MARYLAND GEOLOGICAL SURVEY

Kenneth N. Weaver, Director

GEOLOGIC MAP OF MARYLAND

Scale 1:250,000

50 Statute Miles

50 Kilometers

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ALLEGHENY PLATEAU AND VALLEY AND RIDGE

Dunkard Group — Red and green shale, siltstone, and sandstone; with thin, lenticular beds of argillaceous limestone and coal. Upper part (Washington Formation and younger) contains abundant red beds; Waynesburg coal bed at base. Thickness 0–1,000 feet in Garrett and western Allegany Counties.

Monongahela Formation — Gray and brown, fine-grained sandstone, shale, limestone, and coal beds. Waynesburg coal bed at top, Pittsburgh coal bed at base. Thickness 300–500 feet in west, increases to 575 feet in east.

Conemaugh Formation — Gray and brown, fine-grained sandstone, shale, limestone, and coal beds. Includes the Upper Freeport coal, Lower Freeport coal, Upper Kittanning coal, Middle Kittanning coal, and Brush Creek limestone. Thickness 1,000–1,500 feet in west, decreases to 500 feet in east.

Allegheny Formation — Interbedded sandstone, siltstone, claystone, shale, and coal beds, conglomeratic orthoquartzite and green, fossiliferous limestone. Thickness 300–500 feet in west, increases to about 600 feet in east.

Pottsville Formation — Interbedded sandstone, siltstone, claystone, shale, and coal beds, conglomeratic orthoquartzite and green, fossiliferous limestone. Thickness 300–500 feet in northwest, increases to 800 feet in southeast.

Mauch Chunk Formation — Red and green shale, reddish-brown sandstone, and red, green, brown, and gray fine-bedded and cross-bedded orthoquartzite. Thickness 1,000–1,500 feet in west, increases to about 4000 feet in east.

Greenbrier Formation — Upper part: gray, thin-bedded, nodular-weathering limestone with greenish-gray and reddish-gray argillaceous partings. Lower part: massive, cliff-forming limestone. Thickness 500–1,000 feet.

Loyalhanna Limestone — Gray, thick-bedded, fossiliferous, cross-bedded limestone and sandstone. Thickness 0–100 feet.

Pocono Group — Gray, white, tan, and brown, thin- to thick-bedded, fine- to coarse-grained, cross-bedded orthoquartzite and gray and reddish-brown shale. Thickness 1,000–1,500 feet in Garrett and eastern Allegany Counties.

Purslane Sandstone — Pebble to boulder conglomerate, coarse-grained sandstone and orthoquartzite, with thin gray shale and red shale partings. Thickness 0–100 feet in Allegany County.

Rockwell Formation — Green-grained, yellowish, sandstone. Fine-grained sandstone, siltstone, and shale; gray and red shale. Thickness 0–1,000 feet in Allegany and Washington Counties.

Total thickness of Group 100 feet in west, increases to 1,500 feet in east.

Hampshire Formation — Interbedded red shale, red sandstone, and red to brown micaceous siltstone and sandstone; some thin green shale and sandstone. Thickness 1,000 to 1,500 feet in Allegany and Garrett Counties; 1,400 to 2,000 feet in east, increases to 3,000 feet in east.

"Chemung" Formation — Predominantly marine red, fine-grained to gray to brown micaceous siltstone and shale. Thickness ranges from 2,000 to 3,000 feet.

Portage Group — Interbedded gray to black shale, conglomeratic sandstone, and fossiliferous limestone. Thickness 1,000–2,000 feet, averages 400 feet.

Brallier Formation — Predominantly of marine origin. Medium to dark gray, fossiliferous shale and siltstone; sandstone in lower part. Thickness 1,000–2,000 feet in west, increases to 3,000 feet in east; about 1,500 feet in central Allegany County.

Harrell Shale — Black, fissile, fossiliferous shale; olivine in east where described (as Marcellus) in Pennsylvania. Only known from one bore hole in subsurface of Garrett County. Thickness 0–200 feet.

Note: "Chemung," Brallier, and Harrell Formations formerly were designated as Jennings Formation.

Hamilton Group — Mahantango Formation: Dark gray, laminated shale, siltstone, and very fine-grained sandstone. Thickness 1,000 feet in west, increases to 1,500 feet in east.

Marcellus Shale: Black, fissile, laminated, pyritic, carbonaceous shale. Thickness 200 feet in west, increases to 400 feet in east.

Tioga Metabentonite Bed — Brownish-gray, thinly laminated shale containing numerous thin dykes. Thickness less than one foot.

