DESCRIPTION OF MAP UNITS

QUATERNARY AND TERTIARY SURFICIAL MATERIALS

Qa **Alluvium (Holocene)**--Well to poorly sorted stratified mixtures of unconsolidated clay, silt, sand, gravel, and cobbles underlies flood plains of nearly all rivers and tributaries. The channel of the tributary is commonly on bedrock with alluvium exposed along the banks. Thickness of alluvium is highly variable as a function of bedrock, topography, and land-use practices. Locally, thick alluvium is related to mill dams and siltation associated with agricultural erosion in the 19th century, as well as recent development.

Qt **Terrace deposit, low level (Holocene and Pleistocene)**—Sand, gravel, and boulders on flat benches as much as 50 m above the flood plain

Colluvium (Holocene and Pleistocene)—

Qcf **Fine colluvium--**Lensoid aprons of poorly-sorted, subangular clasts of quartzite, phyllite, greenstone, epidosite, and vein quartz supported in a silt matrix are fine colluvium (Qcf) that covers the bedrock of the western margin of the Culpeper basin along the slope of Catoctin Mountain.

Qc **Coarse colluvium**—Coarse colluvium (Qc) consists of cobbles and boulders of predominately quartzite that are concentrated in hillslope depressions on Blue Ridge-Elk Ridge, Short Hill-South Mountain, Catoctin Mountain, and Sugarloaf Mountain, by gravity, debris-flow, and freeze-thaw processes.

Qr **Residuum (Holocene and Pleistocene)**—Unconsolidated mixture of moderate reddish brown soil, and pebbles, and blocks of grayish pink to white angular, locally euhedral quartz derived from in situ weathering of underlying carbonate rocks. Thickness ranges from a thin veneer to 3 m. Superficially resembles terrace deposits

Ql

Lag gravel (Holocene and Pleistocene)-- A distinctive residuum called lag gravel (Ql) formed from *in situ* weathering of conglomeratic rocks of the Goose Creek. Member of the Turkey Run Formation in the western part of the Culpeper basin south of Leesburg, Va. Natural surface accumulations of rounded quartz pebbles and cobbles superficially resemble terrace deposits. Excavations near the Loudoun County Landfill reveal a thick regolith of saprolitized cobbles and boulders around pinnacles of bedrock.

QTt

Terrace deposit, high level (Pleistocene and Tertiary)--High level terraces (Qt) of the ancestral Potomac, Shenandoah, and Monocacy Rivers are preserved locally on isolated hillocks. The conspicuous deposits are composed largely of rounded sandstone and quartzite with *Skolithus* (trace fossil) whose sources are Lower Cambrian and younger rocks of the Valley and Ridge Province. The deposits are isolated remnants of former more extensive terraces. Some of the highest deposits, such as Mt. Sterling, in Loudoun County and east of Lucketts, Va., and south of Dickerson, Md., are the result of topographic inversion of an ancient channel.

ATLANTIC COASTAL PLAIN

Kp

Potomac Formation (Lower Cretaceous)— Unconsolidated, compact, well-sorted, stratified gravel, sand, silt, and clay that unconformably overlies rocks of the Laurel Formation in the extreme southeast corner of the map area near Silver Spring, Md.

EARLY MESOZOIC ROCKS OF THE CULPEPER AND GETTYSBURG BASINS

Jd

Jdh
Jdc
Jdg

Diabase dikes and sills (Early Jurassic)—Medium- to dark-gray, medium crystalline and equigranular, massive diabase, with characteristic orange-brown weathered surface. Several magma types: (1) olivine normative (olivine-plagioclase-pyroxene) tholeiitic diabase; (2) low-titanium, quartz-normative tholeiitic diabase containing centimeter-

size phenocrystic clusters of calcic plagioclase in a fine-grained groundmass of pyroxene and plagioclase; (3) high-titanium, quartz-normative tholeiitic diabase in differentiated sheets (Jdh). Igneous differentiation produced early, bronzite-bearing cumulates (Jdc) lower in the sheets and late-stage differentiates higher in the sheets such as granophyre (Jdg), ferrogabbro, diorite, syenite, and aplite, which contain pink potassium feldspar, albite, hornblende, biotite, and quartz. Diabase dikes shown as Jd. Dikes vary from a wedge-edge to more than 150 m wide and sheets exceed 600 m in thickness

JTrtm **Thermally metamorphosed rocks (Lower Jurassic and Upper Triassic)**—Variegated hornfels, quartzite, marble, meta-arkose, and metaconglomerate in zoned contact aureoles adjacent to diabase intrusions. Includes dark-gray to olive black cordierite-spotted hornfels, bluish-gray epidote and chlorite hornfels, white to pinkish-gray tourmaline granofels or quartzite, greenish to purplish gray epidote and chlorite meta-arkose, and white, light-gray and pink, crystalline marble. Contact aureoles a few meters thick adjoin narrow dikes. More than 213 m thick and as much as 1.6 km wide adjacent to thick sheets; rocks are hard, brittle, fractured and unweathered; sedimentary structures are commonly preserved

Meriden Group

Js
Jss **Sander Basalt (Lower Jurassic)**—Dark gray to bluish-gray, fine- to medium-crystalline, porphyritic to equigranular basalt with plagioclase, augite, and pigeonite phenocrysts; locally vesicular and amygdaloidal at tops of flows. Lower flows of basalt locally separated from stratigraphically higher flows of basalt by poorly exposed reddish-brown sandstone and siltstone (Jss). Basalts are characterized by distinctive curved columnar joints locally overprinted by closely spaced fractures; apparently paraconformable with underlying and intercalated sedimentary rocks; estimated thickness less than 300 m

Jtr

Jtrc

Turkey Run Formation (Lower Jurassic)—Reddish brown and dark gray sandstone, siltstone, conglomerate, and shale, interbedded in cyclic sequences; sandstone is fine- to coarse-grained, locally pebbly and crossbedded, micaceous, poorly sorted; siltstone has very fine detrital muscovite, ripple-laminated; shale is fissile, laminated, fossiliferous and carbonaceous; conglomerate of variegated, subrounded boulders, cobbles, and pebbles of greenstone, quartzite, marble, quartz, and subangular basalt clasts (Jtrcg). Cycles consist of meter-scale alternation of coarser and finer grained layers. Deeply weathered and poorly exposed

