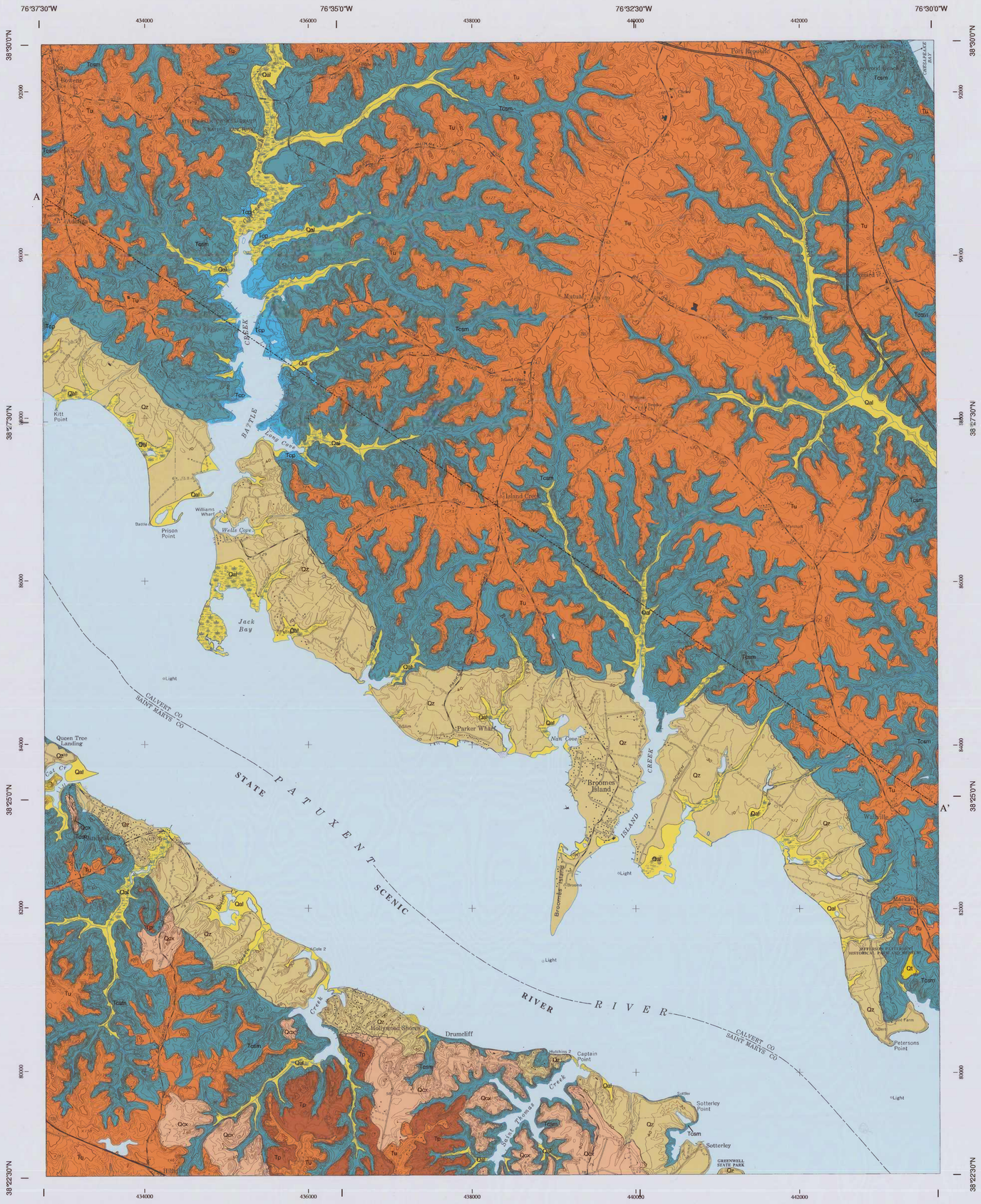

Base map from U.S. Geological Survey
7.5-minute Series (Topographic)
Broomes Island, MD, 1963, photorevised 1986
1986 magnetic north declination (center of sheet): 9.5 degrees west???
(To determine current magnetic declination see: http://www.ngdc.noaa.gov/cgi-bin/seg/gmag/ILdsnth1.pl)

Note:
Hydrology layer shown is from USGS digital line graphs (DLGs) for this quadrangle
Topography and cultural/transportation layers from USGS stable-base film separates
Topography by photogrammetric methods from aerial photographs taken 1961.
Field checked 1963.

