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Reconnaissance bedrock geologic map of the Keysville 7.5-minute quadrangle, Prince Edward, Charlotte, and Lunenburg Counties, Virginia

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INTRODUCTION

The Keysville 7.5-minute quadrangle encompasses approximately 130 square kilometers in south-central Virginia and is primarily underlain by Late Proterozoic metasedimentary, metavolcanic, and associated intrusive rocks. Mesozoic diabase dikes intrude these rocks. The quadrangle is located at the northwestern edge of the Carolina slate belt, an area of volcanogenic greenschist-facies metamorphic rocks in the Piedmont geologic province of the Appalachian orogen. Immediately to the south, in the South Boston 30'x60' quadrangle, the Carolina slate belt is bordered on the east and west by belts of amphibolite-facies gneiss and schist (figure 1).

The geology of the Keysville quadrangle was mapped as part of the Appomattox 30'x60' quadrangle under the Geology of the Mid-Atlantic Corridor Project of the National Cooperative Geologic Mapping Program. Six weeks of fieldwork in July and August, 1997, were spent traversing the quadrangle by four-wheel drive vehicle and on foot. Field notes were recorded at approximately 400 bedrock outcrops and saprolite and soil exposures, and 70 samples were collected for visual inspection and petrographic examination. The map was compiled and text written during August and September, 1997. Several key areas in the quadrangle were revisited during July, 1998, to revise the locations of geologic contacts.

PREVIOUS WORK

Laney (1917) mapped the western part of the Carolina slate belt in an area extending from the Virgilina copper district in North Carolina northward to Keysville in south-central Virginia. He recognized and traced three distinct stratigraphic units that are folded into an upright north-northeast trending synclinorium (the Virgilina synclinorium). These units, from oldest to youngest, he named 1) the Hyco Quartz Porphyry and Goshen Schist, 2) the Aaron Slate, and 3) the Virgilina Greenstone. Glover and Sinha (1973) proposed a ca. 600-Ma Virgilina deformation to form the Virgilina synclinorium. Kreisa (1980) mapped the Omega and South Boston areas in Virginia and discovered numerous structural complexities within the Virgilina synclinorium, including local synclines, anticlines, and faults. Additionally, Kreisa (1980) modified the stratigraphic nomenclature, renaming the Hyco Quartz Porphyry – Goshen Schist and Aaron Slate as the Hyco and Aaron Formations, respectively, and including the Virgilina Greenstone of Laney (1917) as a middle member of the Aaron Formation. This report uses the revised stratigraphic nomenclature of Harris and Glover (1988), who proposed the names Virgilina, Aaron, and Hyco Formations for these rocks. This usage restricts the Aaron Formation to the lower member of the Aaron as used by Kreisa (1980), and defines the Virgilina Formation to include Kreisa's middle (greenstone) and upper (metasedimentary) members of the Aaron.

Offield and others (1991) suggested a Taconic age for formation of regional schistosity in the Carolina slate belt in central North Carolina based on $^{40}Ar/^{39}Ar$ ages from biotite. Kunk and others (1995) found preliminary $^{40}Ar/^{39}Ar$ isotopic evidence supporting an Alleghanian age for regional schistosity with suggestion of an older metamorphic event.

Achtermann (1989) mapped the bedrock geology in the northeastern corner of the Keysville quadrangle and parts of the adjacent Green Bay, Meherrin, and Hampton-Sydney 7.5' quadrangles. Structural data and unit descriptions from Achtermann's map were field checked during this study and incorporated into the present report. Achtermann found evidence suggesting the Carolina slate belt and higher-grade gneiss and schist to the north are separated by a metamorphic gradient. He traced slate belt stratigraphy across a staurolite isograd which he identified as the belt boundary. Additionally, Achtermann suggested that rocks in the northeastern Keysville quadrangle are higher-grade equivalents of the Hyco and Aaron Formations as previously mapped by Laney (1917) to the south, and furthermore, that the axial trace of the Virgilina synclinorium extends from the southwest to the northeast across the Keysville quadrangle. Achtermann did not show the Virgilina Formation on his map but suggested that amphibolites in his Aaron Formation may be Virgilina correlatives.