Jhg

Jhgs

Hickory Grove Basalt (Lower Jurassic)—Medium- to dark-gray, fine- to medium-crystalline, microporphyritic to equigranular basalt, with plagioclase, augite, and pigeonite phenocrysts; locally vesicular and amygdaloidal at tops of flows with vugs filled by zeolites, calcite, and prehnite. Consists of two or three separate flows of basalt (Jhg), locally separated by poorly exposed, reddish-brown sandstone and siltstone (Jhgs). Locally disconformable but regionally paraconformable to underlying and overlying sedimentary rocks

Jmc

Jm

Midland Formation (Lower Jurassic)—Reddish-brown and light- to dark-gray siltstone, sandstone and shale (Jm) and conglomerate (Jmc), interbedded in cyclic sequences; siltstone is micaceous, commonly ripple-laminated, locally bioturbated, calcareous, carbonaceous, and fossiliferous; sandstone is fine- to coarse-grained, feldspathic, locally pebbly, crossbedded and ripple-laminated; shale is silty, burrowed, with dessication cracks, carbonaceous, pyritic, calcareous, microlaminated, and fossiliferous; lenticular variegated cobble and pebble conglomerate and conglomeratic, coarse-grained, arkosic sandstone are locally near border fault. Poorly exposed but unit is paraconformable to basalt formations above and below

Chatham Group

Jmz

Mount Zion Church Basalt (Lower Jurassic)—Dark-gray to black, aphanitic to very-fine crystalline,

microporphyritic high-titanium, quartz-normative tholeiitic basalt. Contains phenocrysts of augite and plagioclase; flow tops are vesicular and contain amygdules filled by calcite, zeolites, and prehnite. Weathers to reddish-brown or gray saprolite in uplands. Poorly exposed but probably conformable or paraconformable to underlying and overlying sedimentary rocks

JTrc **Catharpin Creek Formation (Lower Jurassic and Upper Triassic)--**Very dark red to dusky red sandstone, siltstone, and conglomerate, interbedded in cyclic sequences about 30 m thick. Sandstone is micaceous, arkosic, and pebbly; overlain by dusky red and olive-gray, calcareous, micromicaceous, thin bedded to ripple-laminated siltstone that is sparsely fossiliferous and laterally persistent. Reddish-brown conglomerate is lenticular, with rounded cobbles and pebbles of mainly quartzite and greenstone in fine- to coarse-grained arkosic sandstone matrix

JTrcg **Goose Creek Member—**Variegated**,** lenticular conglomerate and interbedded reddish-brown to grayish-green pebbly sandstone; conglomerate is thick bedded to massive, with subrounded pebbles and cobbles of mainly quartzite, greenstone, metasiltstone, gneiss, vein quartz, and carbonate in medium- to coarse-grained arkosic and calcitic sandstone matrix; dusky-red sandstone is micaceous, arkosic, pebbly, and medium- to thick bedded, poorly sorted, silty, fine- to coarse-grained. Deeply weathered to thick orange-brown saprolite mantled by lag gravel. Intertongues laterally into main body of Catharpin Creek

Bull Run Formation (Upper Triassic)—

Trbg **Groveton Member—**Light- to dark-gray, light greenish-gray, and black, thin-bedded to laminated, locally ripple marked, mud cracked, calcareous and dolomitic, sparsely fossiliferous, silty and sandy shale; interbedded with dusky red, thin bedded, calcareous, bioturbated, micaceous, feldspathic, clayey and sandy siltstone in cyclic sequences 3 to 9 m. Unit grades northward into fluvial and deltaic

sandstones and siltstones, but unit is partly repeated by faulting, and is laterally equivalent to the Balls Bluff Member

Trbb

Balls Bluff Member—Reddish-brown, thin- to medium-bedded, feldspathic, locally crossbedded, fine- to medium-grained silty sandstone interbedded with dusky red, thin bedded, calcareous, bioturbated, micaceous, feldspathic, clayey and sandy siltstone in repetitive sequences 1 to 3 m thick. Intertongues laterally with carbonate conglomerate of Leesburg Member to the northwest, and with the Groveton Member to the south

Trbl

Leesburg Member—Variegated, light gray-weathering, crudely-bedded carbonate conglomerate with conspicuous subangular to subrounded boulders, cobbles and pebbles of grayish and reddish lower Paleozoic limestone and dolostone in reddish-brown pebbly sandstone and calcareous sandy siltstone matrix. Intercalations of calcareous sandstone and siltstone thicken to the southeast where they tongue into the main body of sandstone and siltstone of the Balls Bluff Member

Manassas Sandstone (Upper Triassic)—

Trmp

Poolesville Member—Predominantly gray, pinkish gray, and reddish brown, fine- to coarse-grained, thick bedded, arkosic and micaceous sandstone; locally pebbly and crossbedded where it fills channels; commonly interbedded with calcareous, reddish-brown siltstone in upward-fining sequences in upper part of unit; as much as 900 m thick; gradational and intertonguing relationship to overlying and underlying units

Trmt

Tuscarora Creek Member—Light- to dark- gray and light-red, variegated conglomerate composed of very-fine to very-coarse-grained, angular to subangular pebbles and cobbles of limestone and dolomite within a matrix chiefly of limestone and dolomite granules and dusky-red to grayish-red, clayey sand and silt with calcite cement. Limestone

and dolomite clasts derived from Cambrian and Ordovician strata

Trmr

Reston Member—Light-gray to pinkish-gray, variegated pebble, cobble, and boulder conglomerate containing clasts of phyllite, schist, quartzite, metagraywacke, and quartz in a poorly-sorted, coarse grained, arkosic sandstone matrix; locally interbedded with pale reddish-brown sandstone and siltstone. Basal conglomerate unconformably overlyies metasedimentary rocks of the central and eastern Piedmont.

