GEOLOGY AND MINERAL RESOURCES OF LOUDOUN COUNTY, VIRGINIA
Description of Geologic Map Units

Source: Rader, E.K., and Evans, N.H., editors, 1993, Geologic Map of Virginia – Expanded Explanation: Virginia Division of Mineral Resources, 80p.

MAPPED UNITS OF THE MESOZOIC BASINS

INTRUSIVE IGNEOUS ROCKS

Jd *diabase.* (Lower Jurassic). Fine- to coarsely-crystalline, subaphanitic or porphyritic with aphanitic margins; dark-gray mosaic of plagioclase laths and clinopyroxene, with some masses characterized by olivine or bronzite, others granophyric. Also occurs as dikes and sills in the Valley and Ridge, Piedmont, and Blue Ridge physiographic provinces.

EXTRUSIVE IGNEOUS ROCKS

Jb *basalt.* Fine- to medium-crystalline, equigranular, porphyritic, vesicular, or amygdaloidal; medium- to dark-gray subophitic intergrowths of plagioclase laths and clinopyroxene with amygdules of calcite, zeolites, and prehnite. Occurs only in the Culpeper basin as three principle basalt flows separated by sedimentary rocks.

NEWARK SUPERGROUP (LOWER JURASSIC)

Jss *sandstone and siltstone*. Interbedded fine- to coarse grained, pebbly, reddish-brown, and arkosic sandstone and reddish-brown siltstone; rhythmically interbedded with siltstone and shale unit **(sh)**. Occurs only in the Culpeper basin.

NEWARK SUPERGROUP (UPPER TRIASSIC)

TRc *conglomerate, mixed clasts*. Rounded to subangular pebbles, cobbles, and boulders of mixed lithologies including quartz, phyllite, quartzite, gneiss, schist, greenstone, and marble in a matrix of medium- to very-coarse-grained, reddish-brown to gray, locally arkosic, sandstone.

TRc1 *conglomerate, carbonate clasts*. Rounded to subrounded pebbles, cobbles, and boulders of predominantly Cambrian and Ordovician limestone and dolostone in a matrix of fine- to coarse-grained, calcite-cemented, light-gray, silty sandstone. Occurs only in the Culpeper basin.

TRs *sandstone, undifferentiated*. Fine- to coarse-grained, reddish-brown to gray, primary bedding features such as crossbeds, channel lags, and ripple marks, minor conglomerate, siltstone, and shale beds.

TRss *sandstone, siltstone, and shale, interbedded*. Sandstone, very fine- to course-grained, reddish-brown to gray, micaceous, minor conglomerate beds. Siltstone, reddish-brown to gray, micaceous. Shale, reddish-brown, greenish-gray, gray, yellowish-brown, laminated, fossiliferous. Upward-fining sequences, discontinuous vertically and horizontally.

TRsh *shale and siltstone, interbedded*. Shale, light-greenish gray, light- to dark-gray, carbonaceous, and reddish-brown in cyclic sequences, laminated, silty to sandy, fossiliferous. Siltstone, typically reddish-brown to gray, sandy, micaceous, with minor fine-grained sandstone beds.

BLUE RIDGE ANTICLINORIUM

STRATIFIED ROCKS OF THE BLUE RIDGE ANTICLINORIUM

Cf *Frederick Limestone*. Medium-gray to medium-bluish-gray laminated, thinly bedded limestone.

Ct *Tomstown Dolomite*. Very-pale-orange, purplish-gray, bluish-white, or medium-bluish-gray, fine- to medium-grained massive dolomite.

Cch *Chilhowee Group, undivided*. Quartz pebble conglomerate, quartzite, metasiltstone, and phyllite.

Catoctin Formation (CZc, CZcs, CZcr, CZhb)
CZc *metabasalt*. Grayish-green to dark-yellowish-green, fine-grained, schistose chlorite- and actinolite-bearing metabasalt, commonly associated with epidosite segregations.

Mineralogy: chlorite + actinolite + albite + epidote + titanite ± quartz + magnetite. Relict clinopyroxene is common; biotite porphyroblasts occur locally in south eastern outcrop belts.

Geophysical signature: The Catoctin as a whole has a strong positive magnetic signature. However, between Warrenton and Culpeper the lowest part of the Catoctin, which consists of low-titanium metabasalt and low-titanium metabasalt breccia, is non-magnetic, and displays a strong negative anomaly.