Burton (1995) mapped the Fort Mitchell and Lunenburg quadrangles which are adjacent to the Keysville quadrangle on the south and southeast, respectively. Burton suggested that his map unit **Zf** (felsite) may correlate with the Hyco Formation and that his units **Zph** and **Zvl** (phyllite, metasiltstone and metatuff) may correlate with the Aaron Formation.

J. D. Peper and K. E. Olinger (unpublished geologic mapping) traced the Hyco, Aaron, and Virgilina Formations from near the type localities northward through the Buffalo Springs and Nelson 7.5' quadrangles and found the geologic structure to be that of a simple syncline, the Dryburg syncline.

William C. Burton and J. Wright Horton, Jr. (unpublished geologic mapping) traced the Hyco, Aaron, and Virgilina Formations and the Dryburg syncline through the Drakes Branch quadrangle (figure 1) as part of the overall mapping framework for coverage of the South Boston 30'x60' quadrangle. Their mapping, combined with that of J. D. Peper (Peper and Olinger, unpublished mapping, and Peper, unpublished mapping, Wylliesburg and Clover 7.5' quadrangles, Virginia) completes detailed tracing of both the syncline structure and stratigraphy to the latitude of the southern margin of the Keysville quadrangle.

BEDROCK EXPOSURE AND LITHOLOGY

The bedrock of the Keysville quadrangle primarily consists of Late Proterozoic stratified metavolcanic and metasedimentary rocks and associated intrusive rocks. All rocks have been subjected to a mild deformation and greenschist- to amphibolite-facies metamorphism as evidenced by a pronounced penetrative cleavage and metamorphic mineral assemblages. Unmetamorphosed Mesozoic diabase dikes are intrusive into the stratified rocks and strike northwest.

Bedrock exposure is poor in the upland areas of the quadrangle. Small, isolated outcrops may be found in drainage ditches along the roads and in shallow road cuts; most of these exposures, however, are deeply saprolitized. Narrow creek valleys contain scattered hard bedrock exposure.

Rock unit **Zhw** consists of heterogeneous stratified metavolcanic and metasedimentary rocks in approximately subequal amounts and traces into and regionally correlates with the Hyco Formation of Kreisa (1980), and locally with map unit **hfw$_3$** of Achtermann (1989). This is the most areally extensive unit in the Keysville quadrangle and occurs in two bands on opposite flanks of the Dryburg syncline. The unit is composed of quartz-rich mica schist interlayered with fine- to medium-grained volcaniclastic metawacke, metasandstone, and quartzite. Minor lenses of mafic metatuff and greenstone, unit **Zha**, are found interbedded with the more felsic unit **Zhw**.

Units **Zhc**, **Zhm**, and **Zhf** also are correlated regionally with the Hyco Formation and constitute lenses within, adjacent to, or interfingered with unit **Zhw.** Unit **Zhc**, locally correlated with map unit **hct$_1$** of Achtermann (1989), is composed primarily of felsic to intermediate pyroclastic rocks. Porphyritic felsic metatuff constitutes the bulk of the unit. This rock is particularly susceptible to weathering and upland outcrops are deeply saprolitized, producing a characteristic mottled white and brown soil. Thin (6 inches to 2 feet) lenses in **Zhc** consist of a fine-grained light-gray quartz-rich phyllite that is more resistant to weathering and stands out in stark relief. Unit **Zhm**, locally correlated with map unit **hmf$_3$** of Achtermann (1989), is composed of thin- to medium-bedded, dark-gray amphibolite interbedded with felsic metatuff and metawacke. Unit **Zhf,** locally correlated with map units **hft$_2$** of Achtermann (1989) and **Zf** of Burton (1995), is a fine-grained, strongly foliated micaceous felsite and is interpreted to be a metamorphosed rhyolitic to dacitic lava or ashfall deposit. Subordinate lenses of fine-grained phyllite and medium- to fine-grained metabasite are found interlayered with felsite.

Unit **Zas** is a fine-grained mica schist and traces into and regionally correlates with the lower member of the Aaron Formation of Kreisa (1980), and locally with map units **Zph** of Burton (1995) and with unit **a** of Achtermann (1989). The even distribution of a fine-grained opaque oxide distinguishes unit **Zas** and gives the rock a speckled appearance. **Zas** is distinguished from mica schists in unit **Zhw** by its homogeneity over wide areas, finer grain size, and relative lack of quartz.