Onondaga Limestone — Bloomington or Needmore Shale: dark gray, thin-bedded, fossiliferous, argillaceous limestone; thickness ranges from 0 to 200 feet.

Note: Hamilton Group, Tioga Metabentonite Bed, and Needmore Shale Formation were designated as Mahantango Formation.

Ridgeley Sandstone — Light gray, fine- to coarse-grained, fossiliferous, orthoquartzitic sandstone. Thickness 100 feet in west. Wedges to north and pinches out between Garrett and Allegany Counties.

Helderberg Limestone — Keyser Limestone: Member—Shriver Limestone: Light gray, fossiliferous limestone and dolomite; weathers to a rough, cavernous surface. Thickness 0–100 feet.

Shriver Limestone: Dark gray, thin-bedded, argillaceous, fossiliferous limestone and dolomite; weathers to a rough, cavernous surface. Thickness 0–100 feet.

Corriganville Limestone: Light gray, fossiliferous limestone and dolomite; weathers to a rough, cavernous surface. Thickness 0–100 feet.

Coeymans Limestone: Light gray, fossiliferous limestone and dolomite; weathers to a rough, cavernous surface. Thickness 0–100 feet.

New Scotland Limestone: Dark gray, thin- to thick-bedded, fossiliferous limestone; weathers to a rough, cavernous surface. Thickness 0–100 feet.

Becraft Limestone: Dark gray, thin- to thick-bedded, fine- to coarse-grained, fossiliferous limestone; weathers to a rough, cavernous surface. Thickness 0–100 feet.

Tonoloway Limestone — Gray, thin-bedded limestone, dolomitic limestone, and calcareous shale; weathers to a rough, cavernous surface. Thickness 400 feet in west, increases to 600 feet in east.

Wills Creek Shale — Olive- to yellowish-gray, thin-bedded, weathering shale and argillaceous limestone; some fossiliferous limestone. Thickness 450 feet in west, increases to 600 feet in east.

Bloomsburg Formation — Purple-red, brownish, thin- to thick-bedded sandstone and shale; some dark sandstone and green shale. Thickness 0–1,000 feet in Allegany County; 1,000 feet in southern-central sandstone limestone pebble to boulder conglomerate. Thickness 200 feet in west, increases to 1,000 feet in east.

McKenzie Formation — Gray, thin-bedded shale and argillaceous limestone; some fossiliferous limestone. Thickness 0–200 feet in west, 200 feet in central, Washington County; increases to 500 feet in east and 300 feet in west.

Rochester Shale — Gray, thin-bedded calcareous shale and shaly gray, fossiliferous limestone; some limestone boulders. Thickness 0–75 ft. feet.

Keefer Sandstone — White to yellowish-gray, thick-bedded orthoquartzitic and orthoconglomeratic sandstone; some shale. Thickness 0–75 feet in west, increases to 75 feet in east.

Rose Hill Formation — Green, thin-bedded, argillaceous shale; some fossiliferous sandstone. Thickness 0–75 feet in west, increases to 150 feet in east.

Tuscarora Sandstone — White to light gray, thin- to thick-bedded, conglomeritic orthoquartzite and orthoquartzite. Thickness 50–150 feet in west, increases to 400 feet in east.

SOUTH MOUNTAIN ANTICLINORIUM AND FREDERICK VALLEY

Diabase Sills and Dikes — Sills: Greenish-gray to black, medium-grained diabase. Greenish-gray to black, medium- to fine-grained, local contact metamorphic rocks.

Gettysburg Shale — Red, fissile, micaceous sandstone and siltstone; subordinate shale and red beds. Thickness 5,000 feet.

New Oxford Formation — Red, micaceous sandstone, siltstone, and shale; sandstone and shale members, lithologically identical to those of Gettysburg Shale. Thickness 3,000 feet.

Conococheague Limestone — Dark gray, fine- to medium-grained, thin-bedded argillaceous limestone; subordinate and minor dolomite, calcareous sandstone, and shale. Thickness 1,000 feet.

Elbrook Limestone — Dark gray, fine- to medium-grained, thin-bedded argillaceous limestone; subordinate and minor dolomite, calcareous sandstone, and shale. Thickness 1,000 feet.

Waynesboro Formation — Upper part: red, gray, and mottled-brown, fine- to medium-grained, thin-bedded sandstone, siltstone, and shale; subordinate and minor limestone. Lower part: red and gray, fine-grained, thin-bedded sandstone, siltstone, and shale; subordinate and minor limestone. Thickness 1,000 feet.