Metabasalt **(CZc)** is by far the most widespread unit comprising 3000 feet or more of section (Gathright and others, 1977). Primary volcanic features are well preserved in many places. In the northwestern outcrop belt, these include vesicles and amygdules, sedimentary dikes, flow-top breccia, and columnar joints (Reed, 1955; Gathright, 1976; Bartholomew, 1977); relict pillow structures have been reported in Catoctin greenstones east of Buena Vista (Spencer and others, 1989). In the southeastern outcrop belt, amygdaloidal metabasalts are common, as are volcanoclastic rocks interbedded with basaltic flows (Rossman, 1991). Fragmental zones occur locally between individual lava flows; map-scale hyaloclastite pillow breccias occur at three stratigraphic levels within the southeastern outcrop belt **(CZcb, CZhb, CZlb**; Espenshade, 1986; Kline and others, 1990).

CZcs *metasedimentary rocks*. Quartzite, feldspathic metasandstone, metasiltstone, and phyllite; occurs in discontinuous beds that are generally less than 50 feet thick, interbedded with Catoctin metabasalt (CZc).

CZcr *metarhyolite*. Includes light-gray to medium-light gray, aphanitic to fine-grained metarhyolite containing grayish-yellow potassium feldspar phenocrysts; and, medium-gray to medium-dark-gray tuffaceous metarhyolite containing potassium feldspar phenocrysts and quartz-filled amygdules. Metarhyolite occurs as dikes up to 50 m thick, cutting Grenville basement and the Swift Run Formation (Southworth, 1991); also as cream-colored rhyolitic metatuff which is interbedded with metabasalt (CZc) stratigraphically near the base of that unit

in Loudoun and northwestern Fauquier Counties (Nickelsen, 1956; Gathright and Nystrom, 1974). Metarhyolite at two localities in Loudoun County has been dated at 564 ± 9 Ma and 572 ± 5 Ma (U-Pb zircon; Aleinikoff and others, 1991).

CZhb *metabasalt breccia* (high-titanium) (Espenshade, 1986). Dark-green, amygdular ellipsoids ranging from about 5 to 40 cm in length in a matrix of dark-green, dense angular fragments about 0.5 to 5 cm across; epidote is commonly abundant in the matrix; ellipsoidal amygdules contain quartz and epidote. Titanite constitutes several per cent of the mode. This unit, where present, may be as thick as 2800 feet, and occurs stratigraphically above the low-titanium breccia **(CZlb)**.

Zsr *Swift Run Formation* (Jonas and Stose, 1939; King, 1950; Gathright, 1976). Heterogeneous assemblage includes: pebbly to cobbly quartzite and feldspathic metaconglomerate; gray, grayish-pink, or grayish-green, feldspathic quartzite and metasandstone, locally crossbedded; greenish-gray, silvery quartz-sericite-chlorite sandy schist; and, greenish-gray to grayish-red-purple chlorite-sericite tuffaceous phyllite and slate. In Loudoun County, contains pinkish-gray and yellowish-gray to light brownish-gray, fine-grained dolomitic marble (Southworth, 1991). Individual lithologies are laterally discontinuous; formation ranges up to 350 feet in total thickness, but is locally very thin or absent (Gathright, 1976). The Swift Run was originally defined on the northwest limb of the Blue Ridge anticlinorium (Stose and Stose, 1946), where the unit rests unconformably on Grenville-age rocks, and is overlain conformably by the Catoctin Formation; the upper contact is mapped at the bottom of the lowest massive metabasalt. In places Swift Run lithologies are interbedded with Catoctin metabasalts, and the contact between the two units is gradational (Gathright, 1976). Swift Run metasedimentary rocks on the northwest limb have been interpreted as deposited in alluvial fan, floodplain, and lacustrine environments (Schwab, 1986); these are interbedded with metamorphosed tuffaceous and volcanoclastic units (Gathright, 1976; Bartholomew, 1977). Although the Swift Run has been interpreted as a thin western equivalent of the Lynchburg Group in the southeastern Blue Ridge (Stose and Stose, 1946; Brown, 1970), some workers have correlated the Swift Run with discontinuous lenses of feldspathic sandstone interbedded with felsic metatuff that occur immediately below the Catoctin on the southeast limb of the anticlinorium (Nelson, 1962; Conley, 1978; 1989; Wehr, 1985). On the Geologic Map of Virginia (1993), the Swift Run is terminated along an east-west-trending normal fault just west of Leesburg, and is not mapped farther southwest on the southeast limb of the Blue Ridge anticlinorium.