Unit **Zvg** consists of fine-grained mafic metatuff (chlorite schist) with subordinate metabasalt (greenstone) and chlorite schist. This unit traces into and correlates with the lower part of the Virgilina Formation. **Zvg** occurs within a narrow northeast trending band extending northeast through the town of Keysville and ends near the center of the quadrangle. The absence of greenstone outcrop to the northeast is interpreted to indicate the northeastern termination of the lower part of the Virgilina Formation within the southwest plunging Dryburg syncline. This interpretation is based on field evidence in the Keysville quadrangle, and unpublished mapping of greenstone in the adjacent Eureka and Drakes Branch quadrangles, and is consistent with a regional aeromagnetic map (U.S. Geological Survey, 1978).

Late Proterozoic (W. C. Burton, written communication, 1998) to Early Paleozoic intrusive rocks in the Keysville quadrangle include plutonic metatonalite and metagranodiorite, map units **Zto** and **PzZgd** respectively. Unit **Zto** is a metamorphosed tonalite in the southeastern corner of the Keysville quadrangle. This unit underlies much of the eastwardly adjacent Meherrin quadrangle (P. C. Hackley and J. D. Peper, unpublished mapping) and southwardly adjacent Fort Mitchell and Lunenburg quadrangles (Burton, 1995). The weathered rock appears light-gray to very light-gray in color and fresh samples commonly are white. Biotite commonly is seen in hand sample. Microscopically, biotite is either completely altered to pleochroic chlorite or has acquired a dark-green tint due to iron oxidation. Local biotite and chlorite aggregates pseudomorph hornblende. All primary minerals in **Zto** have been heavily retrograded and abundant epidote and sericite occur as minute grains throughout the rock. One sample of biotite tonalite in the Meherrin quadrangle was noted to have trace sulfide mineralization, with hematite pseudomorphs after cubic pyrite. Although primarily tonalitic, compositions within the pluton range from quartz diorite through tonalite to granodiorite.

Unit **PzZgd** is a metamorphosed porphyritic granodiorite consisting of 1 to 2 mm euhedral plagioclase feldspar phenocrysts set in a fine-grained granophyric groundmass of subhedral to anhedral plagioclase and alkali feldspar with quartz. Minor quartz occurs as a phenocrystic phase. Green biotite occurs as a primary mineral with secondary epidote, chlorite, and sericitic white mica in the groundmass. Retrograded anhedral garnet occurs locally. The map pattern of **PzZgd** suggests that this unit is the northern termination of a granodiorite pluton mapped by Burton (1995) in the Fort Mitchell quadrangle to the south.

Map unit **Jd** represents unmetamorphosed diabase dikes. This unit is probably Early Jurassic and consists of subequal amounts of labradorite and calcic clinopyroxene with ophitic texture. Minor hornblende and opaque oxides constitute accessory minerals.

STRUCTURE

Achtermann (1989) showed the axial trace of the Virgilina synclinorium through the area northeast of the Keysville quadrangle. He inferred the existence of this fold based on the repetition of his Hyco units to either side of the central band of homogeneous Aaron Formation schist. Based on observation of the dip of beds in the limbs of the fold, he suggested the axial plane of the syncline dips steeply southeast and that the Hyco Formation is overturned on the southeastern limb. Our mapping of the Virgilina Formation, here unit **Zvg**, flanked by bands of Aaron schist in the southwestern part of the Keysville quadrangle, and previous mapping by J. D. Peper and K. E. Olinger (unpublished geologic mapping, Buffalo Springs 7.5' quadrangle), demonstrate that the Dryburg syncline trends northeast and plunges southwest across the Keysville quadrangle. The sequence of Hyco Formation units, however, is different on opposite limbs.

Primary sedimentary structures have been rendered almost unrecognizable by the formation of the dominant schistosity; however, relict bedding is commonly expressed as compositional banding. Massive metawacke, metasandstone, and quartzite in unit **Zhw** locally preserve fine bedding laminations. Facing criteria in individual beds have been obscured by recrystallization. Compositional banding, where observed, is mostly parallel or subparallel to schistosity in these rocks.