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 (in black)

Geologic Map of the Broomes Island Quadrangle, Calvert and St. Mary's Counties, Maryland

By
John D. Glaser
2003

Adjoining 7.5' Quadrangle Names
Broomes Island Quadrangle, shaded

1	2	3
4		5
6	7	8

1. Benedict
2. Prince Frederick
3. North of Cove Point
4. Mechanicsville
5. Cove Point
6. Leonardtown
7. Hollywood
8. Solomons Island

GN
(State Plane Grid North)

Quadrangle Location

Scale 1:24,000

1 0.5 0 1 Miles
1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet
1 0.5 0 1 Kilometers

Contour Interval 10 Feet
National Geodetic Vertical Datum of 1929
Shoreline represents the approximate line of mean high water
The mean range of tide is 1.3 feet
(To convert from feet to meters, multiply by 0.3048)

STATE OF MARYLAND
Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lieutenant Governor

DEPARTMENT OF NATURAL RESOURCES
C. Ronald Franks
Secretary

W. P. Jensen
Deputy Secretary

MARYLAND GEOLOGICAL SURVEY
Emery T. Cleaves
Director

Explanation of Map Symbols

Topographic and Hydrologic Symbols

- Topographic Contour – Index (50–ft interval)
- Topographic Contour – Intermediate (10–ft interval)
- Stream
- Water body (including lakes, ponds, streams)
- Marsh, wetland, swamp, or bog

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. Neither the licensor, nor the owner of these data makes any warranty, expressed or implied, as to the use or appropriateness of the licensed 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. Data are only valid at 1:24,000 scale. Data may not be used at a scale greater than that.

Acknowledgements: This map was funded in part by the USGS National Cooperative Geologic Mapping Program. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Geologic field mapping was completed by 1999. Geologic map compiled in digital form and edited by Heather Quinn, Maryland Geological Survey. Digital support provided in part by Towson University, Center for Geographic Information Sciences.

The facilities and services of the Maryland Department of Natural Resources are available to all without regard to race, color, religion, sex, sexual orientation, age, national origin or physical or mental disability.

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Copies of this map are available
in hard copy (paper) and digital form from:
MARYLAND GEOLOGICAL SURVEY
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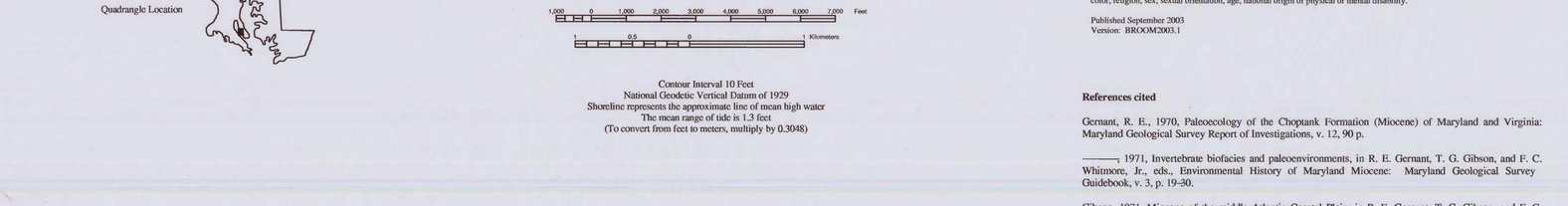
Baltimore, MD 21218
Ph: 410–554–5500
Fax: 410–554–5502
http://www.mgs.md.gov/

CROSS SECTION A-A'
Vertical Exaggeration 10x



DESCRIPTION OF MAP UNITS

Holocene

Qal

Alluvium

Interbedded sand, gravel, and silt-clay.

Sand, quartzose, fine–to coarse-grained, variably clayey; includes pebbly sand and fine to coarse quartz gravel. Silt-clay beds mostly thin, with lenticular bedding; in places bearing logs, twigs, and leaves; rarely thin peats. Tan, gray, brown, and black.

Alluvium includes heterogeneous, moderately–to poorly-sorted sediments underlying floodplains and channels of streams in the map area, as well as deposits underlying sea-level flats and marsh tracts flanking the Patuxent River. The latter deposits bear, in places, sparsely distributed modern molluscan shells and reworked Miocene fossils. These sediments are commonly water-saturated and loosely consolidated in lenticular massive beds.

