Virginia Department of Mines, Minerals and Energy

Open File Report 08-03
Bedrock Geologic Map of the Piney River Quadrangle, Virginia
Virginia Division of Geology and Mineral Resources

BEDROCK GEOLOGIC MAP OF THE PINEY RIVER QUADRANGLE, VIRGINIA

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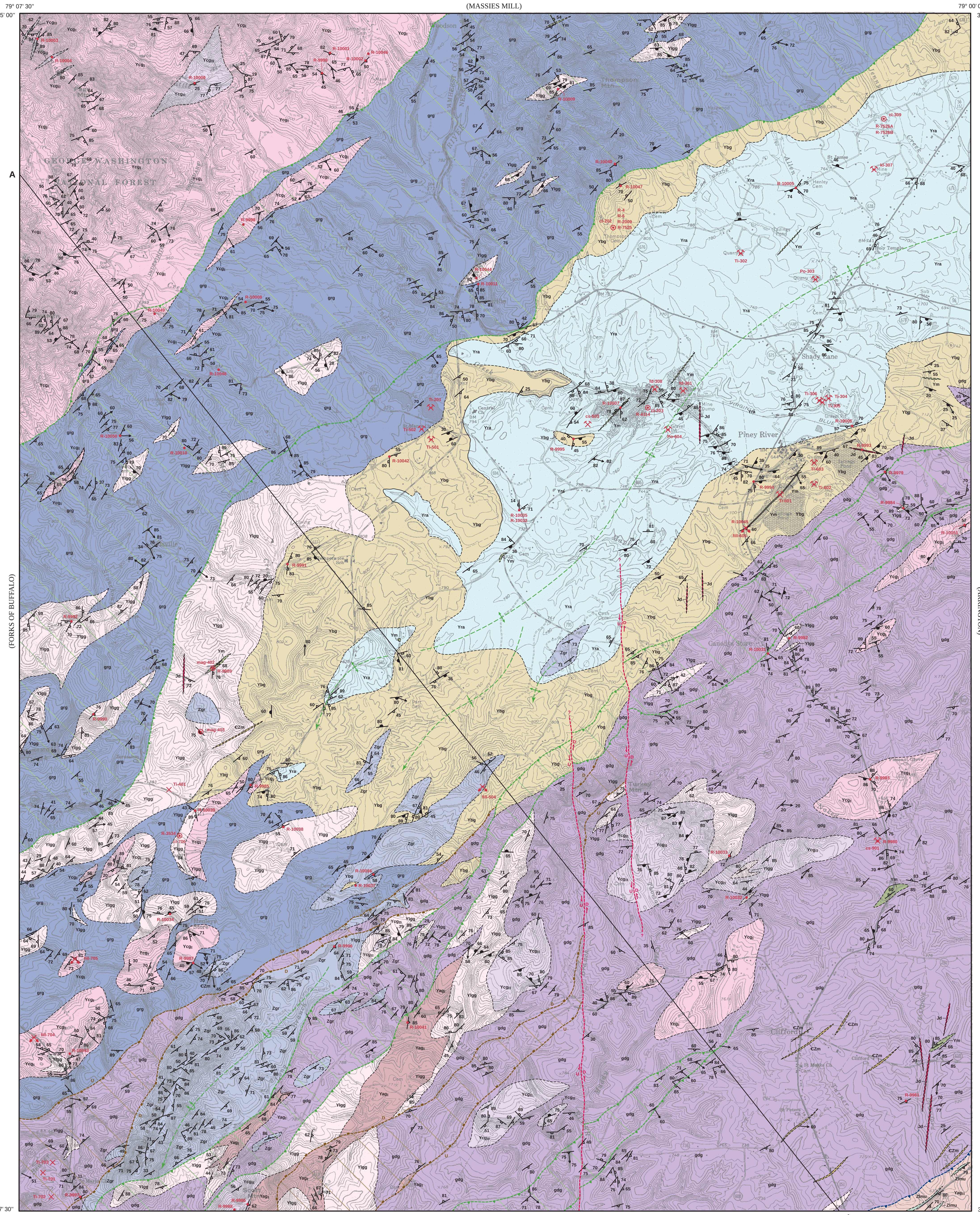
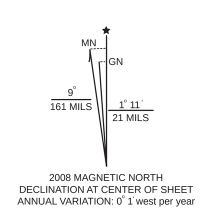
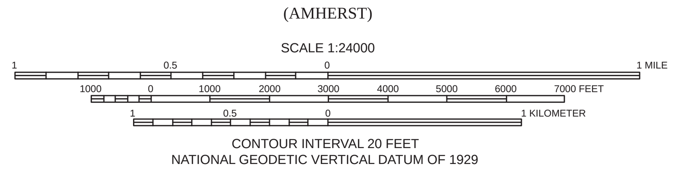
2008



