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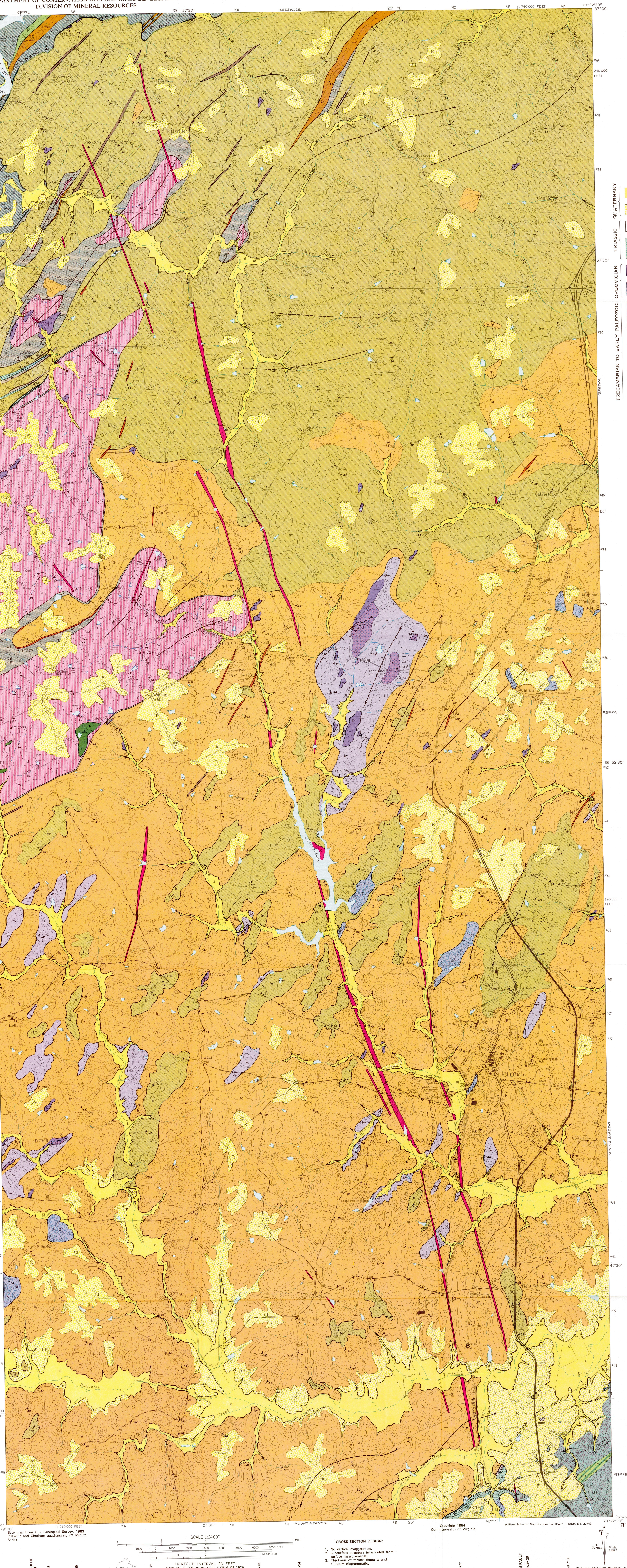
PITTSVILLE AND CHATHAM QUADRANGLES



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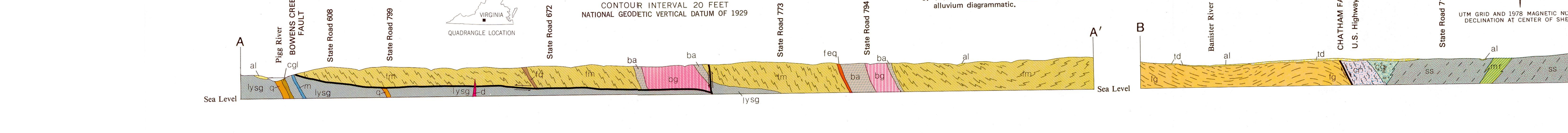