Stratified rocks, particularly in the more fissile units **Zas, Zvg** and **Zha,** exhibit a strong penetrative schistosity primarily defined by the alignment of white mica, biotite, or chlorite. This regional schistosity strikes generally north-northeast and dips moderately to steeply east. Less common are steep westerly dips. Schistosity locally was observed at moderate to high angles to unit contacts and the axial trace of the Dryburg syncline, indicating its development probably occurred during an event subsequent to folding of the syncline, as suggested by Glover and Sinha (1973).

In units **Zas**, **Zvg**, and **Zha**, and in schistose members of **Zhw**, the northeast trending regional schistosity has been deformed locally into tight to isoclinal folds having a 1 to 5 cm wavelength. White mica platelets are bent around fold noses in microscopic view, indicating deformation subsequent to formation of the regional schistosity. These folds plunge gently to moderately south-southeast to south-southwest and represent a late episode of deformation in the Carolina slate belt.

Shear zones in the adjacent Meherrin quadrangle (P. C. Hackley and J. D. Peper, unpublished geologic mapping) and in the Lunenburg and Fort Mitchell quadrangles to the south (Burton, 1995) are subparallel to the regional schistosity. Burton (1995) suggested that the formation of the shear zones is penecontemporaneous with development of the regional schistosity and represents localized areas of higher shear strain.

METAMORPHISM

Rocks in the Keysville quadrangle have been subjected to greenschist-facies metamorphism as evidenced by mineral assemblages and microscopic structural fabrics. In the felsic intrusive rocks, metamorphism is reflected in the presence of abundant sericite and epidote/clinozoisite. Secondary white mica commonly defines a mild foliation. Plagioclase is saussuritized and albite twins are frequently bent, twisted, broken, or pinched. Quartz occurs with shear-bands subparallel to foliation and is locally neoblastic with polygonal grain boundaries. Biotite and minor garnet in unit **PzZgd** are replaced by chlorite, as are biotite and hornblende in unit **Zto**.

Stratified units also preserve evidence of greenschist facies metamorphism. The mafic units **Zvg** and **Zha** contain the metamorphic phase assemblage epidote and chlorite, and metabasites associated with **Zhf** contain the assemblage chlorite, plagioclase, epidote/clinozoisite, and actinolite/hornblende with minor quartz. Metapelites in unit **Zas** contain minor biotite replaced by chlorite and quartz is shear-banded or neoblastic. Garnet was not observed as a metamorphic phase.

One sample of mica schist, collected in the north-central part of the Keysville quadrangle and indicated by **S**, contains staurolite as poikilitic porphyroblasts, and indicates amphibolite-facies metamorphic conditions. Samples of similar schists, collected farther southward in the Keysville quadrangle, apparently do **not** contain staurolite. The continuity of stratigraphy and geologic structures mapped in the Keysville quadrangle with those mapped farther south is interpreted to indicate the northern extension of slate belt lithologies through an increase in metamorphic grade.

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REFERENCES CITED

Achtermann, R. D., 1989, Geology of the Meherrin, Virginia area: tracing formations across the staurolite isograd from the Carolina slate belt into the Charlotte belt [M.S. Thesis]: Blacksburg, Virginia, Virginia Polytechnic Institute and State University, 35 p.

Burton, W. C., 1995, Preliminary Geologic Map of the Lunenburg and Fort Mitchell 7.5' Quadrangles, Virginia: U.S. Geological Survey Open-File Report 95-4, 14 p., map scale 1:24,000.

Glover, Lynn, III, and Sinha, A. K., 1973, The Virgilina deformation, a Late Precambrian to Early Cambrian (?) orogenic event in the central Piedmont of Virginia and North Carolina: American Journal of Science, v. 273-A, p. 234-251.

Harris, C. W., and Glover, Lynn, III, 1988, The regional extent of the ca. 600 Ma Virgilina deformation: Implications for stratigraphic correlation in the Carolina terrane: Geological Society of America Bulletin, v. 100, p. 200-217.