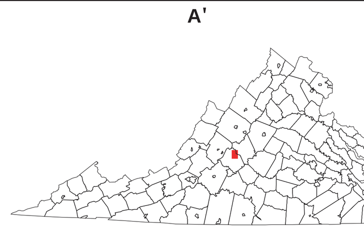
Basemap modified from U.S. Geological Survey DRG
Piney River quadrangle, Virginia, 1963, Photorevised 1984
Projection: Modified UTM, NAD 1927 Datum
(rubber-sheeted to dimensions of paper quadrangle copy)
Digital Cartography by Mark W. Carter





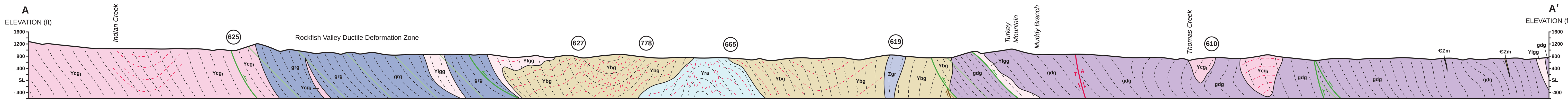
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology mapped from December 2004 to January 2007



QUADRANGLE LOCATION

CROSS SECTION A-A'



DESCRIPTION OF MAP UNITS

MESOZOIC IGNEOUS INTRUSIVE ROCKS

Jd

diabase and gabbro – Igneous intrusive rocks of Mesozoic age; dark-green to black, weather to dark reddish-brown; fine- to medium-grained; diabase is aphanitic; gabbro is ophitic, subophitic, subidiomorphic, to porphyritic; typically contain abundant magnetite; modal analyses average 43% plagioclase, 33% augite, 6% magnetite, ilmenite, and other opaque minerals, 3% K-feldspar, and 1% quartz as primary minerals, and 5% biotite, 4% chlorite, 3% muscovite, 1% epidote, and 1% calcite as post-intrusive hydrothermal alteration minerals from primary mafic phases; occurs as dikes (and minor sills) that intrude into older geologic units throughout the map area. Diabase and gabbro commonly weather to dense, spheroidally rounded boulders, which can be easily traced along strike when outcrop is absent. Several dikes portrayed on the geologic map are exaggerated, and many more are too small to map separately at this scale.

CAMBRIAN TO LATE PROTEROZOIC META-IGNEOUS ROCKS

CATOCTIN FORMATION

€Zm

metamorphosed mafic dikes and sills – garnet-epidote-biotite schist and lesser amphibolite. Schist is dark greenish-gray, weathers to dark reddish-brown; fine-grained; lepidoblastic; well-foliated; cross-biotite texture is common locally; modal analyses average 18% quartz and 4% plagioclase as primary constituents, 1% zircon and 1% apatite as accessory minerals, and 49% biotite, 23% epidote, 2% garnet, and 2% titanite as metamorphic and alteration minerals. Schist is the retrogressed metamorphic equivalent of amphibolite, which is dark greenish-gray, weathers to reddish-brown; fine- to medium-grained; nematoblastic to granoblastic to lepidoblastic, depending on mica content; weakly to well-foliated; cross-amphibole texture is common locally; modal analyses avaerage 78% pargasite, 7% quartz, 4% plagioclase, and 4% ilmenite, magnetite and other opaque minerals as primary constituents, a trace of apatite as an accessory mineral, and 5% biotite and 2% epidote as metamorphic and alteration minerals. Both rock types occur as dikes and sills that intrude into older geologic units throughout the map area; most occur in Middle Proterozoic Yag_{II} augen gneiss, but some occur in the western part of the Late Proterozoic Lynchburg Group and the eastern part of the biotite granodioritic porphyroclastic gneiss (gdg) unit. Brown (1970) and others interpret rocks of this unit to represent intrusive feeder dikes to extrusive Catoctin metabasalts. Many dikes and sills portrayed on the geologic map are exaggerated, and many more are too small to map separately at this scale.