Although radiocarbon dates are not available to document the age of these deposits, they are generally ascribed to fluvial, estuarine, or wind deposition during the last 10,000 years. Thickness of alluvium ranges from a few feet (about one meter) to as much as 50 feet (15.2 m) in places.

Quaternary

Qz

Lowland deposits (undivided)

Interbedded sand, silt-clay, and minor pebbly sand.

Sand, fine–to coarse-grained, variably clayey, with subordinate pebbly sand and thin gravels near base of unit. Sand mostly poorly-sorted and clayey; fine to medium clean sand much subordinate. Generally tan, gray-green or dark gray; silt-clay is dark with plant fragments in places. Fossiliferous in places; fauna dominated by modern mollusks. Oysters make up most of the fauna in some beds.

Included in this map unit are deposits designated as fluvial Terrace deposits flanking the Patuxent River on the Calvert County geologic map (Glaser 1994), and deposits mapped as Kent Island Formation, Maryland Point formation, and Omar Formation in St. Mary's County (McCartan, 1989). The relationships between the deposits designated Lowland deposits on this map and the Kent Island Formation, Maryland Point formation and Omar Formation (of McCartan, 1989) as well as some Quaternary Terrace deposits are not unequivocally defined. Until further study reveals the correlation of these units, the informal name of Lowland deposits undivided (Qz) is applied to identify these deposits.

The Lowland deposits are made up largely of detritus eroded from the adjoining highland areas, redeposited by the ancestral Patuxent River as fluvial or estuarine sediments. Thus, they range from freshwater to brackish in environment of deposition. Sediments presumed to be correlative to the Lowland deposits elsewhere in the Chesapeake Bay area range in age from 24,000 to as old as 180,000 years (e.g., McCartan, 1989).

These sediments collectively lie at 60 feet (18.3 m) or less in elevation. The thickness of these sediments ranges from less than 5 feet (1.5 m) to a maximum of 50 feet (15.2 m).

Pleistocene

Qcx

Chicamuxen Church formation (mapped in St. Mary's County only)

Interbedded sand and gravel.

Sand, medium–to coarse-grained, interbedded with fine to coarse quartz gravel; uppermost 4 to 5 feet (1.2 to 1.5 m) composed of silty clay to silty fine sand. Reworked ironstone and flat slabs of quartz or quartzite are common. Tan to medium yellow-orange.

The Chicamuxen Church formation was initially identified and mapped in St. Mary's County by McCartan (1989). The unit is fluvial or estuarine in origin with an upper surface at or somewhat above 75 feet elevation (22.9 m). The unit lies unconformably on the Park Hall formation or older units. McCartan (1989) indicates that corals in (marine) sediments that are presumed to be correlative elsewhere in the mid-Atlantic region have been yielded uranium-disequilibrium series dates of about 450,000 years and identifies the unit as a lower to middle Pleistocene deposit. These sediments range in thickness from few feet to as much as 50 feet (15.2 m).

Note: The existence or absence of this unit has not been determined in the Calvert County portion of this map. It is possible that there are sediments equivalent with this unit in Calvert County, which have been included in Quaternary Lowland deposits.

Qt

Terrace deposits

Sand and gravel.

Sand, quartz, fine– to medium-grained, with thin beds of fine to medium quartz gravel. Color white, pale-gray, or brown. Thin flat bedding prevalent, cross-bedded in places or massive.

In Calvert County, Glaser (1994) indicated that Terrace deposits include a series of fluvial deposits that flank most major streams and record successive episodes of valley cutting and channel deposition during the late Tertiary and Quaternary time. Most of the lowest and youngest of the fluvial deposits are now included in the Lowland deposits on this quadrangle. In the Brooms Island Quadrangle and the adjacent quadrangle to the east, the Cove Point Quadrangle, Terrace deposits comprise a discontinuous series of small fluvial terraces flanking St. Leonard Creek. In general these terrace surfaces are at 40 feet (12.2 m) or less in elevation. These mostly sandy sediments show minimal oxidation and are relatively young, probably Quaternary in age. They are the record of valley cutting by St. Leonard Creek and channel deposition. In the Brooms Island Quadrangle, a single outcrop of Terrace deposits is mapped in southern Calvert County along an unnamed tributary to St. Leonardtown Creek, which is just east of the quadrangle. The upper surface of this sole Terrace deposit occurs at an elevation of approximately 50 to 60 feet. The terraces are underlain by as much as 35 feet (10.7 m) of sediment.