PALEOZOIC ROCKS OF THE GREAT VALLEY OF THE VALLEY AND RIDGE PROVINCE

Om

Martinsburg Formation (Upper and Middle Ordovician)—Light-brown shale, calcareous shale, siltstone, with thin to medium beds of sandstone and metagraywacke in the upper part; gray argillaceous limestone at base

Oc

Chambersburg Limestone (Middle Ordovician)— Light-gray, argillaceous, nodular limestone

Osp

St. Paul Group (New Market and Row Park Limestone undivided (Middle Ordovician)— Light- to medium-gray, thick-bedded micritic limestone and bioclastic limestone, containing bedded black chert nodules

Beekmantown Group

Ops

Pinesburg Station Dolomite (Middle Ordovician)— Light-gray, medium- to thick-bedded dolostone and dololaminate with white and light-gray chert nodules. Characteristic “butcher-block” (cross-hatched joints) weathered surface. Collapse breccia and paleokarst irregular bedding near top

Orr

Rockdale Run Formation (Middle and Lower Ordovician)—Light-, medium-, and dark-gray, fine- to medium-grained, thin- to medium- bedded fossiliferous limestone and crystalline dolostone. Contains gray chert nodules

Os **Stonehenge Limestone (upper part) (Lower Ordovician)—**Dark-gray, fine- to medium-grained, thick-bedded, fossiliferous limestone with minor black chert. Contains algal bioherms, intraformational conglomerates, bioclastic beds, and minor dolostone beds

Oss **Stoufferstown Member—**Light-gray, silty, laminated limestone, thin interbeds of platy limestone and coarse bioclastic limestone

OCc **Conococheague Limestone (Lower Ordovician and Upper Cambrian)—**Dark- to light-gray algal laminated limestone, dolomitic limestone, light brown dolomite, and sandstone, interbedded

Ccbs **Big Spring Station Member (Upper Cambrian)—**Light gray calcareous to dolomitic sandstone, medium-gray, fine-grained limestone with intraformational conglomerate, and light-gray, fine-grained dolostone

Ce **Elbrook Limestone (Upper and Middle Cambrian)—** Medium-gray, thinly bedded limestone interbedded with white mylonitic marble, light brown laminated dolomite, and thin, calcareous shale to shaly dolomite

Waynesboro Formation (Lower Cambrian)—

Cwac **Chewsville Member—**Dusky red shale, mudstone and argillaceous sandstone, light-gray sandstone, and light brown sandy, dolomitic limestone and dolomite interbedded

Cwak **Cavetown Member—**Medium- to dark-gray, bioturbated dolomite, dolomitic limestone and laminated limestone, interbedded, with a few thin sandy limestone beds near the middle

Cwar **Red Run Member—**Light-olive-gray shale, light-gray, fine-grained sandstone, and medium- to dark-gray, sandy, dolomitic limestone, interbedded

Cwa **Undifferentiated—**Shown in cross section only

Tomstown Formation (Lower Cambrian)—

Ctd — **Dargan Member—**Lower part is dark-gray bioturbated dolomite interbedded with intervals of dark-gray laminated dolomite and dark-gray limestone. Upper part is a dark-gray bioturbated and oolitic dolomite, interbedded with laminated limestone, and silty dolomite

Ctb — **Benevola Member—**Light gray very thick-bedded to massive, sugary dolomite with faint crossbedding. Base is gradational with the underlying bioturbated dolomite of the Fort Duncan Member. Pure and massive dolomite quarried as aggregate

Ctf — **Fort Duncan Member--**Dark-gray, burrow-mottled, thick-bedded dolomite. Base is probably an erosion surface on the Bolivar Heights Member.

Ctbh — **Bolivar Heights Member--**Dark-gray thin-bedded fine-grained limestone having wispy dolomitic burrows that increase upsection. Base of the member is a 15-m-thick interval of gray to white mylonitic marble, termed the Keedysville marble bed, interpreted to be a regional thrust fault that detached the carbonate rocks from the underlying rocks of the Antietam Formation (Brezinski and others, 1996).

Ctu — **Undifferentiated—**Light- to dark-gray limestone, dolomite, and marble; shown in cross section only

BLUE RIDGE PROVINCE

Ct — **Tomstown Formation (Lower Cambrian)—**Medium-light-gray to medium-gray saccharoidal dolomite and dolomitic marble containing thin layers of sericite. Poorly exposed

Ccp — **Carbonaceous phyllite (Lower Cambrian)—** Medium-to dark-gray fine-grained muscovite-graphite phyllite. Locally contains mm- to cm-scale alternating light- and dark-gray bedding laminae. Produces distinctive light-gray soil. Found only as float or small slumped outcrops in discontinuous

lenses above Antietam Quartzite near Furnace Mountain. Interfingers laterally with dolomite of the Tomstown Formation

Chilhowee Group

Ca

Antietam Formation (Lower Cambrian)—Light-olive-gray to olive-gray, medium- to coarse-grained, medium-bedded, locally ferruginous, micaceous, silty metasandstone interbedded with very-fine-grained, silty metasandstone to sandy metasiltstone. Near contact with overlying Tomstown Formation or carbonaceous phyllite are local ferruginous horizons with abundant botryoidal hematite and limonite.

Ch

Harpers Formation (Lower Cambrian)—Dark-greenish-gray to brownish-gray, fine to very fine grained, laminated to massively bedded, chlorite-muscovite-quartz phyllitic metasiltstone. Magnetite-rich sandy metasiltstone, fine-pebble conglomerate, and thin-bedded metasandstone found locally in the western Blue Ridge. On Catoctin Mountain the rock is a phyllite with transposed bedding and metamorphic foliation consisting of alternating mm-scale quartzose and micaceous laminae

Chs

Metasandstone--Light-gray to brown, thin-bedded metasandstone, locally with *skolithus* burrows, is interbedded with metasiltstone west of Blue Ridge-Elk Ridge near Harpers Ferry, W.Va.