LATE PROTEROZOIC METAVOLCANIC AND METAPLUTONIC IGNEOUS ROCKS OF THE CROSSNORE PLUTONIC-VOLCANIC SUITE

The following mafic, ultramafic, and ultrabasic (Zlmu) rocks occur as intrusive dikes, sills, pods, lenses, and interlayers within Middle Proterozoic Yag_{II} augen gneiss of the Blue Ridge Basement Complex, and in Late Proterozoic metasedimentary rocks of the Lynchburg Group on the adjoining Amherst quadrangle. As such, these rocks are no older than Late Proterozoic, and are probably associated with the Late Proterozoic Moneta Gneiss of Wang (1991) and Wang and Glover (1997), which have been dated at 607 ± 7 Ma by Southworth and others (2005). These rocks (Zlmu) and foliated granite of the Mobley Mountain Granite (Zgr) are also included with the Late Proterozoic Crossnore Plutonic-Volcanic Suite (Rankin and others, 1973; Rankin, 1975; Wang and Glover, 1997). Many of the smaller dikes, sills, pods, and lenses portrayed on the geologic map are exaggerated, and many more are too small to map separately at this scale.

Zlmu

metamorphosed mafic, ultramafic, and ultrabasic rocks – metamorphosed mafic to ultramafic rocks ranging from metagabbro and amphibolite to biotite gneiss and schist; occur as intrusive dikes, sills, pods, lenses, and interlayers in Yag_{II} augen gneiss. Mafic and ultramafic rocks of this unit are distinguished from younger Jurassic diabase and gabbro by their foliated texture and retrogressive mineralogy. Metagabbro is dark greenish-gray to black; medium-grained; granoblastic to nematoblastic; weakly foliated. Amphibolite is the most common rock type, and is dark greenish-gray to black, weathers dark reddish-brown. Amphibolite is commonly coarse- very coarse-grained, with porphyroblastic to porphyroclastic megacrysts of pargasite up to several centimeter in diameter, but some varieties are fine- to medium-grained, and nematoblastic. All textural varieties of amphibolite are weakly to well-foliated. Modal analyses of amphibolite average 51% pargasite, 17% quartz, 8% plagioclase, and 2% K-feldspar as primary constituents, traces of zircon and apatite as accessory minerals, and 8% biotite, 5% epidote, 4% zoisite, 2% chlorite, 2% ilmenite, magnetite, pyrite and other opaque minerals, 1% muscovite, and traces of titanite and calcite as metamorphic and alteration minerals. Amphibolite commonly exhibits a cross-amphibole texture, consisting of distinct needles of acicular amphibole that overprint earlier-formed foliation surfaces, which suggests post-peak-deformation thermal metamorphism. Amphibolite within the Yag_{II} augen gneiss is interlayered (meters to several meters) with amphibole-bearing biotite granitic augen gneiss (which is similar to rocks of the Yag_{II} augen gneiss unit, except that amphibole is the dominant mafic mineral phase rather than biotite), and is indicative of assimilation of the country rock during intrusion; some amphibolite in Yag_{II} augen gneiss is locally completely retrogressed to biotite gneiss and schist. Garnet-biotite gneiss and chlorite-biotite schist is dark greenish-gray; fine- to medium-grained; granoblastic to locally lepidoblastic, depending on mica content. Amphibolite and biotite gneiss and schist are interpreted to be retrogressively altered metavolcanic and metaplutonic rock (Rankin and others, 1973).

LATE PROTEROZOIC METAVOLCANIC AND METAPLUTONIC IGNEOUS ROCKS OF THE CROSSNORE PLUTONIC-VOLCANIC SUITE (CONTINUED)

MOBLEY MOUNTAIN GRANITE

Zgr

foliated granite – Leucocratic to mesocratic, amphibole-bearing, muscovite-biotite granite gneiss of the Mobley Mountain Granite, and/or related granitoids, is light bluish-gray to yellowish-gray; fine- to medium-grained; granoblastic to porphyroclastic; weakly foliated, locally massive; locally mylonitic; modal analyses average 29% quartz, 19% K-feldspar, 16% perthite, 10% plagioclase, 5% pargasite, and some biotite and muscovite as primary constituents, 1% zircon and traces of magnetite, ilmenite, apatite, rutile, and allanite as accessory minerals, and 10% biotite, 5% epidote, 3% muscovite, 1% garnet, and 1% chlorite as metamorphic and alteration minerals. Fluorite is present in some samples. Zones of migmatitic layering, which range in thickness from centimeters to about 0.5 meters, is common near the contact between the main body of granite on Mobley Mountain and surrounding country rocks. Weakly foliated pegmatitic, granitic and aplitic dike swarms cut the granite and extend as a halo into surrounding country rocks for about 2 kilometers. Granitoids that are lithologically identical to the Mobley Mountain Granite also crop out as smaller stocks, plugs, dikes, and sills to the north, northeast, and southeast of the main body. Mobley Mountain Granite is dated at 652 Ma (Brock and others, 1987).