Kreisa, R. D., 1980, Geology of the Omega, South Boston, Cluster Springs, and Virgilina quadrangles, Virginia: Virginia Division of Mineral Resources Publication 5, 22 p., map scale 1:24,000.

Kunk, M. J., Horton, J. W., Jr., and Peper, J. D., 1995, Preliminary $^{40}Ar/^{39}Ar$ mineral ages from the Raleigh metamorphic belt, Carolina slate belt, and Milton belt, in the South Boston, VA-NC, 30 X 60 minute quadrangle: Geological Society of America Abstracts with Programs, v. 27, no. 2, p. 67.

Laney, F. B., 1917, The geology and ore deposits of the Virgilina District of Virginia and North Carolina: Virginia Geological Survey Bulletin 14, 176 p.

Offield, T. W., Kunk, M. J., and Koeppen, R. P., 1991, Style and age of deformation in the Carolina slate belt of central North Carolina: Geological Society of America Abstracts with Programs, v. 22, no. 2, p. 54.

U.S. Geological Survey, 1978, Aeromagnetic map of parts of Prince Edward, Lunenburg, and Mecklenburg Counties, Virginia: U.S. Geological Survey Open-File Report 78-599, map scale 1:250,000.

Virginia Division of Mineral Resources, 1993, Geologic Map of Virginia: Virginia Division of Mineral Resources, map scale 1:500,000.