Weverton Formation (Lower Cambrian)—

Cwo

Owens Creek Member—Dusky blue, dark-gray, to dark-purplish-gray very coarse grained quartzite and quartz pebble conglomerate. Poorly sorted, thick bedded, with graded beds and crossbeds; contains local accumulations of magnetite, ilmenite, and pebbles of red jasper, red and purple quartz, and phyllite. Interbedded with poorly exposed dark greenish-gray phyllitic metasiltstone. Gradational with overlying Harpers Formation

Cwm

Maryland Heights Member—Greenish-gray to light-gray massive, medium-grained to granular quartzite in 5 to 10 m thick beds. Forms topographic ledges but is not well exposed. Thick quartzite bed mapped separately on Catoctin Mountain in Maryland (Cwmq)

Cwb

Buzzard Knob Member—Light- to medium-gray, fine- to medium-grained, well sorted, graded, crossbedded, massive thick bedded vitreous quartzite interbedded with light-gray metagraywacke and metasiltstone; locally arkosic where unconformable to Mesoproterozoic gneiss on Blue Ridge. White to gray, massive to thickly bedded vitreous quartzite with thin (less than 0.3 m thick) interbeds of dark phyllite is restricted to Catoctin Mountain in Virginia

Cw

Undifferentiated

Loudoun Formation (Lower Cambrian)—

Clc

Conglomerate—Dark-gray to dusky-blue, very coarse pebble conglomerate with pebbles of rounded to subrounded white, blue, and red quartz, gneiss(?), red jasper, and variegated phyllite in grayish-black, iron-rich silty matrix; local interbeds of fine pebble conglomerate and graded and crossbedded quartzite conglomerate is locally transitional with overlying Weverton Formation.

Clp

Phyllite—Gray-black, light-olive-gray to dark-purple-gray phyllite containing tuffaceous clasts and elongated amygdules. Dark-gray to greenish-gray weathering chlorite-quartz-graphite-muscovite phyllite and lesser white to gray-weathering pebbly metasandstone with thin phyllite interbeds are on Catoctin Mountain. Base of unit is transitional with the underlying Catoctin Formation; top of unit is sharp contact with conglomerate or overlying Weverton Formation

Catoctin Formation (Neoproterozoic)—

Zc — **Metabasalt—**Light-green, dark-greenish-gray to medium-bluish-gray, fine-grained to aphanitic, massive to schistose, amygdaloidal metabasalt and schistose greenstone, composed of actinolite, chlorite, epidote, albite, and rare quartz. Contains lenses and layers of fine-grained, hard, massive apple-green epidote-quartz rock (epidosite). Locally contains interlayered agglomeratic metabasalt breccia

Zcs — **Metasedimentary phyllite—**Light gray to variegated, finely-laminated quartz-graphite-muscovite phyllite

Zcp — **Tuffaceous phyllite—**Dark variegated to lustrous, silvery-white metarhyolitic vesicular blebby phyllite and fine-grained quartz-sericite phyllite interpreted as felsic metatuff

Zcr — **Metarhyolite—**Light gray and tan vesicular and blebby phyllite, massive silvery-white schist with phenocrysts, and aphanitic quartz-muscovite schist

Zcm — **Marble—**Pinkish white, light green massive to schistose marble gray- to buff-weathering, fine- to medium-grained, massive to schistose white calcite marble. Margins of the marble locally contain coarse-grained actinolite, tremolite, and chlorite.

Zrd — **Metarhyolite dikes (Neoproterozoic)—**White- to gray-weathering, aphanitic to fine-grained quartz sericite schist and very fine grained flinty rock with plagioclase feldspar phenocrysts in a felted groundmass consisting of quartz, feldspar, biotite, and epidote

Zmd — **Metadiabase dikes (Neoproterozoic)—**Dark-greenish-gray, fine- to medium-grained, massive to schistose metadiabase and schistose greenstone composed predominantly of chlorite, albite, epidote, and actinolite. Coarser grained variety has stubby, 2 to 8 mm long actinolite pseudomorphs after clinopyroxene which produce distinctive nubbly texture. Rare aphanitic metadiabase has relict

euhedral plagioclase laths. Compositionally similar to metabasalt of the Catoctin Formation

Swift Run Formation (Neoproterozoic)—

Zsl

Marble—Gray- to buff-weathering, medium- to fine-grained, white calcitic and dolomitic marble with local thin arenaceous layers in discontinuous layers

Zsp

Phyllite—Grayish-red-purple phyllite, grayish-green finely laminated phyllite, dark-greenish-gray to brown-gray sandy sericitic phyllite, and medium-dark-gray slate in fining-upward sequence. Pink-gray to light-brownish-gray fine-grained, dolomitic marble locally found near top

Zss

Metasandstone and schist—Pinkish- to greenish-gray very coarse to medium-grained metasandstone and quartzite with crossbeds and quartz pebbles and cobbles, brownish-green chlorite-sericite-feldspar-quartz metagraywacke, and lustrous, silvery quartz sericite schist in fining-upward sequence. Grayish-brown meta-arkose (fossil soil?) locally found at basement-cover contact

Fauquier Group

Zcrs

Carter Run Formation (Neoproterozoic)—Light to medium gray and olive gray, light yellowish-gray weathering, coarse- to fine-grained sericite-potassium feldspar-quartz metasiltstone and meta-arkose. Bedding is of variable thickness (0.3-2 m), defined by fining-upward sequences; tangential and trough crossbeds are common. Gravel and isolated cobble sized clasts occur locally

Swains Mountain Formation (Neoproterozoic)—

Zsm

Mudstone--Light gray, light-brown weathering, thinly laminated (less than 2 cm) sericite-quartz metamudstone and lustrous sericite phyllite. Quartz in metamudstone is very fine sand. Upper contact gradational with rocks of the Catoctin

Zsmc

Boulder conglomerate--Light to dark gray, cobble conglomerate and meta-arkose with biotite-chlorite-sericite-potassium feldspar-quartz matrix. Bedding is of variable thickness (0.5-6 m), defined by fining-upward sequences. Cobbles are locally derived metagranite. Trough crossbeds of coarse- to medium-grained arkose are common. Lower contact is an unconformity which has as much as 100 m relief and is distinct and abrupt; elsewhere it is obscured within a zone of schist that is possibly metamorphosed fossil soil. Upper contact is gradational into meta-arkose unit

Robertson River Igneous Suite (Neoproterozoic)—

Zrc

Cobbler Mountain Alkali Feldspar Quartz Syenite—Gray to buff weathering, massive medium-grained alkali feldspar quartz syenite. Consists of stubby, euhedral mesoperthite grains 2 to 4 mm in diameter intergrown with anhedral quartz, amphibole breaking down to quartz, plagioclase, and oxides, and minor, interstitial plagioclase. Mesoperthite crystals conspicuous on weathered surface. Locally cut by dikes of fine-grained granite of presumably coeval magma source

Ypb

Megacrystic metagranite (Mesoproterozoic)—Light- to medium- gray, medium- to coarse-grained quartz monzonite gneiss with large pink potassium feldspar porphyroblasts; strong Paleozoic schistosoity is the dominant foliation

Ybg

Biotite granite gneiss (Mesoproterozoic)--Orange to gray-weathering, pink, medium-grained, well foliated or lineated biotite plagioclase-quartz-microcline gneiss. Biotite 10-15 percent by volume. Middle Proterozoic foliation expressed by planar aggregates of biotite; locally, foliation is weak or absent and replaced by a lineation expressed by biotite streaks and rodded quartzofeldspathic grains. Occurs interlayered with leucocratic metagranite (Yg and Ygt).