MIDDLE PROTEROZOIC META-IGNEOUS AND ALTERED META-IGNEOUS ROCKS OF THE BLUE RIDGE BASEMENT COMPLEX

Middle Proterozoic rocks of the Blue Ridge Basement Complex on the Piney River quadrangle consist of charnockites, associated mafic and ultramafic rocks, altered charnockites, augen gneisses, granulitic orthogneisses, granulitic paragneisses, and anorthosite. Much research has been conducted in this region at both the detailed- and reconnaissance-levels, and numerous nomenclatural and stratigraphic schemes have been proposed, based on geochronology and tectono-orogenic interpretations, since the seminal work of Bloomer and Werner (1955). The following subdivisions of these rocks are grouped primarily on lithology, rather than stratigraphic order.

CHARNOCKITIC ROCKS

Charnockitic rocks of the Blue Ridge Basement Complex on the Piney River quadrangle are subdivided on the basis of constituent feldspar. Charnockites of the Ycg_{I} unit contain abundant perthite; Ycg_{II} charnockites consist of plagioclase and microcline. Ycg_{I} charnockites are part of the antiquated Pedlar Formation of Bloomer and Werner (1955), and may be correlative with the Pedlar River Suite of plutons of Bartholomew (1977, 1981), Bartholomew and others (1981, 1991), and Bartholomew and Lewis (1984). Ycg_{II} charnockites appear to be equivalent to the Turkey Mountain Suite of plutons of Herz and Force (1984,1987). Sinha and Bartholomew (1984) dated Pedlar charnockites at 1075 Ma; Herz and Force (1987) report a younger age of 1040 Ma. Herz and Force (1984,1987) also reported an age of 970 Ma for the Roses Mill Pluton (a unit that they interpreted to be stratigraphically equivalent to the Turkey Mountain charnockites on the Massies Mill quadrangles to the north). Pettingill and others (1984) report and older age of 1027 Ma for these rocks. The approximate age and stratigraphic order of these charnockites are confirmed by cross-cutting relationships; plagioclase-rich Ycg_{II} charnockites intrude older, perthite-rich charnockite of the Ycg_{I} unit in the northwest corner of the quadrangle.

Ycg_{II}

plagioclase charnockite and charnockitic gneiss – Hypersthene- and amphibole-bearing granodioritic gneiss of this unit is grayish-green to medium dark-gray; medium- to coarse-grained; hypidiomorphic-granular to coarsely porphyroclastic; massive to weakly foliated; modal analyses average 23% plagioclase, 21% quartz, 15% K-feldspar, 8% hypersthene, 4% ilmenite, magnetite, and other opaque minerals, 2% perthite, 1% myrmekite, and 1% hornblende as primary constituents, 2% apatite, 1% rutile, and traces of zircon and allanite as accessory minerals, and 7% chlorite, 4% tremolite, 4% actinolite, 3% epidote, 2% clinopyroxene, 1% pargasite, 1% biotite, and a trace of muscovite as metamorphic and alteration minerals. Herz and Force (1987) describe several additional lithologies within their Turkey Mountain and Roses Mill plutons, based on petrographic and geochemical criteria, including leucodiorite and ferrodiorite. These lithologies are not easily distinguished at this scale, and are collectively grouped into plagioclase charnockitic gneiss on this map. Plagioclase charnockite and charnockitic gneiss grade into, and are interlayered with biotite granodioritic porphyroclastic gneiss (gdg, described below) along common contacts, and represent the relatively unaltered protoliths of the more widespread porphyroclastic gneiss unit.

Ycg_{I}

perthitic charnockite and charnockite gneiss – Hypersthene- and amphibole-bearing granodioritic gneiss is bluish gray to dusky green; medium- to coarse-grained; hypidiomorphic-granular to coarsely porphyroclastic; massive to weakly foliated; locally coarsely layered, layering ranges from centimeters to several decimeters; grades into and is interlayered with mylonitic altered charnockite gneiss. In outcrop and hand specimen, blue quartz is common, as are uralitized pyroxene and suassuritized feldspars; modal analyses average 23% quartz, 14% perthite, 11% K-feldspar, 6% plagioclase, 3% ilmenite, magnetite, and other opaque minerals, 2% hypersthene, and 1% myrmekite as primary constituents, 2% apatite and a trace of zircon as accessory minerals, and 14% biotite, 11% epidote, 5% chlorite, 4% tremolite, 3% muscovite, 1% pargasite, and traces of clinopyroxene, hornblende, actinolite, clinozoisite, titanite and calcite as metamorphic and alteration minerals.