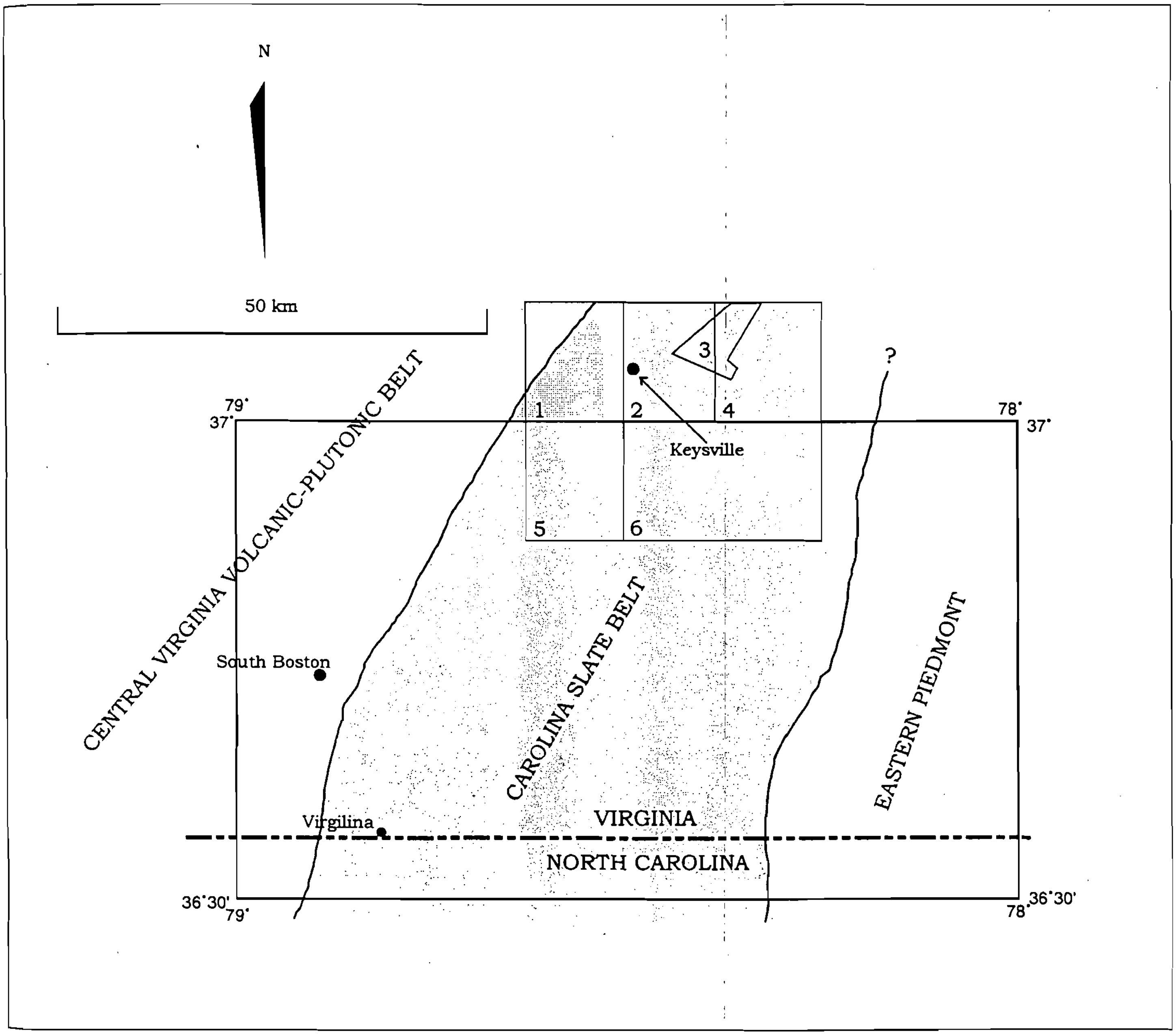
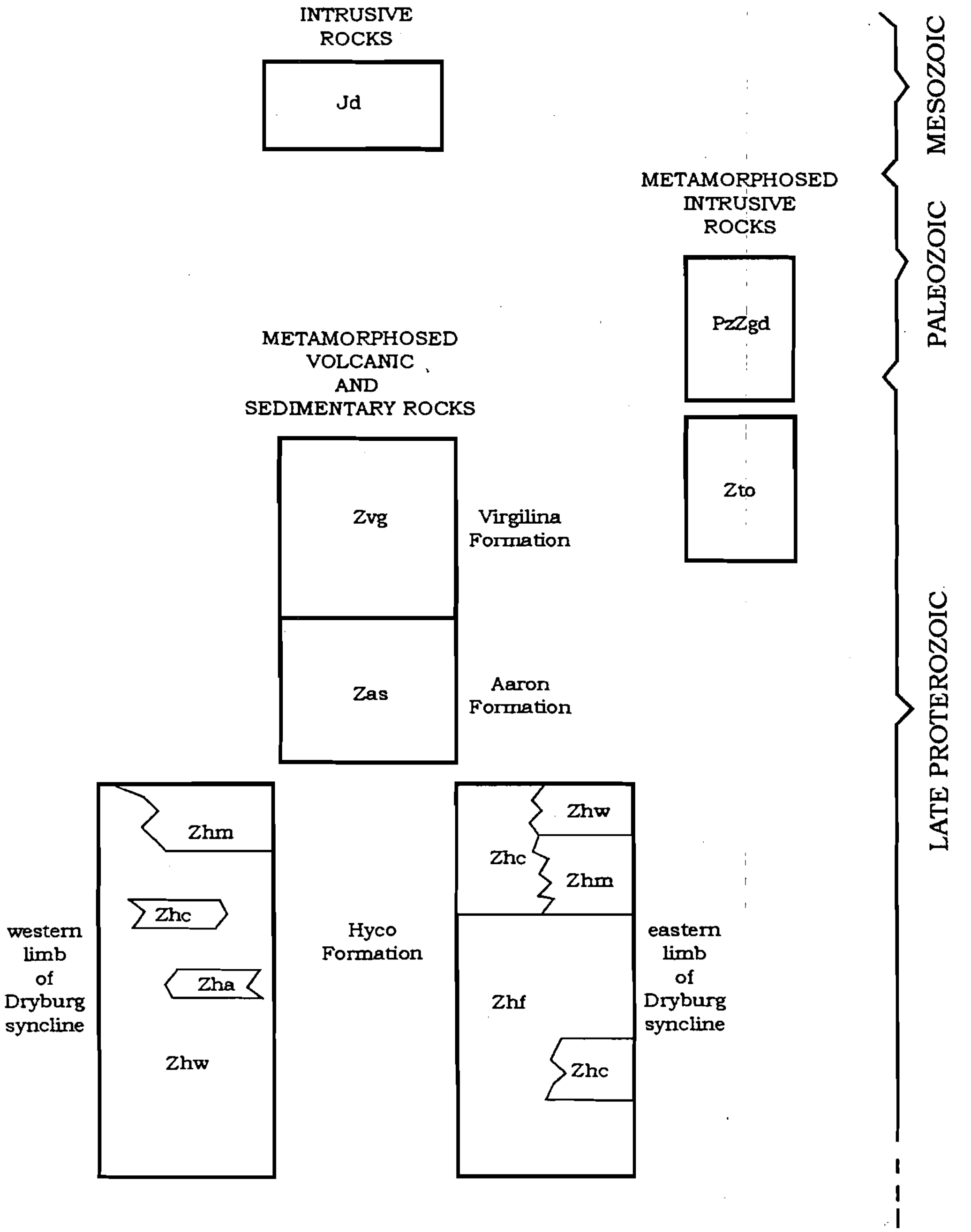