GEOLOGIC MAP OF THE PITTSVILLE AND CHATHAM QUADRANGLES, VIRGINIA

By

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EXPLANATION

QUATERNARY

al — Alluvium: *Silt, sand and gravel*

td — Terrace deposit: *Rounded pebbles and cobbles in a sandy-clay matrix*

TRIASSIC

d — Diabase dike: *fine to medium-grained, black diabase*

ss, cg — Dry Fork Formation: *ss, predominantly gray to browish-gray sandstone with mr, thin interlayered mudrock with cg, sandy conglomerate at base*

ORDOVICIAN

p — Pegmatite intrusives

ra, lw, lg — Rich Acres Formation: *ra, medium to coarse-grained gabbro and norite*
Leatherwood Granite: *lw, coarse-grained granite; lg, leucogneiss*

PRECAMBRIAN TO EARLY PALEOZOIC

fm, fq, feq, fg — Fork Mountain Formation: *fm, garnetiferous mica schist and fg, biotite gneiss with interlayered fq, ferruginous quartzites and feq, quartz-epidote fels*

ba, tts, bg — Bassett Formation: *primarily bg, biotite gneiss overlain by ba, amphibolite; tts, talc-tremolite schist*

lysg, gm, q, m, a, cgl — Lynchburg Formation: *predominantly lysg, biotite schist and gneiss with interlayers of gm, graphitic metasiltstone; q, quartzite; m, marble; a, mafic volcanic rock; and cgl, conglomerate*

cr — Cataclastic rock

KEY

CONTACTS

Exposed or approximate

Covered or inferred

FOLDS

Antiform: Trace of fold and direction of plunge

Synform: Trace of fold and direction of plunge

Overturned antiform: Trace of fold and direction of plunge

Overturned Synform: Trace of fold and direction of plunge

FAULTS

Exposed or approximate (black); covered or inferred (gray); U, upthrown; D, downthrown block; T, overthrust plate; arrows indicate relative direction of movement; 90 indicates vertical fault

SHEAR ZONE

ATTITUDE OF ROCKS

Strike and dip of inclined beds

FOLIATION

Strike and dip of foliation

Vertical foliation

Horizontal foliation

LINEATION

Bearing and plunge of mineral lineation

MINES AND QUARRIES

1 Ridgeway (Hematite)
2 Dalton (Magnetite)
3 Herter (Magnetite)
4 Tuck (Barite)
5 Berger (Barite)
6 Ramsey (Barite)
7 Bennet (Barite)
8 Parker (Barite)
9 Thompson (Barite) Dryden Wright mine assimilated by Thompson mine early 1900's
10 Whittles (Emery)
11 crushed stone

PROSPECTS

1 Area of numerous prospects (Magnetite and hematite)
2 Area of numerous prospects (Pegmatite)
3 Area of numerous prospects (Emery)

▲R-7772 R, repository number of rock sample on file at the Division of Mineral Resources

INTRODUCTION

Pittsville and Chatham quadrangles are located in northern Pittsylvania County in the Piedmont of south-central Virginia. They contain 112 square miles and are bounded by 36°45′ and 37°00′ north latitudes and by 79°22′30″ and 79°30′ west longitudes. The area is accessible by a network of primary and secondary roads as well as logging trails. The primary highway is U. S. Highway 29 which runs north-south along the eastern edge of the study area. Virginia Highway 40 bisects Pittsville quadrangle in an east-west direction, and Virginia Highway 57 bisects Chatham quadrangle in an east-west direction. The Southern Railway closely parallels the east side of U. S. Highway 29 through both quadrangles.

A well developed dendritic drainage pattern in the area in part appears to be structurally controlled by pervasive joint sets and faults, and in part by the trend of certain rock units that are resistant to weathering.