MIDDLE PROTEROZOIC META-IGNEOUS AND ALTERED META-IGNEOUS ROCKS OF THE BLUE RIDGE BASEMENT COMPLEX (CONTINUED)

MAFIC, ULTRAMAFIC AND ULTRABASIC ROCKS

Ym

metamorphosed mafic and ultramafic dikes and sills – Numerous metamrophosed mafic, ultramafic and ultrabasic dikes and sills crop out on the Piney River quadrangle, consisting of nelsonite, ferrodiorite, metagabbro, talc-amphibole schist, amphibolite, and chlorite-biotite gneiss and schist. Nelsonite (Watson, 1907; Watson and Tabor, 1913; Ross, 1941; Fish and Swanson, 1964), or zircon-apatite-ilmenite granofels, is very dark-gray to black; medium-grained (grains are typically up to several mm, but larger masses are common); generally equigranular; granoblastic; massive to weakly foliated; pyroxene and amphibole are sometimes present. On the Piney River quadrangle, nelsonite occurs mostly as dikes and sills, but Herz and Force (1984, 1987) also report nelsonite as discontinuous cumulate at the base of Roses Mill Pluton on the Horseshoe Mountain quadrangle to the north. Ferrodiorite is dark-gray to dark brownish-gray; fine- to medium-grained; granoblastic to nematoblastic to lepidoblastic, depending on feldspar-amphibole-pyroxene content; weakly foliated. Apatite, ilmenite, amphibole, and biotite are also common constituents of ferrodiorite. Ferrodiorite occurs as dikes and sills east of the Rockfish Valley deformation zone. Herz and Force (1987) suggest ferrodiorite dikes are swarms from the Turkey Mountain and Roses Mill plutons. Metagabbro is olive-black, weathers to light olive-gray; fine- to medium-grained; original texture is hypidiomorphic-granular to ophitic, but altered locally by metamorphism and deformation to a porphyroclastic-textured rock; massive to foliated; easily distinguished from younger Jurassic gabbro by its foliated texture and local retrogression. Modal analyses of metagabbroic rock average 7% quartz, 5% plagioclase, 3% ilmenite, magnetite and other opaque minerals, 1% hypersthene, and a trace of K-feldspar as primary constituents, and 25% epidote, 21% chlorite, 19% tremolite, 9% pargasite, 9% titanite, 1% zoisite, and traces of biotite and talc as metamorphic and alteration minerals. Other ultramafic and ultrabasic rocks include talc-amphibole schist, which is dark greenish gray; fine-grained; lepidoblastic; well foliated. A body within anorthosite at the intersection of SR 665 and Maple Creek is mapped on the distribution of float, and is similar in lithology to altered pyroxenite reported by Herz and Force (1987) farther east along Maple Creek. Herz and Force (1987) report that altered pyroxenite bodies on Maple Creek are cut by blue quartz-bearing veins, which suggest that the bodies are pre-990 Ma. Amphibolite (retrogressed metagabbro) is dark greenish gray; medium-grained; nematoblastic. Garnet-chlorite-biotite gneiss and schist (retrogressed amphibolite) is dark greenish gray; fine- to medium-grained; granoblastic to locally lepidoblastic, depending on mica content. On the Piney River quadrangle, chlorite-garnet-biotite orthogneiss occurs as a cross-cutting dike and consists of about 30% quartz, 16% plagioclase, 4% K-feldspar, and 1% ilmenite, magnetite and other opaque minerals as primary constituents, 1% zircon and a trace of allanite as accessory minerals, and 35% biotite, 5% muscovite, 5% epidote, 3% garnet, and traces of chlorite and clinozoisite as metamorphic and alteration minerals. Multiple foliations, garnet overgrowths, and highly strained quartz distinguish this orthogneiss dike from younger Late Precambrian to Cambrian-age mafic dikes of the Catoctin Formation. Herz and Force (1984, 1987) present field- and geochemical-evidence suggesting that nelsonite, ferrodiorite, and other mafic and ultramafic rocks in the region are cumulates occurring at the base of the Turkey Mountain and Roses Mill plutons, or are dike swarms of differentiated parent material intrusive into these plutons. If so, mafic and ultramafic rocks of this unit are approximately equivalent in age to charnockites of the Ycg_{II} unit.