Figure 1. Index map showing location of map area with respect to Carolina slate belt and other lithologic belts in the Virginia Piedmont (labeled). Belt names and boundaries modified from the Geologic Map of Virginia (Virginia Division of Mineral Resources, 1993). Large rectangle is South Boston 30'x60' quadrangle. Geologic mapping credits are as follows: 1) Peper and Hackley (unpublished geologic mapping, Eureka 7.5' quadrangle); 2) this report; 3) (Achtermann, 1989); 4) Hackley and Peper (unpublished geologic mapping, Meherrin 7.5' quadrangle); 5) Burton and Horton (unpublished geologic mapping, Drakes Branch 7.5' quadrangle); 6) Fort Mitchell and Lunenburg 7.5' quadrangle (Burton, 1995).

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Mesozoic intrusive rocks

Jd Diabase - fine- to medium-grained, massive, dark-gray to black, equigranular diabase in dikes. Composed of subequal amounts of insertal labradorite and calcic clinopyroxene with ophitic texture. Opaque Fe-Ti oxide and hornblende make up about 2–3 percent of the rock.

Intrusive rocks of Late Proterozoic or Early Paleozoic age

PzZgd Metagranodiorite – medium-grained, black to dusky-yellowish-brown weathering, weakly foliated to massive, very light-gray to pinkish-gray, porphyritic metagranodiorite composed of 1 to 2 mm euhedral to subhedral plagioclase phenocrysts in a fine-grained granophyric groundmass of plagioclase, alkali feldspar and quartz. Minor quartz phenocrysts. Dark-yellowish-green biotite makes up about 5 percent of rock. Fine-grained epidote and sericite indicate a greenschist-facies metamorphic overprint. Metamorphic foliation is defined by alignment of white mica.

Intrusive rocks of Late Proterozoic age

Zto Metatonalite - medium- to coarse-grained, light-gray to white weathering, massive to foliated, inequigranular metatonalite. Mineralogy consists of saussuritized plagioclase, quartz, and green biotite, with secondary sericite/muscovite, epidote, and chlorite. Hornblende is locally pseudomorphed by aggregates of biotite and chlorite. Hematite pseudomorphs after cubic pyrite found locally. Rock composition varies to quartz diorite and granodiorite. Metamorphic foliation is defined by alignment of white mica.

Stratified metasedimentary and metavolcanic rocks of Late Proterozoic age

Zvg Virgilina Formation - metamorphosed mafic volcaniclastic rocks – poorly exposed, fine-grained, moderate brown to very dark red weathering, thin-bedded, strongly foliated, duskyblue-green to dusky-yellowish-green, fissile mafic metatuff with subordinate metabasalt (greenstone) and chloritic schist. Typically weathers to moderate red homogeneous soils. The minerals hornblende and/or actinolite and/or plagioclase locally occur as porphyroblasts or phenocrysts within a fine-grained matrix of epidote, chlorite, actinolite and/or hornblende, and plagioclase. Plagioclase phenocrysts typically are rounded or broken and approximately 2 to 3 mm in diameter; euhedral laths are up to 5 mm in longest dimension. Actinolite needles typically are about 1 mm long or less. Epidote plus quartz locally occurs in thin veins. Fine-grained, moderate red weathering, thick-bedded, massive metabasalt (greenstone) and fine-grained, thin-bedded, dark yellowish-green, fissile chlorite schist make up discontinuous lenses at outcrop scale. Unit crops out in a narrow continuous band underlying most of the town of Keysville and flanked by bands of phyllitic unit **Zas.**

Zas Aaron Formation - metapelitic rocks - fine-grained, dark reddish-brown to moderate red weathering, thin-bedded, light gray, fissile, white mica schist. Typically weathers to moderate red homogeneous soils. Distinguished from mica schists in unit **Zhw** by the evenly distributed presence of a fine-grained Fe-Ti oxide, finer grain size, and relative lack of quartz.