Antietam Formation — White to dark gray and brown, fine- to coarse-grained quartzite with fine argillaceous partings; subordinate and minor dolomite, calcareous sandstone, and shale. Thickness 1,000 feet.

Harpers Formation — Brown to dark brown-gray banded shale; in light gray, fine-grained quartzite; subordinate and minor dolomite in basal part. Thickness 1,000 feet.

Weverton Formation — Light gray, fine- to medium-grained quartzite; in basal part, thin-bedded, micaceous shale and fine-grained, micaceous sandstone. Thickness 1,000 feet.

Loudoun Formation — Metaconglomerate: Quartz and graywacke pebbles in quartz-graywacke matrix; subordinate and minor metasiltstone and metashale. Thickness 0–100 feet in southern part of Frederick Valley; pinches out to northeast.

Metarhyolite and Associated Pyroclastic Rocks — Metarhyolite flows, fine- to coarse-grained, with white feldspar phenocrysts and green quartz, and pyroclastic metarhyolite or crystal tuff. Thickness 1,000 feet.

Catoctin Metabasalt — Dark green, fine-grained metabasalt with conglomeratic layers and metabasite tuffs of quartz, calcite, and epidote; subordinate metasiltstone, phyllite and blue conglomeratic metaquartzite.

Swift Run Formation — Metaconglomerate and metaquartzite. Blue and green sedimentary clasts with smooth faces, some cobbles; matrix with coarse-sand grains.

ϵGr Granodiorite and Biotite Granite Gneiss — Light gray to pink, fine-grained, granodioritic gneiss; biotite granite gneiss; subordinate and minor amphibolite gneiss; in places a layered, concordant, banded gneiss; local basaltic rock dykes; extruded by metasedimentary rocks and by Catoctin Metabasalt.

WESTERN PIEDMONT METASEDIMENTARY ROCKS

Urbana Formation — Dark gray to green, cryptocrystalline phyllite, metasiltstone, and quartzite; thin layers of impure marble and carbonaceous phyllite near base.

Sugarloaf Mountain Quartzite — White, massive, orthoquartzite with saccharoidal texture, and phyllite.

Libertytown Metarhyolite — Purple, blue-gray, or white flows of Wissahickon Formation; in Harford County, also in Baltimore County. Phenocrysts of quartz and feldspar in aphanitic matrix; flow and fragmental textures; commonly intensely sheared and altered to quartz-sericite schist.

Setters Formation — Light gray, fine- to medium-grained, thin-bedded quartzite; in basal part, thin-bedded, dark gray, fine-grained, micaceous metasiltstone and metashale. Thickness 1,000 feet.

Baltimore Gneiss — Medium-grained, gray and biotite-hornblende gneiss; amphibolite subjacent but subordinate. Gneiss is layered, banded, and locally migmatitic; banding commonly is parallel to regional foliation, but locally is discordant to it. Intruded by granite and pegmatite dikes during Taconic orogeny.

* Baltimore date from Wetherill et al., 1966.

EASTERN PIEDMONT METASEDIMENTARY ROCKS

Peach Bottom Slate — Black, black-lead graphitic slate; thin beds of fine-grained, black quartzite near base; apparent maximum thickness 2,000 feet.

Cardiff Metaconglomerate — Pebble to boulder conglomerate; quartz-pebble metaconglomerate and quartzite; apparent maximum thickness 500 feet.

Upper Peltic Schist — Dark-gray, graphitic mica schist of Wissahickon Formation; differentiated from lower peltic schist on basis of lithologic similarity to Peach Bottom Slate, especially contrast from west to east; primary sedimentary structures rare; thickness 2,000 feet in coastal belt, and undifferentiated Wissahickon Formation, adjacent thickness 14,000 feet or more.

Metagraywacke — Gray, massive, Setters Creek Formation; Blankenship subfacies: dark-gray, massive, metamorphosed graywacke and subordinate dark-gray, graphitic mica schist; thickness 2,000 feet or more. Cockeysville subfacies: dark-gray, massive, metamorphosed graywacke; 1,000 feet.

Boulder Gneiss — Metamorphosed boulder and lateral conglomerate; gneissic boulders and matrix; thickness 1,000 feet or more.

Lower Peltic Schist — Dark-gray, graphitic mica schist of Wissahickon Formation; differentiated from upper peltic schist on basis of lithologic similarity to Baltimore Gneiss, especially contrast from west to east; primary sedimentary structures rare; thickness 2,000 feet or more. Gneissic phase: as above, but layered, banded, and migmatitic; 15,000 feet.