ALTERED CHARNOCKITIC ROCKS

gdg

biotite granodioritic porphyroclastic gneiss – Biotite granodioritic porphyroclastic gneiss is brownish-gray to grayish olive-green; fine- to medium-grained; protomylonitic throughout, becoming mylonitic near and within high-strain zones; multiply foliated; locally exhibits a cross-muscovite or cross-biotite texture; modal analyses average 30% quartz, 11% plagioclase, 6% K-feldspar, 3% perthite, and 1% ilmenite, magnetite, and other opaque minerals as primary constituents, 1% apatite, and traces of zircon and allanite as accessory minerals, and 29% biotite, 10% epidote, 4% muscovite, 4% titanite, 1% penninite, and traces of garnet, chlorite, clinozoisite, and calcite as metamorphic and alteration minerals. Mylonitic rocks of this unit are characterized by sericitic phyllonite, which is silvery greenish gray, weathers to medium to dark brownish gray; fine- to medium-grained; lepidoblastic; mylonitic; well foliated. Biotite granodioritic porphyroclastic gneiss is locally interlayered with pods, lenses, and screens of charnockitic gneiss and leucocratic granitoid gneiss, and xenoliths of leucogranulite orthogneiss, most too small to show at this scale of mapping. Biotite granodioritic porphyroclastic gneiss represents an altered derivative of the more massive, weakly foliated charnockite gneiss units, Ycg_{I} and Ycg_{II}, as proposed by Evans (1987, 1991) and Bailey and Simpson (1993).

AUGEN GNEISSES

Augen gneisses of the Blue Ridge Basement Complex on the Piney River quadrangle are subdivided on the basis of constituent feldspar. Augen gneisses of the Yag_{I} unit, in the south-central portion of the quadrangle, are perthitic; Yag_{II} augen gneiss crops out in the southeastern corner of the quadrangle, and consists of abundant microcline. Yag_{I} augen gneisses are identical to Shaeffer Hollow Granite mapped by Herz and Force (1984, 1987), who report discordant ages of 1787 to 990 Ma for Shaeffer Hollow Granite. On the Piney River quadrangle, Yag_{I} augen gneiss is associated both lithologically and structurally with similarly perthite-bearing layered granulitic gneisses (Ylgg) and perthitic charnockites (Ycg_{I}). Yag_{II} augen gneiss is possibly equivalent, at least in part, to the Stage Road Layered Gneiss of Sinha and Bartholomew (1984). However, Sinha and Bartholomew (1984) suggest the Stage Road Layered Gneiss is paragneissic (and cite two distinct ages of detrital and metamorphic zircons - 1870 and 915 Ma); mesoscopically, Yag_{II} augen gneiss on the Piney River quadrangle appears orthogneissic. Pettingill and others (1984) report a younger age of 1147 Ma for Stage Road Layered Gneiss. Yag_{II} augen gneiss may also be correlative to the Marshall Metagranite of Espenshade (1986) to the north, which is similar in compostion (Clarke, 1984). Aleinikoff and others (2000) report an age of 1112 Ma for the Marshall Metagranite.

Yag_{II}

microcline-bearing augen gneiss – The dominant rock type of this unit is biotite granitic augen gneiss, which is dark yellowish-brown to dark greenish-gray; medium- to very coarse-grained; generally protomylonitic throughout, but mylonitic along contact with altered charnockitic gneiss (gdg) to the west and Lynchburg Group rocks to the east; modal analyses average 38% quartz, 25% K-feldspar (mostly microcline), 5% plagioclase, and traces of ilmenite, magnetite, and other opaque minerals as primary constituents, traces of zircon, apatite, and allanite as accessory minerals, and 20% biotite, 6% epidote, 4% muscovite, 2% titanite, and traces of garnet and chlorite as metamorphic and alteration minerals. Coarse- to very coarse-grained composite porphyroclasts of quartz and potassium feldspar, up to several centimeters in length, are diagnostic of this unit; as grain-size of the porphyroclasts decreases, biotite content increases and the rocks grade into biotite granitic gneiss. This unit is sometimes compositionally layered into coarse-grained quartzofeldspathic and finer-grained biotite-rich domains; layering ranges from several centimeters to several decimeters; protomylonitization disrupts compositional layering. Locally, an earlier foliation is recognized by a cross-foliation alignment of quartz and feldspar porphyroclasts. Augen gneiss also locally exhibits a younger cross-muscovite or cross-biotite texture. Augen gneiss is interlayered with Late Proterozoic amphibolite (Zlmu).

Yag_{I}

perthitic megaporphyritic augen gneiss – Perthite-bearing augen gneiss is pale-blue to medium bluish-gray; coarse- to very coarse-grained; porphyritic, with perthitic-feldspar phenocrysts commonly up to five centimeters in length; becomes protomylonitic, with coarse-grained feldspar augen, near high-strain zones; massive to foliated; contains distinctive dark blue to violet quartz in matrix between phenocrysts or porphyroclasts; modal analyses average 32% microcline, 28% perthite, 18% quartz, 7% plagioclase, 2% myrmekite, and 1% ilmenite, magnetite, and other opaque minerals as primary constituents, traces of zircon and apatite as accessory minerals, and 5% biotite, 4% muscovite, 2% epidote, 1% chlorite, and a trace of titanite as metamorphic and alteration minerals.