Zm *marble*. Includes white and light-gray to grayish-blue, fine-grained dolomitic marble and siliceous marble, dolomitic meta-arkose, dolomitic quartz-muscovite schist, and calcitic marble; may contain quartz, feldspar, muscovite, phlogopite, and tremolite. Marble is poorly exposed in discontinuous lenses either just below the top of the Fauquier Formation laminated metasiltstone **(Zfl)** or just above the base of the Catoctin **(CZc)**; a lens of dolomitic marble occurs within the Swift Run Formation in Loudoun County. Along the Hazel River, a marble clast conglomerate with a biotite-rich feldspathic matrix occurs just below the base of the Catoctin Formation.

Fauquier Formation (Zfl , Zfs, Zfa, Zfc; Furcron, 1939; Espenshade, 1986)
Zfl *laminated metasiltstone and phyllite.* Medium- to dark-gray (fresh), very-pale-orange (weathered), very-fine grained, laminated metasiltstone, composed of alternating silty and micaceous layers on the order of a millimeter to several millimeters thick, and phyllite without

discernable layers; major minerals are silt-size quartz and sericite; chlorite, biotite, and magnetite occur locally. Thiesmeyer (1939) described these rocks as “varved slates” interpreted as lacustrine deposits. Espenshade (1986) called this unit metarhythmite. The unit is on strike with, and in part equivalent to the Monumental Mills Formation of Wehr (1985), interpreted as deposited in a delta front-slope environment.

Zfs *meta-arkose and metasiltstone*. Alternating beds of dark-gray, very-fine-grained meta-arkose and metasiltstone; composed dominantly of angular quartz grains, with lesser plagioclase and potassium feldspar, and minor biotite. Crossbedding and graded bedding are present; thickness ranges from 300 to 500 meters.

Zfa *arkosic metasandstone*. Dark-gray, medium- to coarse-grained metasandstone contains quartz, plagioclase, perthitic potassium feldspar, and sericite, with minor biotite and epidote; thin beds of pebble conglomerate occur with coarse-grained metasandstone; commonly cross-bedded. Unit comprises the lowest part of the Fauquier; thickness is extremely variable. In the vicinity of Castleton, fine-grained volcanogenic rocks geochemically indistinguishable from nearby Battle Mountain Felsite (Zrbf) are interbedded with the basal Fauquier (Hutson, 1990).

Zfc *metaconglomerate*. Pebbles, cobbles, and occasional boulders of quartz, several varieties of granite, and feldspar, in a meta-arkosic matrix. Discontinuous lenses occur at or near the base of the Fauquier. Meta-arkose, metasiltstone, and metaconglomerate of the Fauquier **(Zfs, Zfa, Zfc)** are interpreted as non-marine, fluvial sediments, deposited unconformably on Grenville-age basement (Espenshade, 1986). These units have been mapped on a lithologic basis in metasedimentary outliers west of the principal Fauquier strike-belt, and include some rocks previously mapped as Mechums River Formation (Gooch, 1958). Stratigraphic and facies relations between Fauquier lithologic units and laterally equivalent Monumental Mills and other Lynchburg Group units are discussed by Wehr (1985), Wehr and Glover (1985), Conley (1989), and Kasselas (1993).

BLUE RIDGE BASEMENT COMPLEX

LATE PROTEROZOIC IGNEOUS ROCKS

Zrc *Cobbler Mountain Alkali Feldspar Quartz Syenite*. Light- to dark-gray, medium- to coarse-grained, porphyritic (mesoperthite phenocrysts) to seriate-equigranular alkali feldspar-quartz syenite composed of microcline mesoperthite, quartz, and plagioclase, with hastingsitic amphibole, biotite, stilpnomelane, zircon, allanite, fluorite, and rare aegirine-augite. Euhedral to subhedral feldspar phenocrysts are diagnostic. Syenite locally displays miarolitic cavities containing quartz. The rock has been dated at 722± 3 Ma (U-Pb zircon; Tollo and Aleinikoff, in press).