Cockeysville Marble — Metadolomite, calcareous, and calcite marble; subordinate thin beds of mica schist; lower member, metadolomite; upper member, calcite marble; maximum thickness 1,000 feet.

Setters Formation — Light-gray, fine- to medium-grained quartzite; subordinate mica schist and mica gneiss; thin-bedded, dark-gray, fine-grained, micaceous metasiltstone and metashale; thickness 1,000 feet.

Baltimore Gneiss — Medium-grained, gray and biotite-hornblende gneiss; amphibolite subjacent but subordinate. Gneiss is layered, banded, and locally migmatitic; banding commonly is parallel to regional foliation, but locally is discordant to it. Intruded by granite and pegmatite dikes during Taconic orogeny. Lateral gradation to Baltimore Gneiss southeast of Relay, Queen Anne's County.

* Baltimore date from Wetherill et al., 1966.

HARFORD COUNTY

Stratigraphic relationships of lithofacies of Wissahickon Formation in Harford County (from Southwick and Owens).

Volcanic Complex of Cecil County — Metarhyolite, metadacite, and metaandesite flows, pyroclastic rocks, and metamorphosed equivalents of volcanic rocks; thickness 2,000 feet or more.

James Run Gneiss — Light-gray, fine- to medium-grained, biotite-quartz-plagioclase gneiss with thin beds of quartz-amphibolite gneiss; thickness 1,000 feet or more.

COASTAL PLAIN

Quaternary Deposits Undivided — Unconsolidated gravel, sand, and clay; includes Wisconsin and Illinoian deposits, and alluvium, swamp deposits, and beach sand of Recent age. Thickness 0–100 feet.

Lowland Deposits — Gray, brown, and red clay, silt, and sand; includes Wisconsin and Illinoian deposits, and alluvium, swamp deposits, and beach sand of Recent age. Thickness 0–100 feet.

Upland Deposits (Eastern Shore) — Gravel and sand, commonly orange-brown, locally cemented by limonite; includes a few lenses of clay; includes Wisconsin and Illinoian deposits of Susquehanna River. Thickness 0–100 feet.

Upland Deposits (Western Shore) — Gravel and sand, commonly orange-brown, locally cemented by limonite; includes a few lenses of clay; includes Wisconsin and Illinoian deposits of Potomac River. Thickness 0–100 feet.

Yorktown Formation — Gray, yellow, and blue, fine- to medium-grained sand, clay, and shell marl; includes Pliocene deposits of Susquehanna River. Thickness 0–100 feet.

St. Marys Formation — Diatomaceous earth, sandy silt, and diatomaceous earth. Thickness 0–40 feet.

Choptank Formation — Interbedded brown to yellow, very fine-grained to fine-grained sand and gray to dark blue-gray, fossiliferous clay. Thickness 0–100 feet in southern part of Calvert County; thickness 0–50 feet in northern part of Calvert County.

Calvert Formation — Gray, fine-grained sand; brown, fine-bedded dark green to dark blue-gray, fine-grained argillaceous sand and sandy clay; contains fossiliferous shell beds and lenses of diatomaceous earth. Thickness 0–100 feet in southern part of Calvert County; thickness 0–50 feet in northern part of Calvert County; includes Pliocene deposits of Susquehanna River.

Piney Point Formation — Gray, fine- to medium-grained, micaceous sand; dark-gray and red-brown, fossiliferous clay; contains calcareous concretions and fossiliferous shell beds. Thickness 0–100 feet in southern Calvert County; thickness 50 to 100 feet in northern part of Calvert County; includes Pliocene deposits of Susquehanna River.

Nanjemoy Formation — Dark green to gray, argillaceous, glauconitic, fine- to coarse-grained sand; contains fossiliferous shell beds. Thickness 0–100 feet in southern Calvert County; thickness 50 to 100 feet in northern part of Calvert County; includes Pliocene deposits of Susquehanna River.

Aquia Formation — Dark green to gray-green, argillaceous, highly glauconitic, fine- to coarse-grained sand; contains fossiliferous shell beds. Thickness 0–100 feet.

Brightseat Formation — Dark-gray, micaceous, argillaceous, glauconitic, gritty, fine- to very fine-grained sand; contains fossiliferous shell beds. Thickness 0–100 feet; includes Pliocene deposits of Susquehanna River. Locally called Aquia Formation.