Pittsville and Chatham quadrangles are underlain primarily by rocks of the Smith River allochthon. The allochthon is bounded on the northwestern side by the Bowen's Creek fault, which in this area is a low-angle thrust fault the trace of which forms a sinuous line marked by re-entrants and salients. The allochton is bounded on the southeastern side by the Chatham fault, which separates rocks of the Smith River allochthon from Triassic age rocks of the Danville basin. The Chatham fault is a high angle shear zone that involves several intersecting normal faults. The Smith River allochthon is composed of metasedimentary and metavolcanic rocks which have been intruded by plutonic igneous rocks. The metasedimentary rocks are subdivided into a lower Basset Formation composed of biotite gneiss overlain by amphibolite, and an upper Fork Mountain Formation consisting of mica schist and biotite gneiss. Both of these formations have been intruded by gabbro and granite of the Martinsville igneous complex. The rocks within the Smith River allochthon have been polydeformed and polymetamorphosed.

The Lynchburg Formation lies on the southeastern limb of the Blue Ridge anticlinorium and is exposed in the northwestern corner of the study area. The Lynchburg Formation, composed predominantly of biotite schist and gneiss, includes interlayered metagraywackes, micaceous schists, marbles, quartzites, and mafic metavolcanic rocks.

The area has had a long history of sporadic mining which began in the 1850's when iron ore was mined and continues with current exploration for uranium. The various deposits include: iron minerals, emery, barite, vermiculite, pegmatite minerals, and uranium.

STRATIGRAPHY

SMITH RIVER ALLOCHTHON

Bassett Formation

The lowest stratigraphic unit in the Smith River allochthon is the Bassett Formation. The Bassett Formation occupies several structural domes within the area. It is divided into a lower biotite gneiss and an upper amphibolite. The biotite gneiss is light gray, equigranular, faintly banded, and faintly foliated. It is composed of quartz, plagioclase, biotite, and potassic feldspar. Biotite occurs as disseminated flakes oriented in the plane of foliation and as thin segregation bands producing a gneissic banding. Massive biotite gneiss, quartz-feldspar layers, and epidote-quartz layers occur sporadically throughout the unit. Thin, elongate to pod-shaped, discordant ultramafic bodies occur in the biotite gneiss unit in the extreme southwestern corner of Pittsville quadrangle.

Amphibolite and amphibole gneiss occur as concordant, discontinuous lenses and irregular masses interlayered with the top of the biotite gneiss and as persistent bands overlying it. The first interlayering apparently reflects the beginning of an episode of mafic volcanism. Major and trace element analysis of this rock indicates that it is similar in composition to continental basalts (Conley, 1981). The amphibolite is dark gray to greenish-black, medium- to coarse-grained, foliated and is composed of hornblende and plagioclase with quartz and epidote. Locally it contains discontinuous lenses of epidosite and irregular, dike-like masses of pyroxene granofels. It is also cut by felsite dikes, pegmatites, and ptygmatically folded bands of feldspar, quartz, and epidote. The amphibolite locally contains ovoid masses composed of plagioclase, epidote, and quartz which resemble amygdules (Conley and Henika, 1970).

Fork Mountain Formation

The Fork Mountain overlies the Bassett Formation. The contact is gradational over tens of feet. The Fork Mountain Formation is divided into a lower biotite gneiss unit and an upper garnetiferous mica schist. The Fork Mountain Formation also contains thin lenses of quartz-epidote rock and ferruginous quartzites.

The lower biotite gneiss unit of the Fork Mountain Formation is a light to dark gray, moderately-foliated, segregation-banded, medium- to coarse grained rock composed of alternating quartzo-feldspathic and dark biotite schist layers. The biotite schist is light to dark silvery gray, medium to coarse grained and consists of intergrown biotite and muscovite with porphyroblasts of muscovite which have grown perpendicular to the foliation.

The garnet-mica schist is light silvery gray, medium grained, well foliated, and contains porphyroblasts of garnet and cross-grown muscovite, as well as staurolite at lower grade and sillimanite at higher grade metamorphism.

Calc-quartzite lenses and boudins occur throughout the Fork Mountain Formation. They are light greenish-gray equigranular rocks that have a granoblastic texture. The calc-quartzites probably represent original carbonate-rich sandstones.