GRANULITIC ORTHOGNEISS

Ylgg

layered granulitic orthogneiss – leucocratic to mesocratic, layered granulitic orthogneiss is light bluish-gray to greenish-gray; medium- to coarse-grained; granoblastic to coarsely porphyroclastic, but locally hypidiomorphic-granular; massive to foliated; commonly compositionally layered into coarse-grained quartzofeldspathic and finer-grained biotite-, amphibole- and pyroxene-rich domains, layering ranges from several centimeters to several decimeters; modal analyses average 31% quartz, 19% microcline, 19% perthite, 9% plagioclase, and traces of myrmekite and ilmenite, magnetite, and other opaque minerals as primary constituents, traces of zircon, apatite and rutile as accessory minerals, and 8% biotite, 8% muscovite, 4% epidote, 1% chlorite, and 1% titanite as metamorphic and alteration minerals. Meta-igneous textures and blue quartz in granulite orthogneiss suggest an igneous protolith; compositional and lithologic similarities (particularly medium- to dark-blue to violet interstitial quartz), and field relationships indicate an association with both Yag_{II} augen gneiss and layered granulite paragneiss; occurs as map-scale xenoliths within biotite granodioritic porphyroclastic gneiss (gdg), and distinguished from those rocks by abundance of dark blue to violet quartz and common compositional layering. Although the absolute age of these rocks have not been determined, they are assumed to be Middle Proterozoic, and interpreted to be pre- or syn-metamorphic, Grenville-age plutons or hypabyssal subvolcanic rocks.

MIDDLE PROTEROZOIC META-IGNEOUS AND ALTERED META-IGNEOUS ROCKS OF THE BLUE RIDGE BASEMENT COMPLEX (CONTINUED)

ALTERED ROCKS OF THE ROCKFISH VALLEY SHEAR ZONE

grg

mylonitic biotite granitic gneiss – biotite granitic gneiss to sericitic phyllonite, mostly within the Rockfish Valley high-strain zone, is dusky-green to dusky-blue, weathers to medium- to dark-brownish-gray; fine- to medium-grained; porphyroclastic; mylonitic, becoming ultramylonitic near and within the Rockfish Valley and other high-strain zones; multiply foliated; modal analyses average 29% quartz, 15% perthite, 13% K-feldspar, 6% plagioclase, and a trace of ilmenite, magnetite, and other opaque minerals as primary constituents, 1% apatite and a trace of zircon as accessory minerals, and 18% muscovite, 11% biotite, 5% epidote, 1% chlorite, and 1% titanite as metamorphic and alteration minerals. Mylonitic texture and distinctive dark-blue to violet-quartz distinguishes this unit from biotite granodioritic porphyroclastic gneiss (gdg). Mylonitic biotite granitic gneiss is locally interlayered with pods, lenses, screens, and xenoliths of undeformed to protomylonitic perthitic megaporphyritic augen gneiss (Yag_{I} augen gneiss, Shaeffer Hollow Granite) and layered granulite orthogneiss (Ylgg). All of these units contain distinctive dark-blue to violet interstitial quartz, and thus, mylonitic biotite granitic gneiss must represent the mylonitized and metamorphically retrogressed equivalents of these rocks, as proposed, in part, by Herz and Force (1984, 1987). Pods, lenses, and screens of protomylonitic to mylonitic perthitic charnockite and charnockite gneiss (Ycg_{I}) also occur throughout the unit, but are more easily distinguished from perthitic megaporphyritic augen gneiss (Yag_{I}) and layered granulite orthogneiss (Ylgg) protoliths in that mylonitic charnockite is typically unakitic, with uralitized pyroxenes and sausseritized feldspars giving these rocks a silvery greenish gray color.

ROSELAND ANORTHOSITE

Yra

alkalic anorthosite – light bluish-gray to bluish-white; coarse- to very coarse-grained; porphyritic to porphyroclastic; brecciated to coarsely protomylonitic, to mylonitic; commonly coarsely layered, layering ranges from centimeters to several decimeters; modal analyses average 25% plagioclase, 15% quartz, 11% perthite, 8% K-feldspar, and 8% antiperthite as primary constituents, 5% apatite and traces of titanite, zircon, rutile, perovskite, and ilmenite, magnetite, and other opaque minerals as accessory minerals, and 17% zoisite, 7% muscovite, 2% epidote, 2% clinozoisite, and a trace of calcite as metamorphic and alteration minerals. Abundant perthite and antiperthite megacrysts, 10 to 20 centimeters in diameter, occur in a much finer-grained granulated matrix of plagioclase, K- feldspar, and blue quartz. Zoisite forms radiating crystal masses from the alteration of feldspars, as previously noted by Ross (1933), Moore (1940), and Force and Herz (1982). Along the margins of the anorthosite, megacrysts of blue quartz and pyroxene are common. Rutile and ilmenite are also common in these areas. Aplite dikes and sills, too small to map accurately at this scale, cross cut anorthosite locally. Pettingill and others (1984) report an age of 1045 Ma for the Roseland Anorthosite.

