

Base map from U.S. Geological Survey 7.5-minute Series (Topographic) South River, 1957 (revised 1993) 1913 magnetic north declination (center of original South River quadrangle): 10.5 degrees west (To determine current magnetic declination see: <http://www.ngs.gov/cgi-bin/wsp/gmag1.html>) Annapolis, 1957 (photorevised 1978)

Geologic Map of the South River Quadrangle, and Portions of the Annapolis Quadrangle, Anne Arundel County, Maryland

By John D. Glaser 2002

Scale 1:24,000

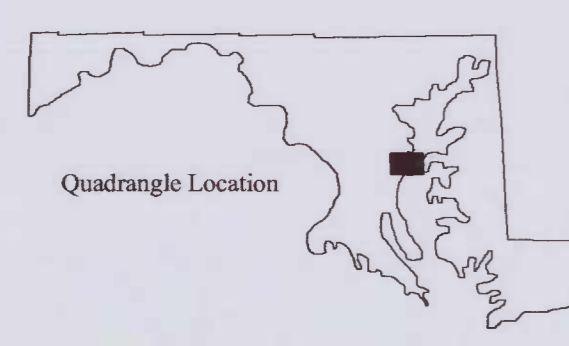
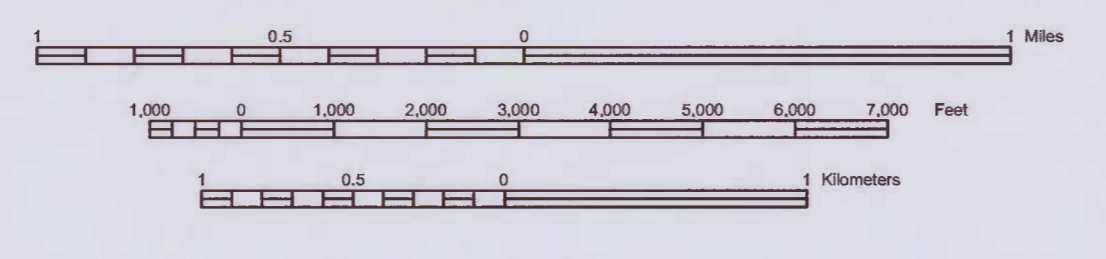


Table with 3 columns and 3 rows showing adjacent 7.5-minute quadrangle names: 1. Odenton, 2. Broad Bay, 3. Glenwood, 4. Broad River, 5. Annapolis, 6. Broad, 7. Horsehoe Point.

Copies of this map are available in hard copy (paper) and digital form from: MARYLAND GEOLOGICAL SURVEY 2340 Saint Paul Street Baltimore, MD 21218 Ph: 410-554-5500 Fax: 410-554-5502 <http://www.mgs.md.gov/>

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Current map projection (projection change from original): Maryland State Plane Coordinate System (1987) (meters) (Projection: Lambert Conformal Conic, 1987 spheroid reference system) (Horizontal Datum: North American Datum 1983) State Plane (NAD83) 2000 meter grid files and coordinates shown in black Geographic coordinates (latitude/longitude) (NAD83) shown near centers and 2.5 intervals (in black)

STATE OF MARYLAND Parris N. Glendening Governor Kathleen Kennedy Townsend Lieutenant Governor



DEPARTMENT OF NATURAL RESOURCES J. Charles Fox Secretary Karen M. White Deputy Secretary MARYLAND GEOLOGICAL SURVEY Emery T. Cleaves Director

References cited: Gibson, T.G., Bybell, L.M. and Mason, D.B., 2000, Stratigraphic and climatic implications of clay mineral changes around the Paleocene/Eocene boundary of the northeastern US margin. *Sedimentary Geology*, volume 134, issue 1-2, pp. 65-92. McCartan, L., 1989a, Geologic map of Charles County, Maryland: Maryland Geological Survey map 1.62500. McCartan, L., 1989b, Geologic map of St. Mary's County, Maryland: Maryland Geological Survey map 1.62500. Owens, J.P., and Denny, C.S., 1979, Upper Cenozoic deposits of the central Delmarva Peninsula, Maryland and Delaware: U.S. Geological Survey Professional Paper 1067-A, 28 p.