MIDDLE PROTEROZOIC (GRENVILLE-AGE) PLUTONIC ROCKS

Ygt *garnetiferous leucocratic metagranite*. Leucocratic, medium- to fine-grained, equigranular to granoblastic monzogranite contains very-light-gray to light-gray feldspar, medium-gray quartz

as much as 0.5 cm in diameter, and dusky-red euhedral to anhedral almandine garnet as much as 1 cm in diameter. Mineralogy includes quartz, microperthite, microcline, myrmekite, plagioclase, symplectitc biotite and minor chlorite, ilmenite, zircon, titanite, epidote, leucoxene, and clinozoisite. Modal composition ranges from 28 to 29 percent quartz, 35 to 40 percent potassium feldspar, 28 to 32 percent plagioclase feldspar, 2 to 5 percent almandine garnet. U-Pb zircon data suggest a crystallization age of approximately 1070 Ma (Aleinikoff and others, 1993). In northern Virginia there are numerous localities where dikes of this unit cut porphyroblastic granite gneiss **(Ybp)**.

Yg *leucocratic metagranite*. White to light-olive-gray, to pink, fine- to medium-grained, massive monzogranite composed of 22 to 38 percent quartz (white, clear, or blue), 33 to 34 percent orthoclase, microcline, and rod and bleb microperthite, and 38 to 44 percent oligoclase and albite, and minor biotite. Locally, potassium feldspar porphyroblasts are 1 to 2 cm in diameter. In Loudoun County this unit becomes coarser-grained and richer in biotite from west to east across the outcrop belt. U-Pb zircon data from two localities in Loudoun County indicate crystallization ages of 1058±3 Ma and 1060±2 Ma (Aleinikoff and others, 1993).

Ygr *biotite granite gneiss*. Pink to gray, medium-grained, well-foliated or lineated biotite-plagioclase-quartz-microcline gneiss.

Yt *metatrondhjemite*. White, medium- to fine-grained, weakly to moderately well-foliated biotite-quartz-plagioclase gneiss; potassium feldspar is rare or absent.

Marshall Metagranite (Ymc, Ymm; Espenshade, 1986)
Ymc *coarse-grained metagranite*. Medium-gray to brownish- gray, medium- to coarse-grained monzogranite composed of 30 percent quartz (clear or blue), 28 percent rod and bleb perthite, microcline, and orthoclase, and 42 percent saussuritized oligoclase. Sheared rock commonly has as much as 20 percent biotite. Porphyroblastic augen, commonly 1 to 2 cm in length, consist of aggregates of potassium feldspar, plagioclase, and quartz. U-Pb zircon data indicate a crystallization age of 1127±7 Ma (Aleinikoff and others, 1993).

Ymm *medium-grained biotite metagranite*. Medium- to dark-gray, fine- to medium-grained, mostly equigranular, but rarely inequigranular granite. Principal minerals are bluish-gray quartz, oligoclase, microcline, and biotite, with lesser amounts of muscovite, opaque minerals, epidote, chlorite, and rare garnet. Gneissic layering, commonly absent, is well developed locally. This unit commonly occurs as dikes intruding porphyroblastic granite gneiss **(Ybp)**, and contains xenoliths of **Ybp**. U-Pb zircon data indicate crystallization ages of 1110±4 Ma and 1112±3 Ma (Aleinikoff and others, 1993). Single crystals of monazite give an age of 1051±3 Ma, interpreted to be a metamorphic age related to intrusion of adjacent granites that yield ages ranging from 1055 to 1070 Ma **(Yg, Ygt, Ybg)**.

Yc *charnockite.* Includes dusky-green, mesocratic, coarse- to very-coarse-grained, equigranular to porphyritic, massive to vaguely foliated pyroxene-bearing granite to granodiorite; contains clinopyroxene and orthopyroxene, intermediate-composition plagioclase, potassium feldspar, and blue quartz. Reddish-brown biotite, hornblende, and poikilitic garnet are present locally; accessory minerals include apatite, magnetite-ilmenite, rutile, and zircon.

Geophysical signature: charnockite pods in the southeastern Blue Ridge produce a moderate positive magnetic anomaly relative to adjacent biotite gneisses, resulting in spotty magnetic highs.

This unit includes a host of plutons that are grouped on the basis of lithology, but are not necessarily consanguineous. These include Pedlar charnockite, dated at 1075 Ma (U-Pb zircon, Sinha and Bartholomew, 1984) and Roses Mill charnockite (Herz and Force, 1987), dated at 1027±101 Ma (Sm-Nd, Pettingill and others, 1984).