Hyco Formation

Zhw Metasedimentary and metavolcanic rocks - fine- to medium-grained, dark reddish brown to moderate brown weathering, thin-bedded to finely laminated, massive metawacke, metasandstone, and minor quartzite with local lenses of micaceous fissile metawacke and micaceous quartz pebble metaconglomerate. Interbedded with the quartzose lithologies are fine- to medium-grained, moderate red weathering, thin-bedded, massive, light gray mica schists with stretched and flattened quartz clasts. Fine-grained fissile schists and massive actinolite-bearing mafic metatuffs occur as minor lenses. Mafic lenses are mapped as **Zha** and described below. Lenses of felsic crystal metatuff (**Zhc**) also are interbedded with **Zhw**. Soils typically are sandy and light in color.

Zhm Interbedded amphibolite and felsic metatuff and metawacke – medium-grained, foliated, thin- to medium-bedded, dark gray hornblende/actinolite + epidote/clinozoisite + plagioclase + quartz amphibolite interbedded with metatuff and metawacke similar to that in units **Zhc** and **Zhw** respectively.

Zhc Felsic crystal metatuff - medium- to fine-grained, thick-bedded, massive, white, pinkish gray, yellowish gray, or pale pink felsic crystal metatuff with subordinate felsic crystal lithic metatuff. Typically weathers to a mottled moderate brown and white saprolite. Soils are dusky yellow or light in color. Phenocrysts typically are 1 to 3 mm in diameter, constitute 5 to 40 % of the rock where present, and include sub- to anhedral quartz, plagioclase, and rare alkali feldspar. Phenocrysts commonly are broken. Thin, discontinuous lenses exhibit a phyllitic sheen and are strongly foliated. Relict vesicles, filled with an opaque oxide, occur locally. Fine-grained, thick-bedded, massive, white, felsic crystal-lithic metatuff occurs as discontinuous lenses. Lithic fragments, when present, include metawacke and metasandstone and constitute approximately 5 to 10 % of the rock. Beds of micaceous quartz-pebble metaconglomerate are sparse.

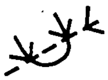
Zha Mafic metatuff - poorly exposed, fine-grained, moderate brown to moderate red weathering, thin-bedded, strongly foliated, dark yellowish-green to dusky-yellowish-green, fissile mafic metatuff. Occurs as a minor lense within unit **Zhw**. Typically weathers to very dark red homogeneous soils. Amphibole and plagioclase occur locally as porphyroblasts or relict phenocrysts within a fine-grained matrix of epidote, chlorite, amphibole, and plagioclase.

Zhf Fine-grained felsic metatuff - white to light brown weathering, thick-bedded, strongly foliated, white mica felsite with subordinate fine-grained, thin-bedded, massive, grayish-green to dusky-yellowish-green phyllite. Moderate brown weathering, massive felsic metatuff, and massive greenstone occur as minor lenses. Metabasite lenses composed of actinolite, epidote, chlorite, plagioclase and minor quartz found near contact with metatonalite (**Zto**). Soils typically are sandy and light in color.

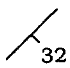
EXPLANATION OF MAP SYMBOLS

 Contact - Solid where accurately known; dashed where approximate

Fold axis - approximately located

 Overturned syncline (Dryburg syncline); arrow points in direction of fold plunge

Strike and dip of bedding (compositional layering)

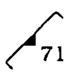


Inclined

Strike and dip of dominant schistosity (regional schistosity)

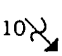
Inclined

Vertical



Strike and dip of dominant schistosity and parallel compositional layering

Trend and plunge of tight to isoclinal minor fold hinge



Trend and plunge of minor asymmetric open fold hinge; sense of asymmetry shows map pattern of fold

S Staurolite locality

\+ observation of soil/saprolite texture and content