EARLY(?) TO MIDDLE PROTEROZOIC PARAGNEISS OF THE BLUE RIDGE BASEMENT COMPLEX

BORDER GNEISS

Ybg

layered granulite paragneiss – feldspathic granulite gneiss and graphite-garnet-granulite gneiss; fine- to medium-grained; granoblastic; weakly foliated; distinctly layered, layering consists of coarser-grained quartzofeldspathic and finer-grained biotite-, amphibole- and pyroxene-rich domains that range from several centimeters to several decimeters in thickness; modal analyses average 17% quartz, 12% perthite, 12% plagioclase, and 8% K-feldspar as primary constituents, 2% apatite, 1% titanite, 1% ilmenite, magnetite, and other opaque minerals, 1% allanite, and traces of rutile and perovskite as accessory minerals, 17% clinozoisite, 7% actinolite, 5% hypersthene, 5% biotite, 5% epidote, 4% garnet, 2% hornblende, 2% pargasite, 2% anthophyllite, 2% chlorite, 2% zoisite, 1% diopside-hedenbergite, 1% graphite, and traces of myrmekite, muscovite, and calcite as metamorphic and alteration minerals. Herz and Force (1987) describe several subordinate orthogneissic lithologies within this unit, including platy-textured leucocharnockite, charnockitic gneiss and mangerite. These lithologies are not easily separated at this scale, and are collectively grouped into layered granulite paragneiss on this map.

MAP SYMBOLS

For all line symbols: lines are solid where the location is exact (located in field to within 50 feet, or 15 meters), long-dashed where the location is approximate (located to within 200 feet, or 60 meters); short-dashed where the location is inferred. For geologic observation symbols, observation sites are centered on the strike bar, or are at the intersection point of multiple symbols.

Line Symbols

- Stratigraphic contacts
- Fault contacts
  Queries used to indicate uncertainty about the existence of the fault beyond mapped locations
  - Late Proterozoic high-strain zone, with "normal" sense of movement - "U" on upthrown block; ornaments show dip direction
  - Taconic-Acadian reverse fault - ornaments show dip direction
  - Alleghanian high-strain zone - ornaments show dip direction
  - Mesozoic tear fault - "U" on upthrown block; arrows show strike-slip displacement
- Fold axes
  - Trend and plunge direction of axis of Alleghanian antiform
  - Trend and plunge direction of axis of Alleghanian synform
  - Trend and plunge direction of axis of overturned Alleghanian synform

Line Symbols in Cross Section

- Stratigraphic contact
- Form line of Grenville compositional layering (earliest foliation)
- Form line of Late Proterozoic to Taconic-Alleghanian mylonitic foliations
- Late Proterozoic high-strain zone - arrows show relative displacement
- Alleghanian high-strain zone - arrows show relative displacement
- Mesozoic tear fault - arrows show relative vertical displacement; "T" indicates "toward, "A" indicates "away"

Geologic Observations

- Strike and dip of inclined Late Proterozoic to Taconic-Alleghanian mylonitic foliations
- Strike and dip of inclined Grenville compositional layering (earliest foliation)
- Strike and dip of inclined joints and fractures
- Trend and plunge of mesoscale fold hinges
- Trend and plunge of mineral stretching lineations

Geologic References

- R-10037 Rock repository sample

Mineral Resources

Commodity letter symbol precedes identification number (identification numbers are preceded by "133A-" in Mineral Resources of Virginia database). Commodity letter symbols: cl - clay; cs - crushed stone; fd - feldspar; fill - saprolite or earth material; kl - kaolin; mag - magnetite; Po - phosphate; Ti - titanium

- Occurrence
- Prospect
- Mine or quarry
- Abandoned mine or quarry
- Borrow pit
- Abandoned borrow pit

FOOTNOTES

[1]Brock, J.C., 1981, Petrology of the Mobley Mountain Granite, Amherst County, Virginia [MS Thesis]: Athens, University of Georgia, 130 p.

[2]Herz, N. and Force, E.R., 1987, The geology and mineral deposits of the Roseland district of central Virginia: US Geological Survey Professional Paper 1371, 56 p.

[3]Hillhouse, D.N., 1960, Geology of the Piney River-Roseland titanium area, Nelson and Amherst counties, Virginia [PhD Dissertation]: Blacksburg, Virginia Polytechnic Institute and State University, 129 p.

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