Yml

Pink leucocratic metagranite (Mesoproterozoic)—Pink leucocratic metagranite-pink, medium- to medium-

fine-grained, massive to moderately foliated plagioclase-quartz-microcline granite gneiss. Biotite locally present (0-10 percent). Foliation defined by flattened quartz and feldspar grains and local thin biotite-rich layers

Yg **White leucocratic metagranite (Mesoproterozoic)—** White, medium- to medium-fine-grained, massive to moderately foliated plagioclase-quartz-microcline granite gneiss. Biotite locally present (0-5 percent). Middle Proterozoic foliation defined by biotite where present and by flattened grains of quartz and feldspar and thin aplite layers

Ygt **Garnetiferous metagranite (Mesoproterozoic)—**White, medium to medium-fine-grained, massive to moderately foliated garnet-plagioclase quartz-microcline granite gneiss. Garnets commonly dark due to rim alteration to biotite and chlorite

Yqp **Quartz-plagioclase gneiss (Mesoproterozoic)—**White, medium to medium-fine-grained, weakly to moderately well-foliated biotite-quartz-plagioclase gneiss. Biotite content variable, from 0-5 percent. Foliation defined by biotite where present and by flattened quartz and feldspar grains and thin aplite layers. Strongly resembles leucocratic metagranite (Yg) but potassium feldspar rare or absent

Ym **Marshall Metagranite (Mesoproterozoic)—**Light gray, and pink, medium-grained, weakly to moderately well foliated and/or lineated biotite-plagioclase-quartz-microcline biotite metagranite with a leucocratic phase and a biotitic phase. Biotite ranges in abundance from 10-15 percent. Layering locally produced by veins of pink pegmatite parallel to foliation

Ymc **Coarse-grained metagranite (Mesoproterozoic)—**Gray to pink, medium to coarse-grained, massive to well-foliated biotite-plagioclase-quartz-microcline granite gneiss. Characterized by 1 to 2 cm long white or pink microcline porphyroblasts and aggregates of blue quartz; biotite content ranges from 0-10 percent. Commonly contains

pronounced augen texture due to overprinting by Paleozoic schistosity

Ypg **Porphyroblastic metagranite (Mesoproterozoic)—** Yellowish-brown-weathering, medium- to coarse-grained garnet-biotite-plagioclase-quartz-microcline metagranite. Characterized by megacrysts of orange to pink microcline or microcline-rich aggregates which are deformed into rounded ovoids 1-3 cm diameter; garnet, biotite, plagioclase, opaques, and distinctive clots of blue quartz occur interstitially. Flattened ovoids define foliation, which is locally cut by dikes of garnetiferous metagranite (Ygt)

Yhm **Hornblende monzonite gneiss (Mesoproterozoic)—** Gray-weathering, medium-fine to fine-grained, well-foliated hornblende-quartz-microcline-plagioclase gneiss. Foliation defined by strongly flattened quartz and feldspar grain aggregates and prismatic hornblende; quartz content 10-20 percent and hornblende as much as 30 percent. Rarely occurs as a more massive, spotted rock. Biotite and orthopyroxene are rare mafic constituents

Ylg **Layered granitic gneiss (Mesoproterozoic)—**White, gray, or pink, medium to fine-grained, well-layered garnet-biotite plagioclase-quartz-microcline gneiss. Mm- to cm-scale layering defined by concentrations of biotite and aplitic layers; garnets up to 1 cm in diameter scattered throughout rock. Folded layering and swirly, migmatitic texture suggests partial melting; protolith is interpreted to be a felsic volcanic rock

Yc **Charnockitic granite (Mesoproterozoic)--**Dark green and brown, yellow-brown weathered, medium- to coarse-grained, massive to well-foliated quartz-hornblende-orthopyroxene-microcline-plagioclase charnockitic granite (Yc); poorly exposed underlying topographic knolls, mapped primarily on the basis of float of fresh black rock having a distinctive orange crust and orange soil. Charnockitic granite occurs as discontinuous lensoid and plug-like bodies.

Ya **Amphibolite (Mesoproterozoic)—**Dark green and brown, gray-weathering, medium- to coarse-grained, massive to weakly foliated hornblende-orthopyroxene-plagioclase gneiss or amphibolite (Ya) is spotted, medium- to coarse-grained, and mostly massive but locally well-foliated. It contains subordinate sill or dike-like bodies of metanorite, metadiorite, and hornblende-biotite gneiss

Yp **Garnet graphite paragneiss (Mesoproterozoic)—** Reddish brown (rusty-weathering), medium-fine to fine-grained, well-foliated to layered graphite-biotite-garnet plagioclase-quartz gneiss and schist. Layering defined by alternating mm-scale garnet-rich zones containing 0.1 to 1 cm diameter garnets and garnet aggregates and cm-scale quartzofeldspathic layers. Garnets typically deformed and retrograded to green lensoid clots of fine-grained chlorite and muscovite. Graphite occurs as disseminated, small, rounded flakes. Distinctive orange-red stain produced by secondary hematite after accessory magnetite. Retrograded, schistose varieties include quartz-chlorite-magnetite schist and carbonaceous phyllonite. Probable remnant of pre-granitic country rock