Monmouth Formation — Dark gray, micaceous, glauconitic, argillaceous, fine- to coarse-grained sand, and stiff clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Matawan Formation — Dark gray, micaceous, glauconitic, argillaceous, fine-grained sand and stiff clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Magothy Formation — Gray, fine-grained sand; "Arundel clay" facies: gray, micaceous, argillaceous, carbonaceous, lignitic clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Patapsco Formation — Gray, fine-grained sand; "Arundel clay" facies: gray, micaceous, argillaceous, carbonaceous, lignitic clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Raritan and Patapsco Formations — Gray, fine-grained sand; "Arundel clay" facies: gray, micaceous, argillaceous, carbonaceous, lignitic clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Potomac Formation — White or light gray to orange-brown, moderately sorted, fine- to coarse-grained sand; gray, micaceous, carbonaceous, lignitic clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Undifferentiated Mesozoic Rocks — Undifferentiated sedimentary rocks; interbedded, fine- to coarse-grained sand, gravel, and clay; contains fossiliferous shell beds. Thickness 0–100 feet.

Undifferentiated Crystalline Rocks — Weathered schist and mica gneiss; with saprolite and residual sand, gravel, and clay. Thickness 0–100 feet.

Fault

Formation boundary; where abrupt indicates sharp contact between formations due to differing interpretations

Base map from Army Map Service sheets, 1:250,000. Culture partly revised, 1967.

EASTERN PIEDMONT PLUTONIC ROCKS

GRANITIC SERIES

Pegmatite Dikes — Quartz-alkali feldspar-plagioclase-muscovite granite pegmatite; associated with granite domes; age 420 ± 30 m.y.* by radioactive dating.

Woodstock Quartz Monzonite — Medium-grained, massive, and well-developed foliation; intrusive; age 420 ± 30 m.y.* by radioactive dating.

Guilford Quartz Monzonite — Medium-grained, massive, and well-developed foliation; intrusive; age 420 ± 30 m.y.* by radioactive dating.

Ellicott City Granodiorite — Ranges from biotite granodiorite (near margin of pluton) to biotite granite (near center of pluton); intrusive; age 420 ± 30 m.y.* by radioactive dating.

Norbeck Quartz Diorite — Ranges from mafic-banded quartz diorite to strongly gneissic and schistose rock with recrystallized minerals; intrusive; age 420 ± 30 m.y.* by radioactive dating.

Port Deposit Gneiss — Medium-grained, layered and very gneissic quartz-plagioclase-biotite gneiss; quartz diorite, hornblende gneiss, and amphibolite subjacent but subordinate; age 420 ± 30 m.y.* by radioactive dating.

Kensington Quartz Diorite — Moderately to strongly foliated, gneissic intrusive; ranges from quartz diorite to granodiorite; intrusive to granodioritic complexes; has considerable mafic or augen-textured silica-poor phase; age 420 ± 30 m.y.* by radioactive dating.

Granodiorite Gneiss — Medium- to coarse-grained, gneissic, fine- to medium-grained, massive rock; locally, subtrachytic texture; intrusive; age 420 ± 30 m.y.* by radioactive dating.

* Radiogenic date from Wetherill et al., 1966.

GABBROIC SERIES

Georgetown Mafic Complex — Dark-colored, massive, dark quartz diorite, gabbro, amphibolite, and metaperidotite and serpentinite; differentiated; and complex-related basic rocks.

Relay Quartz Diorite — Medium-grained, massive, light-colored, orange-brown quartz diorite to white granite; age 420 ± 30 m.y.* by radioactive dating.

Ultramafic Rocks — Olivine serpentinite with partly to completely altered olivine, pyroxene, and amphibole; includes metaperidotite, metadunite, and subordinate rock and altered gabbro pyroxenite or metagabbro.

Baltimore Gabbro Complex — Hypersthene gabbro with subordinate amounts of olivine gabbro, norite, troctolite, and pyroxenite; igneous structures and textures well preserved; intrusive; age 420 ± 30 m.y.* by radioactive dating; regions of alteration and recrystallization, and still younger metamorphism and localized mafic to ultramafic structural assemblages.

* Radiogenic date from Wetherill et al., 1966.

HARFORD COUNTY

Metagabbro and Amphibolite — Massive, medium-grained, light-colored, orange-brown quartz diorite to white granite; age 420 ± 30 m.y.* by radioactive dating.

Ultramafic and Gabbroic Rocks — Mixed metagabbro, serpentinite, amphibolite, and ultramafic, chlorite, and mafic-bearing schists.

SOURCES OF GEOLOGIC INFORMATION

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