Ybp *porphyroblastic granite gneiss*: Dark-yellowish brown to moderate-yellowish-brown, medium-grained, granoblastic to megacrystic, mafic-rich monzogranite composed of 27 to 38 percent quartz, 28 to 39 percent orthoclase, rod and bleb perthite, microcline, and myrmekite, and 33 to 40 percent oligoclase and andesine. Porphyroblasts of potassium feldspar range from 1 to 10 cm while plagioclase and quartz are generally 2 cm or less in maximum dimension. Mafic minerals, including almandine, biotite, chlorite, hornblende, and opaque minerals, are, in places, concentrated in layers. Almandine (up to 1 cm in diameter) makes up as much as 3 percent of the mode, while hornblende, commonly 0.5 to 0.75 cm in length, constitutes less than 1 percent. The rock breaks along cleavage surfaces that are commonly rich in chlorite, giving the whole rock a light green color. A U-Pb zircon age from this rock is 1144±2 Ma; two different populations of monazite give ages of 1106±1 Ma and 1063±1 Ma, respectively (Aleinikoff and others, 1993). This unit is the oldest dated granitic rock in the northern Virginia Blue Ridge, and is very commonly intruded by dikes of the Marshall Metagranite **(Ym)** and garnetiferous leucocratic metagranite **(Ygt)**, and less commonly by leucocratic metagranite **(Yg)**. These field relations suggest that the monazite ages are not cooling ages but represent the times of metamorphic growth during subsequent intrusive events.

Ybg *porphyroblastic biotite-plagioclase augen gneiss*. Mesocratic, medium- to coarse-grained, biotite-rich quartzofeldspathic gneiss contains prominent subhedral to euhedral monocrystalline feldspar augen. The ratio plagioclase: potassium feldspar may be as high as 10:1; color index ranges from 30 to 50. Apatite, epidote, muscovite, ilmenite, and titanite are ubiquitous accessories. Plagioclase contains abundant prismatic epidote and white mica; ilmenite is rimmed with masses of anhedral titanite; subhedral hornblende and subhedral to euhedral almandine-grossular garnet occur locally. In the vicinity of adjacent charnockite, anhedral actinolitic amphibole pseudomorphs after pyroxene or rims thoroughly uralitized relict pyroxene. Rock fabric is gradational from granofels to mylonite gneiss.

Geophysical signature: negative magnetic signature relative to adjacent charnockite. In northern Virginia, this unit strongly resembles prophyroblastic granite gneiss **(Ybp)**; however, the augen in **Ybp** are more commonly polycrystalline aggregates rather than single-crystal porphyroblasts. This unit is widespread in the central and southeastern Blue Ridge, encompassing a number of lithologically similar metaplutonic entities: the “biotitic facies” of the Roses Mill and Turkey Mountain ferrodiorites of Herz and Force (1987), the Archer Mountain quartz monzonite of Bartholomew and others (1981), biotite granofels and augen gneiss of Evans (1984, 1991), biotite augen gneiss of Conley (1989), and augen-bearing gneiss of Lukert and Halladay (1980), and Lukert and Nuckols (1976). Historically, most workers have interpreted these rocks as

Grenville-age plutons in which the present-day biotite-rich mineral assemblage is a primary igneous assemblage that crystallized from a melt (for example, Bartholomew and others, 1981). Herz and Force (1987) and Evans (1991) presented evidence that these biotite gneisses were derived from charnockite plutons by retrograde hydration reactions. Pettingill and others (1984) reported ages of 1009±26 Ma (Rb-Sr whole-rock) and 1004±36 Ma (Sm-Nd whole-rock) for ferrodiorite to quartzmonzonite in the Roseland district. Where this unit has been mapped in the Upperville quadrangle (A.E. Nelson, unpublished data), U-Pb zircon data suggest a crystallization age of 1055±2 Ma (Aleinikoff and others, 1993).

Yn *metanorite and metadiorite*. Gray-weathering, medium- to coarse-grained, massive to weakly foliated hornblende-orthopyroxene-plagioclase metanorite and medium- to fine-grained biotite-hornblende-plagioclase metadiorite. Occurs as lenses and thin belts, commonly in proximity to garnet graphite paragneiss **(Yp)**.