Note: The relationship between the ages of the Terrace deposits, other Quaternary units and (in St. Mary's County) the Tertiary Park Hall formation of McCartan (1989) is not well defined. These units may represent coeval deposition in some places and not in others.

upper Pliocene

Tp

Park Hall formation (St. Mary's County only)

Interbedded sand, minor silt-clay, and pebbly sand and gravel.

Sand, fine to coarse-grained, variably clayey, mostly poorly-sorted, bearing pebbles, cobbles, and boulders in basal portion of unit. Pink, pale-brown, and yellow-orange.

The Park Hall formation was identified and mapped separately from Upland deposits in St. Mary's County by McCartan (1989). The Park Hall is dominated by sediment derived from source areas in the Piedmont and Appalachian Mountains. The top of the unit lies at about 105–110 feet (32.0-33.5 m) in elevation, and the base at 60–70 feet (18.3-21.3 m); it rests unconformably on the middle Miocene to Pliocene units (Choptank-St. Marys Formations undivided or the Upland deposits).

The Park Hall formation is considered a fluvial-estuarine deposit. McCartan (1989) indicates that sparse pollen found in some clay beds in the Park Hall unit suggest deposition in a warm temperate climate and a Pliocene age. Units that are presumed to be correlative to the Park Hall elsewhere in the Chesapeake Bay area and mid-Atlantic region are late Pliocene in age. These sediments range in thickness from 30 to 40 feet (9.1–12.2 m).

Note: The existence or absence of this unit is not defined in the Calvert County portion of this map. It is possible that there are sediments equivalent with this unit in Calvert County that have been included in other units, mainly Terrace or Upland deposits.

upper Miocene – Pliocene

Tu

Upland deposits (former Brandywine Formation)

Sand, gravel, and minor silt-clay.

Sand, quartzose, medium–to coarse-grained, poorly-sorted, pebbly in places, interstratified with many thin beds of fine gravel. Pebbles are vein quartz, sandstone, and chert. Silt-clay beds rare. Sand is tan, yellow, and reddish-brown; clay is buff, pale gray, or red. Bedding lenticular, cross–bedded; rarely massive or flat-bedded.

The unit occupies dissected upland areas of the quadrangle. Exposures are relatively poor in the quadrangle except for a few deep road cuts and stream valley walls. Where intact, the formation sand and gravel capped with as much as 15 feet (4.6 m) of reddish-brown massive sandy loam bearing "floating" pebbles. McCartan (1989) indicates that the weathering front in the unit (as evidenced by dioctahedral vermiculite and destruction of illite or illite-smectite) generally occurs at a depth of about 10 feet (3 m) as compared with only about 3 ft (1 m) in the Park Hall. McCartan (1989) also indicates that the Upland deposits are separated from the younger Park Hall unit by a low (10–15 feet, 3-4 m) poorly defined scarp.

The base of the unit lies at about 90 feet (27.4 m) elevation across the northern tier of the map area, declining to 80 feet (24.4 m) or less in the south. The basal contact is an erosional unconformity on the Choptank-St. Marys part of the Chesapeake Group, but the contact is obscure where similar light-colored sand with gravel comprises the uppermost St. Marys.

The Upland deposits are typically fluvial in origin, generally regarded as a channel-floodplain couplet laid down by a river or rivers, probably the ancestral Potomac, during late Miocene or Pliocene time (e.g., Hack, 1955; Schlee, 1957; Glaser, 1971). McCartan (1989) indicates that in St. Marys County, the unit includes both estuarine and fluvial deposits. Unit thickness is as much as 40 feet (12.2 m), but generally less.

Tertiary

middle Miocene

CHESAPEAKE GROUP

Tcsm

Choptank and St. Marys Formations undivided

Sand, sandy clay, and clay.

Sand, quartzose, fine– to medium-grained, variably clayey, interbedded gradationally with clay and sandy clay. Sand is dark-gray to gray-green where unweathered; pale-gray or yellow to whitish where weathered and in uppermost St. Marys Formation. The latter contains beds of coarse quartz sand, granule beds, and thin pebbly layers. Choptank and lower St. Marys strata are variably fossiliferous, peaking in two thick shell-packed sand units – the Drumcliff and Boston Cliffs Members –in the Choptank.