Yq **Quartzite and quartz tectonite (Mesoproterozoic)—** Light-gray to white, fine- to medium-grained, massive quartzite and quartz-sericite tectonite. No primary textures recognized such as bedding or early metamorphic foliation. Rounded zircons in a quartz mylonite are seen in thin section; commonly contains strong Paleozoic penetrative cleavage. Contains thin lenses of graphite in outcrop and larger mappable pods of paragneiss (Yp)

PIEDMONT PROVINCE

WESTERN PIEDMONT

Frederick Valley

Grove Formation (Lower Ordovician and Upper Cambrian)—

OCgu

Upper member—Medium-light-gray locally sandy, thrombolitic and stromatolitic algal limestone and medium-gray laminated dolomitic limestone and olive gray dolomite. Thickly interbedded

OCgs

Lower member—Medium-light-gray to medium-gray thick-bedded and crossbedded, arenaceous limestone and sandy dolomitic limestone containing 0.3 m thick interbeds of medium-light-gray sandy dolomite

Frederick Formation (Upper Cambrian)—

Cfl

Lime Kiln Member—Dark gray fine-grained limestone and calcareous shale interbedded, thinly laminated to thin-bedded, and medium-bedded, fine-grained limestone near the base, becoming more thickly interbedded toward the top with wavy-bedded medium-dark-gray, fine-grained limestone containing local stromatolitic algal beds. Near the top, becomes interbedded with crossbedded, sandy, medium-light-gray limestone

Cfa

Adamstown Member—Thinly-interbedded, medium-dark-gray to dark-gray, argillaceous, fine-grained limestone thinly interbedded with dusky-yellow to medium-dark-gray, silty dolomite. Several thin, dark-greenish-gray to greenish-black, light-olive-brown weathering, silty, calcareous shale intervals 2 to 15 m thick are present throughout the member

Cfr
Cfrs

Rocky Springs Station Member—Dark-gray, argillaceous, nodular to lumpy-bedded dolomitic limestone at the base containing an interval of grayish-black, platy shale (Cfrs) as much as 20 m thick mapped along the eastern flank of the Frederick Valley. Upsection becomes laminated to flaggy-bedded, dark-gray limestone having dusky-yellow to light-olive-gray, silty dolomitic partings and laminations, and intervals as much as 10 m thick of medium-dark-gray, polymictic breccia that grade upsection into planar-bedded, arenaceous, medium-gray (N5) limestone. Clast sizes range from sand size to 0.5 m diameter on the western side of the Frederick Valley and diminish to less than 1 cm in diameter on the eastern side of the Frederick Valley

Cf

Undivided—Light gray limestone

Ccs

Cash Smith Formation (Middle and Upper Cambrian)—Grayish black fissile, platy, and cleaved shale and slate, grading upward into thin-bedded calcareous shale with limestone nodules

Car

Araby Formation (Middle and Lower Cambrian)— Light-olive-gray, mottled metasiltstone containing sandy intervals; pervasively cleaved bedding typically obscure

Sugarloaf Mountain Anticlinorium

Urbana Formation (Lower Cambrian?)—

Cu

Undivided--Moderate olive brown to light olive gray calcareous metasandstone, metagraywacke, quartzite, and metasiltstone. Poorly sorted, graded beds, crossbeds, and sparse ripple marks

Cum

Marble—Light greenish-gray thin-bedded crystalline marble, and schistose to massive chlorite-rich, sandy calcitic marble. Poorly exposed; produces distinctive reddish orange soil

Cuq

Quartzite—Light olive gray and light brownish gray, very calcareous, metasandstone and quartzite. Fine- to coarse-grained, thin- to medium-bedded, crossbedded, pitted, vuggy, friable, lensoidal and discontinuous. Interbedded with light brown (5 YR 5/6) laminated metasiltstone.

Sugarloaf Mountain Quartzite (Lower Cambrian)—

Csqu

Upper member--Pink and white massive, cross-stratified quartzite with ripple marks. Medium bedded to massive, and well-sorted

Csqm

Middle member—White, purple to light gray massive quartzite interbedded with seldom exposed moderate-brown quartzose metasiltstone and dusky-blue laminated metasiltstone similar to that of the conformably overlying Urbana Formation

Csql

Lower member—Poorly exposed light gray quartzite

Csq **Undivided--**Shown in cross section only

CENTRAL PIEDMONT

Westminster Terrane

CZwm **Wakefield Marble (Lower Cambrian? and Neoproterozoic?)—**Massive to finely bedded reddish-white dolomite-calcite marble, marble rich with quartz sand, and sandy marble

Sams Creek Formation (Lower Cambrian? and Neoproterozoic?)--

CZscg **Metabasalt—**Dark greenish gray to medium bluish gray aphanitic to porphyritic, massive to schistose metabasalt composed of chlorite, epidote, quartz, altered lagioclase, actinolite, hornblende, and albite; igneous texture is locally preserved and pods of epidosite are common; includes some metaconglomerate composed of greenstone pebbles and cobbles, and local pillow structures and hyaloclastite

CZscf **Felsic schist—**Medium bluish gray, grayish blue, very pale blue, and light olive gray fine-grained intermediate-composition tuffaceous fragmental metavolcanic and metavolcaniclastic quartz-muscovite-feldspar schist locally interbedded with metabasalt

CZscm **Marble—**Brownish gray to grayish red purple massive- to thin-bedded calcite marble containing quartz sand; includes minor calcareous metasiltstone

CZsctp **Tuffaceous phyllite—**Grayish red purple and bluish gray, variegated vesicular phyllite with light gray streaks and blebs

CZscmp **Muscovite phyllite—**Light bluish gray, dusky yellow, and moderate orange pink muscovite-chlorite phyllite containing albite porphyroblasts, quartz, and hematite dust. Contains minor

metasiltstone. Lithologically distinct from rocks of the Ijamsville Phyllite and Marburg

CZschp — **Hematite phyllite—**Bluish-purple hematite-rich phyllite; resembles Ijamsville Phyllite

CZscl — **Metalimestone—**Light gray thin-layered argillaceous metalimestone

CZscqs — **Quartzite interbedded phyllite—**Light gray quartzite interbedded with purple phyllite and slate, variegated conglomeratic phyllite, and bluish gray tuffaceous phyllite