Yum *metaperidotite, hornblende metagabbro, and metapyroxenite*. Metaperidotite, greenish-black, dark-yellowish brown weathering, medium-grained, massive; consists of serpentine, amphibole, dark chlorite, and magnetite; serpentine replaces subhedral olivine; non-pleochroic amphibole occurs as single crystals, presumably pseudomorphic after subhedral to anhedral pyroxene; some amphibole occurs as large poikilitic crystals. Hornblende metagabbro, greenish-black, medium grained, speckled-white-weathering, massive, with a weak foliation and well-preserved primary igneous fabric; subhedral plagioclase is replaced by clinozoisite and albite; anhedral pyroxene is replaced by fibrous tremolite; brown hornblende occurs as subhedral single crystals. Metapyroxenite, dark-greenish-gray to greenish-black, light-greenish-gray weathering, medium-grained, weakly-foliated actinolite-rich rock contains lesser chlorite; amphibole is pseudomorphic after pyroxene.

MIDDLE PROTEROZOIC GNEISSES

Ygg *layered leucocratic granite gneiss*. Pale-red, pinkish-gray to light-gray leucocratic syenogranite with medium light-gray to greenish-gray melanocratic layers (0.25 to 1 cm thick) that are commonly migmatitic. Mineralogy consists of 26 to 39 percent quartz, 49 to 51 percent rod and bleb perthite, microcline, and orthoclase, 12 to 23 percent oligoclase, and minor garnet and biotite. Layering consists of 0.5- to 2-cm thick segregations of alkali feldspar, plagioclase, and quartz. Garnet and biotite are commonly restricted to melanocratic layers containing plagioclase and quartz. Isotopic data from multigrain fractions and single zircons are scattered, with Pb-Pb ages ranging from 1092 to 1139 Ma (Aleinikoff and others, 1993). Field relations are complex and suggest that the protolith for this unit may have been a composite of **Ybp** and younger granite(s) that was highly tectonized and homogenized during the Grenville orogeny.

Ygh *hornblende gneiss*. Gray-weathering, medium- to fine grained, massive to strongly-foliated hornblende-quartz-microcline-plagioclase gneiss with rare biotite and orthopyroxene. This lithology is very similar to layered pyroxene granulite (Ypg), and is considered equivalent.

Yp *garnet graphite gneiss*. Light-brown-weathering, medium- to fine-grained graphite-biotite-garnet-plagioclase quartz paragneiss; includes quartz-chlorite-magnetite schist and carbonaceous phyllonite; graphite makes up 10 percent of the rock in places and garnet, up to 25 percent

locally. The protolith of this unit is interpreted to be metasedimentary country rock that Grenville-age plutonic rocks intruded. The rock is similar in appearance to parts of the border gneiss (Ybr).

Yq *quartzite and quartz-sericite tectonite*. Light-gray to white, fine- to medium-grained, massive; contains rounded zircons, thin lenses of graphite, and pods of paragneiss (Yp); unit is considered part of a metasedimentary suite.

STRATIFIED ROCKS OF THE WESTERN PIEDMONT

Mather Gorge Formation (CZms, CZmg; Drake and Froelich, in press)
CZms *schist*, greenish-gray to gray, reddish-brown-weathering, fine- to coarse-grained, lustrous, quartz-rich; and much lesser mica gneiss; contains interbedded metagraywacke and some calc-silicate rock; also contains abundant mafic and ultramafic rock debris. Typical mineral assemblages from west to east and from low to high metamorphic grade are: (1) quartz + muscovite + chlorite + plagioclase + epidote + magnetite-hematite; (2) quartz + muscovite + biotite + garnet + staurolite + plagioclase + magnetite ± andalusite; (3) quartz + muscovite + garnet + kyanite + plagioclase + staurolite + magnetite; and (4) quartz + biotite + plagioclase + sillimanite ± microcline + magnetite. Higher-grade schists are migmatitic, and in many places show effects of a retrograde metamorphic over print.

CZmg *metagraywacke*, light- to medium-gray, yellowish- to reddish-brown-weathering, fine- to medium-grained, generally well-bedded, and lesser semi-pelitic schist; contains interbedded quartzose schist and some calc-silicate rock; mineral assemblages as in schist **(CZms)**. Beds range from about 3 cm to 3 m, averaging about 20 cm; graded bedding, sole marks, and slump features are abundant. Mather Gorge is unconformable beneath Popes Head Formation, which is intruded by Occoquan Granite; includes rocks previously mapped in northern Virginia as Peters Creek Schist.