The Choptank-St. Marys contact is a sand-on-sand discontinuity which is unmappable outside of the type section, and consequently, the two formations are mapped as a single unit. Similarly, the contact between the Choptank and the underlying Calvert is within a sequence of similar muddy sands, also untraceable inland from the type section. Consequently, the lower contact of the Choptank is herein repositioned to the base of the Drumcliff Member, a horizon that has proved mappable throughout the map area. [This is in agreement with the base of the unit as defined by Kidwell (1984) but differs from some other earlier workers (e.g., Gernant, 1970, 1971; Gibson 1971).] Moreover, the St. Marys Formation has been expanded to include sandy strata heretofore included in the Upland deposits. Thus, the repositioned contact between the St. Marys Formation and the Upland deposits now lies at the base of the generally coarser-grained oxidized sand and gravel section exhibiting fluvial sedimentary structures.

The typical Choptank-St. Marys section in the map area is as follows. The basal Choptank consists of 8 to 30 feet (2.4-9.1 m) of pale yellowish-brown, fine-grained, well-sorted, sand (Drumcliff Member) containing conspicuous layers of molluscan shells dominated initially by large *Isognomen*. Overlying the Drumcliff is about 20 feet (6.1 m) of fine-grained, dusky-blue muddy sand with few fossils (St.Leonard Member). The St. Leonard is succeeded by the Boston Cliffs Member, 15 feet (4.6 m) thick, which is similar to the Drumcliff in both lithology and fossil content. The top of the unit is oxidized and limonite-cemented, suggesting subaerial exposure. Overlying the Boston Cliffs Member is a variable sequence of gray to gray-green, fine– to medium-grained, muddy to clean sand, interbedded with dark-gray silty to plastic clay (Conoy Member and lowest St. Marys Formation). Bands of fossils, rich in gastropods, are scattered throughout the sand. This sequence grades upward to predominantly dark-gray clay with lenticles of laminated silt laced with well-defined burrows, interbedded with well-sorted non-fossiliferous sand. The sands grade upward into a few tens of feet (approximately 3 to 9 m) of pale-gray to yellow or orange sand, fine–to coarse-grained, locally with pebble bands and thin lenticular pale–gray clay lenses. These beds are marked by *Ophiomorpha* burrows, diagnostic of the shoreline environment. The contact with the overlying Upland deposits is marked locally by a line of cobbles.

The Choptank-St. Marys section is overall a marine regressive sequence and records environments ranging from shallow marine shelf in the Choptank, to nearshore and marginal marine facies in the upper St. Marys. Within the overall regressive trend, however, several lesser transgressive-regressive cycles are indicated within the Choptank Formation (e.g., Kidwell, 1984; Gernant, 1970). The Choptank and St. Marys Formations are considered middle Miocene in age. The thickness of the combined section is 150 feet (45.7 m) at maximum.

lower – middle Miocene

Calvert Formation

Tcp

Plum Point Marls

Sand and clayey sand.

Sand, very fine to medium-grained, moderately sorted to well sorted, interbedded in the upper part of the unit with several beds of massive silty clay. Color olive-gray to pale olive-green where unweathered; pale-gray to buff or tan where weathered. This unit is fossiliferous at several horizons, sparingly so throughout; shell preservation rare, molds and casts common. Bedding -massive or burrow-mottled.

The Plum Point Marls unit was mapped only in the Calvert County portion of the map, mainly along the lower parts of the banks of Battle Creek and its tributaries. As noted above, the top of the Plum Point Marls unit is placed at the base of the prominent shell bed in the Drumcliff Member of the Choptank Formation which is in agreement with Kidwell (1984).

The Plum Point Marls are estimated to be relatively thick (up to about 70 to 90 feet) in the subsurface of the map area. The Plum Point Marls have been interpreted as sediments largely of the open marine shelf (Gernant 1971) but record environments ranging from relatively deep to shallow subtidal and some intertidal sediments (Kidwell 1984).

Tcf

Fairhaven Member (subsurface; in cross section only)

Sand and diatomaceous silt.

Sand, very fine to fine-grained, clayey in part, grading to silt and diatomaceous silt. Color olive-green to olive-gray where unweathered; pale–gray, tan, or brown in weathered sections. Diatomaceous silt is concentrated in lower portion of the member; upper portion is relatively homogeneous sand and silty sand with pervasive burrow mottling.