CZscq — **Quartzite**—Light gray (N7) to grayish-green (5 G 5/2) medium-grained, thin-bedded to massive quartzite and minor calcareous sandstone; contains detrital plagioclase, orthoclase, and polymictic quartz. Bedding is defined by concentrations of heavy minerals. Interbedded with phyllite (Ꞓ Zscp), greenstone (Ꞓ Zscg), and metasiltstone and metagraywacke (Ꞓ Zscu)Light gray, medium and coarse grained quartzite, locally calcareous and cross bedded

CZscs — **Metasiltstone**—Metasiltstone, phyllite, quartzite, and metagraywacke, undifferentiated. Contains marble (Ꞓ Zscm) and quartzite (Ꞓ Zscq) units, and appears to overlie greenstone (Ꞓ Zscg). Bedding can be recognized except where transposed in shear zones adjacent to faults. Muscovite phyllite containing albite porphyroblasts and elongate blebs of chlorite is interpreted to be a metatuff Light brown metasiltstone interbedded with quartzite and calcareous metasandstone

CZscc — **Calcareous metasandstone—**Light brown and gray cross-stratified calcareous metasandstone and quartzite

Ijamsville Phyllite (Lower Cambrian? and NeoProterozoic?)—

CZi — **Phyllite--**Dusky blue, grayish blue, very dusky red purple, greenish gray to pale olive phyllite, phyllonite containing abundant pods and folded

stringers of white vein quartz, and minor slate. Intensely folded and sheared; finely laminated beds seen only in slate. Phyllite consists mostly of muscovite and chlorite, but also contains paragonite and chloritoid. Has a lustrous sheen because of paragonite (determined by x-ray diffraction) and dark color because of abundant hematite dust

CZig **Metabasalt—**Dark green and schistose metabasalt composed of chlorite, epidote, and quartz; rare pillows locally preserved

CZiq **Quartzite—**Yellowish gray, fine- to medium-grained sericitic quartzite locally intervenes between phyllite and metabasalt

CZim **Marble—**Light olive gray sandy limestone and dusky red calcareous quartzite occurs within phyllite locally

CZil **Metalimestone—**Light-bluish-gray, medium-light-gray, thin-bedded, laminated, carbonaceous and argillaceous metalimestone and minor medium-dark-gray, carbonaceous finely-laminated phyllite

CZid **Phyllite Conglomerate—**Light olive gray muscovite phyllite clasts supported in a dark gray matrix of chlorite, quartz, illmenite, magnetite, and zircon, occurs at two localities

CZic **Conglomeratic metagraywacke—**Light gray and green medium- to coarse-grained metagraywacke with white quartz pebbles, variegated phyllite, and green chloritic matrix

CZip **Chlorite phyllite—**Light olive gray and greenish gray chlorite phyllite and metasiltstone

Marburg Formation (Lower Cambrian? and Neoproterozoic?)—

CZmb **Metasiltstone**—Greenish gray, light olive gray, quartz-sericite-chlorite phyllitic metasiltstone containing thin (0.25 cm thick) light gray quartz laminae and ribbons, and Dusky blue, grayish blue, dusky red purple, greenish gray to pale olive muscovite- chlorite-paragonite hematite phyllite similar

to that of the Ijamsville Phyllite. Porphyroblasts of albite and chloritoid occur locally. Much of unit is transposed, phyllonitized, and has abundant pods and folded stringers of white vein quartz

CZmbg **Metagraywacke--**Grayish green to black, massive graywacke interbedded with dark phyllite

CZmbgs **Metabasalt—**Dark greenish gray to dusky yellow green aphanitic to porphyritic metabasalt containing epidosite

CZmbq **Quartzite—**Light gray to grayish-green, medium to coarse grained, massive quartzite

CZp **Prettyboy Schist (Lower Cambrian? and Neoproterozoic?)—**Dark green-gray quartz-muscovite-chlorite-albite schist with white euhedral albite crystals

CZpg **Metabasalt—**Dark green, massive, porphyritic, coarse to schistose greenstone composed of chlorite, epidote, and quartz

CZpq **Quartzite—**Brown, medium-grained quartzite interbedded with schist

EASTERN PIEDMONT

Potomac Terrane

Dp **Pegmatite (Late Devonian)—**Light-gray and white muscovite-microcline-albite-quartz pegmatite. Locally contains minor amounts of biotite, tourmaline, allanite, monzonite, magnetite, and pyrite. Most of the microcline is microperthitic. Crosscuts schistosity and foliation of the country rocks and is not deformed

Dg **Guilford Granite (Late Devonian)**--Light-gray, medium- to fine-grained, homogeneous nonfoliated monzogranite. About equal parts of microcline, plagioclase, and quartz constitute about 90 percent of the rock. The remainder consists of equal amounts of biotite and muscovite and minor amounts of apatite, garnet, clinozoisite, zircon, and

magnetite. Forms thin sheets that crosscut bedding and schistosity of the Northwest Branch Formation

Ok

Kensington Tonalite (Middle Ordovician)—Medium gray, coarse-grained, weakly- to moderately-foliated, locally garnetiferous, muscovite-biotite tonalite. In and near the Rock Creek shear zone and other sheared areas, the rock is intensely foliated to mylonitic muscovite-biotite granodiorite containing microcline augen and coarse porphyroblasts of microcline that suggest metasomatism during the shearing event. Petrographic and chemical data are given in Hopson (1964) and Fleming and others (1994)

Georgetown Intrusive Suite (Middle Ordovician)—

Ogh

Biotite-hornblende tonalite—Dark gray, medium- to coarse-grained, massive to foliated rock that has a strong relict igneous flow structure at many places. Unit contains many ultramafic and mafic xenoliths and(or) autoliths, and xenoliths of metasedimentary rocks. Typically contains 40-50 percent dark minerals. Petrographic and chemical data are given in Drake and Froelich (1997) and Fleming and others (1994)

Ogg

Quartz gabbro—Dark-gray, mostly medium- to coarse-grained quartz-augite-hornblende metagabbro, lesser quartz diorite, and much lesser quartz norite. At many places the unit contains thin cumulus layers of metapyroxenite and augite-hornblende rock. Petrographic and chemical data are given in Fleming and others (1994)