DESCRIPTION OF MAP UNITS

- Artificial fill: Heterogeneous unstratified materials including sand, gravel, clay, silt, construction debris, and dredge spoil. Only major fill areas have been mapped, most of these adjacent to the shoreline.
Alluvium: Interbedded sand, gravel, and silt-clay. Sand, very fine to fine-grained, silty, silt, and minor clay. Unit includes a variable thickness of diatomaceous silt. Color olive-green to greenish-gray where unweathered, pale-gray, tan or brown in weathered sections. The basal portion contains, in places, a thin (< 5 ft) bed of diatomaceous silt containing as much as 40 percent of diatoms. Most of the unit consists of relatively homogeneous sand and silt with obscure bedding and pervasive burrow-mottling. Ghosts of mollusks are common in some strata, but intact shells are absent, having been leached from the sediment. The lower contact is sharp and unconformable on the underlying Nanjemoy. All of the Calvert sediments in the map area belong to the lower Tortonian Member. The upper member, the Plum Point, was not recognized in the area.
The lower Calvert is a restricted-basin marine unit, deposited in relatively deep water. A maximum thickness of about 50 feet of strata is present in the South River Quadrangle. The Annapolis Quadrangle contains only a tiny hilltop remnant of the unit.
Nanjemoy Formation: Glauconitic sand, silty sand, and silt-clay. Sand, fine to coarse-grained, variably silty or clayey, containing as much as 50 percent glauconite. Grades to silt-clay in some places. Color medium-gray to dark greenish-gray where unweathered, mottled yellowish and pale-brown in weathered outcrops. Silt-clay is dark gray to chocolate brown. Bedding massive or thick-bedded with prevalent burrow-mottling. Fossiliferous in some beds, chiefly *Favosites*. Lower contact sharp marked by sand-filled burrows excavated in the underlying clay of the Marlboro. Indurated beds and concretionary bodies present at some horizons. Sand generally coarsens upward in the section. The Nanjemoy accumulated on the inner shelf in relatively shallow water. The unit may be as much as 60 feet thick but generally is much less.
Marlboro Clay: Clay, dense and brittle, beds massive and thickly-stratified ranging to finely-laminated. Beds lenticular to lamellar with sparse partings and thin lenses of micaceous, lignitic, clayey silt, evenly laminated in places. Color pale-red to silvery-gray, silt yellowish to reddish-gray. Bedding massive to typically gray, and the remainder red; in places, the lowermost beds are also gray. The lower contact is gradational over a few feet of interbedded glauconitic sand and thin clay beds. Because it is thin and readily obscured by slumped overlying sandy sediments, good outcrops of the Marlboro are scarce. Nonetheless, the best exposures in Anne Arundel County are found in the Central Avenue corridor in the southern portion of the South River Quadrangle. The presence of the unit at the surface is commonly revealed by soils containing abundant small flat clay chips. The precise depositional environment of the Marlboro is uncertain. The sparse faunal evidence and the sedimentary structures have been interpreted as representing deposition in very shallow water (e.g. intertidal). Recently, however, regional studies of the Marlboro Clay suggest a deeper water depositional environment. Gibson et al. (2000) indicate that the unit probably represents deposits from an inner to middle marine shelf area that received sediments from river drainage systems. Regional microfaunal studies indicate that the Marlboro Clay ranges in age from latest Paleocene to earliest Eocene (calcareous nanoplankton unit Zone 9 and lower Zone 10) (e.g. Gibson et al., 2000). The Marlboro is as much as 20 feet thick.
Aquia and Brightseat Formations (unmapped)
Aquia Formation: Glauconitic sand and calcareous sandstone. Most of the Aquia consists of well-sorted, medium-grained sand, always glauconitic to some degree, but rarely totaling more than 30 percent of the sediment. Some beds fine or coarse-grained. Color dark gray-green to dark greenish-gray where unweathered, and pepper sand where moderately weathered, and rusty-brown with abundant limonite crusts where deeply weathered. Bedding massive and thick-bedded with abundant burrow-mottling. Highly fossiliferous in places with oysters and *Turritella* dominant. The Aquia is at the surface over most of the northern half of the South River Quadrangle and over nearly all of the Annapolis Quadrangle. Thus, outcrops are numerous, particularly in bluffs facing the lower Severn and South Rivers where as much as 80 feet of Aquia is exposed in continuous sections. Much of the unit is deeply weathered (to depths as great as 70 feet) to a limonitic rusty sand in which much of the glauconite has been oxidized and shell carbonates leached from the sediment. Boulders and blocks of reddish-brown sandstone are common in the soil zone developed on the Aquia and later the surface in places. Below the South River, partial beds or irregular pods of shaly calcareous sandstone as much as 5 feet thick are commonly encountered. The Aquia probably accumulated in very shallow marine water on the inner shelf and record a regressive cycle during the Paleocene. At its thickest, the Aquia totals nearly 180 feet of beds, but it is generally much thinner over the map area.
Brightseat Formation (not mapped separately from Aquia Formation in this area): Glauconitic clayey sand. Most of the Brightseat consists of predominantly fine-grained, poorly sorted sand with as much as 25 percent of glauconite, but generally much less. Color dark-gray to dark greenish-gray where unweathered; pale-gray to tan in weathered outcrops. In places, the basal Brightseat contains some medium to coarse sand with granules, small pebbles, phosphatic clasts, and fish teeth, molluscan ghosts are uncommon. The Brightseat is lithologically similar to the overlying Aquia, and in most areas, the contact is gradational, marked by coarsening sand and increasing glauconite content. In most outcrops and boreholes, the two units are not readily separable; consequently, they are mapped as one unit. Brightseat sediments probably accumulated on the inner shelf during early Paleocene time. The known thickness is maximally 65 feet, but generally less in many areas.
Severn and Matawan Formations (unmapped)
Glauconitic sand and micaceous silt. Both of these units are thin and lithologically similar, consisting of very fine to fine-grained, poorly-sorted, variably glauconitic sand and micaceous silt. Color dark-gray to olive-black in unweathered sections, buff to pinkish-gray where weathered. Both units are thick-bedded to massive with abundant burrow-mottling; molluscan ghosts are common in places. Lithological convergence, limited thickness (about 50 ft maximum), and generally poor exposure combine to prevent separate mapping of the Severn and Matawan Formations. In addition, the combined section is thin in the map area to the extreme northwest corner of the South River Quadrangle. The Severn-Matawan sequence is of latest Cretaceous age and is a continental shelf deposit. The combined thickness is maximally 55 feet, but generally less in the map area.
Terrace Deposits: Interbedded sand, gravel, and silt-clay. Heterogeneous sediments comprising fine to coarse gravel, poorly-sorted sand containing glauconite where scarce materials include Aquia or Nanjemoy beds, clayey sand, and thin lenses of silt-clay. Bedding chiefly lenticular or massive. Color tan, buff, grayish-brown, or reddish-brown. Terrace deposits have a very limited distribution in the map area. Remnant patches of Q1 can be found flanking the shallow valleys of Broad Creek and the Muddy Creek-Mill Swamp drainage in the southwestern part of the South River Quadrangle. The deposits are as thick as 25 feet, but are generally much thinner.