Ogp

Metapyroxenite—Dark-green to black, massive to well-foliated, medium- to coarse-grained metapyroxenite occurs within metagabbro (Ogg). Much of the rock has been altered to dark-green to grayish-green serpentinite. Unit forms small pods and xenolith swarms within or along the borders of larger tonalite and quartz gabbro plutons

Norbeck Intrusive Suite (Middle Ordovician)—

Ont

Biotite-hornblende tonalite—-Gray, medium- to coarse-grained fairly massive to foliated rock consisting largely of quartz, andesine, hornblende, and biotite and lesser chlorite, epidote, apatite, and magnetite. At many places, has a strong relict flow structure. Contains many xenoliths and(or) autoliths of more mafic rock. Petrographic and chemical data are given in Hopson (1964)

Ong

Quartz gabbro—Dark-gray, medium-grained quartz-augite-hornblende metagabbro. Forms small bodies within biotite-hornblende tonalite (Ont)

Onu

Ultramafic rocks—Dark-green, well-foliated serpentinite and lesser soapstone, probably altered from pyroxenite. Forms small bodies within biotite-hornblende tonalite (Ont)

Ontr

Trondhjemite—Light-gray, medium-grained, muscovite trondhjemite

Dalecarlia Intrusive Suite (Middle Ordovician)—

Odm

Biotite monzogranite and granodiorite— Medium-gray, medium- to coarse-grained, massive to well-foliated biotite monzogranite and lesser granodiorite. Locally contains plagioclase phenocrysts. Mapped bodies contain widespread lenses, zones, and irregular bodies of leucocratic biotite-muscovite monzogranite (Odl)

Odl

Leucocratic muscovite-biotite monzogranite— Light-gray, leucocratic, medium- to coarse-grained, foliated muscovite-biotite monzogranite. Locally grades into monzogranite (Odm), with which it commonly occurs

Odt

Muscovite trondhjemite—Light-gray, fine-to medium-grained, sugary textured, massive to weakly foliated muscovite trondhjemite dikes, sheets, and irregular bodies. Petrographic and chemical data are given in Drake and Fleming (1994)

Ob **Bear Island Granodiorite (Early Ordovician?)—**Light-gray, fine-grained, very leucocratic, muscovite-biotite granodiorite and related pegmatite composed largely of quartz, albite, and microcline. Forms small- to moderate-sized crosscutting sheets and bodies in rocks of the Mather Gorge Formation

OCq **Quartz bodies (Ordovician and Cambrian)—**White, massive, and fractured quartz probably intruded as a large vein

Cs **Sykesville Formation (Lower Cambrian)—**Gray variegated, metamorphosed sedimentary melange consisting of a quartzofeldspathic granofels matrix containing quartz and feldspar grains, and fragments and bodies of metamorphosed sedimentary, volcanic, and intrusive rocks

Cl **Laurel Formation (Lower Cambrian)—**Light- to medium-gray, medium- to coarse-grained, moderately- to well-foliated sedimentary melange consisting of a quartzofeldspathic matrix that contains quartz "eyes" and fragments of meta-arenite, and biotite schist. Is typically spangled with very large muscovite porphyroblasts. Upper part (Clo) contains more than 50 percent olistoliths of meta-arenite and biotite schist that are locally as much as 5-10 m long

Clo

CZo **Oella Formation (Lower Cambrian and(or) Neoproterozoic)—**Gray, fine- to medium-grained, quartz-plagioclase-biotite-muscovite-meta-arenite interbedded with lesser schist

CZl **Loch Raven Schist (Lower Cambrian and(or) Neoproterozoic)—**Medium-gray, lustrous, medium- to coarse-grained, thin-bedded quartz-muscovite-biotite-plagioclase schist that at places contains chlorite or garnet and(or) staurolite. Contains some interbedded semi-pelitic schist and meta-arenite (CZlm) similar to the underlying Northwest Branch Formation (Ꞓ Zn) into which it grades

CZlm

CZn **Northwest Branch Formation (Lower Cambrian and Neoproterozoic)—**Light-gray, medium-grained, well-bedded quartz-plagioclase-biotite meta-arenite and lesser quartzite and calc-silicate rock. Beds range from 1.3 cm to 1.2 m in thickness. Contains interbedded schist similar to the overlying Loch Raven Schist (Zl). Both the meta-arenite and quartzite have a good schistosity marked by biotite flakes

Mather Gorge Formation (Lower Cambrian and(or) Neoproterozoic)—

CZms **Quartz-rich schist—**Greenish-gray to gray, reddish-brown-weathering, lustrous, very fine grained, quartz-muscovite-chlorite-plagioclase-epidote-magnetite-hematite schist containing interlayers of phyllitic metasiltstone, mica gneiss, metagraywacke, and calc-silicate rock. Thin to very thin beds are largely transposed into early cleavage and contain white veins of quartz that have been folded

CZmg **Metagraywacke--**Light- to medium-gray, yellowish- to reddish-brown weathering, fine- to medium-grained, generally well-bedded metagraywacke and semi-pelitic schist. Beds range from about 3 cm to as much as 3 m thick, averaging about 20 cm. Many beds are graded; sole marks and slump features are abundant. Contains interbedded quartzose schist and lenses of calc-silicate rock

CZmm **Migmatite—**Light-gray stromatic migmatite consisting of a quartz-plagioclase leucosome and dark-gray quartz-rich schist paleosome

CZmp **Phyllonite—**Greenish-gray, chlorite-sericite phyllonite containing white vein quartz and highly folded

CZmt **Metatuff—**Dark-gray, hornblende-plagioclase-quartz-muscovite felsic metatuffaceous schist

CZs **Soldiers Delight Ultramafite (Lower Cambrian and(or) Neoproterozoic)--**Green serpentinite, talc

schist, and soapstone, interpreted to be mostly altered pyroxenite

CZu **Ultramafic rocks (Lower Cambrian and Neoproterozoic)—**Greenish-gray serpentinite, soapstone, and talc schist that occur as blocks within rocks of the Mather Gorge Formation

CZg **Metagabbro and metapyroxenite (Lower Cambrian and Neoproterozoic)—**Dark-green and black metagabbro and metapyroxenite that occur as blocks within rocks of the Mather Gorge Formation