Quartzite containing magnetite or specular hematite occurs as thin, discontinuous lenses and beds in both the garnet-mica schist and garnet-biotite gneiss of the Fork Mountain Formation. The rock is light to dark gray to tan, fine-grained and dense. The content of the rock is variable between 20-45 percent mica and 5-15 percent calcite. Some of these quartzites in the northwest corner of Pittsville quadrangle have been mined for magnetite and specular hematite (Watson, 1907).

Rich Acres Formation

Gabbro and diorite of the Rich Acres Formation intrude the rocks within the Smith River allochthon. These plutonic rocks are of dark gray to greenish-gray, porphyritic nonfoliated, medium- to coarse-grained with a subophitic texture. These intrusive rocks occur as sill-like to elongate irregular masses that are locally discordant and intersect the regional foliation at a small angle.

Leatherwood Granite

The Leatherwood Granite intrudes the rocks of the Smith River allochthon as dikes, sills, and irregular shaped plutons. The granite is light gray, coarse grained, porphyritic, and generally exhibits a rapakivi texture. It is composed of quartz, microcline, plagioclase, biotite, and muscovite. U/Pb and Rb/Sr whole-rock dates indicate that the Leatherwood Granite is Ordovician in age (Rankin, 1975, Odom and Russell, 1975). Leucogneiss, a light gray segregation banded gneiss, occurs intimately associated with the Leatherwood Granite.

Pegmatites

A number of small, discordant granitic pegmatite dikes and sills intrude the pre-Triassic rocks of the study area. These pegmatites are directly on strike to the southwest with pegmatites found in the Altavista area by Pegau (1932). They range in length from a few inches to tens of feet. They are complexly intergrown masses of quartz, plagioclase, microline, and muscovite. A few of the pegmatites are zoned, and contain quartz cores, perthitic intermediate zones, and plagioclase-rich wall zones.

BLUE RIDGE ANTICLINORIUM

Lynchburg Formation

The Lynchburg Formation is composed of a variety of metasedimentary and metavolcanic rocks. These include thin discontinuous mafic volcanic rocks (amphibole gneiss), quartzites, marbles, graphitic metasiltstones, metagraywackes (biotite schist and gneiss), and minor conglomerates. The rocks of the Lynchburg Formation are cut by numerous shear zones which locally repeat the stratigraphy.

Interlayered biotite schist and gneiss are the dominant lithologies within the Lynchburg Formation. The gneissic layers constitute 60 percent of the unit and are fine to medium grained, light to dark gray. Biotite schist interlayers contribute 40 percent of the unit and are composed of quartz, biotite, muscovite, and feldspar. The biotite gneiss locally contains graded bedding.

Graphitic metasiltstone occurs as discontinuous lenses and layers within the biotite schist and gneiss. The graphitic metasiltstone is massive to thinly laminated and fine grained. Graphite occurs throughout the metasiltstone as disseminated material and as graphite-rich beds.

Quartzite occurs as interlayers within the Lynchburg Formation. Many thin discontinuous lenses were not mapped. The quartzites contain calcareous, micaceous, and conglomeratic facies. They range from iron-rich quartzites, which probably represent recrystallized volcanic cherts, to clean, well-sorted quartzites. Thin conglomeratic zones contain feldspar and blue quartz clasts. Blue quartz is common in the rocks of the Blue Ridge anticlinorium to the west, thus implying a western source area. However, Conley (1981) has observed cross-beds in the Lynchburg Foundation that indicate an additional source area to the southeast.

Thin discontinuous interlayers of fine- to coarse-grained marbles are common within the biotite schist and gneiss of the Lynchburg Formation. Approximately 90 percent of these marbles are fine grained, thinly laminated, and moderately schistose. The remaining ten percent are coarsely crystalline. The marbles contain a schistosity due to the alignment of abundant micaceous minerals. Most of the coarsely-crystalline marbles are associated with cataclastic zones marked by crushed and strained vein quartz, and development of pervasive shear cleavage. Therefore, some of these marbles appear to have recrystallized.

Mica schist also occurs as thin lenses and layers within the Lynchburg Formation. These schists are fine to medium grained and highly foliated. They contain muscovite, biotite, quartz, and minor amounts of graphite and garnet.

Amphibole gneiss occurs as concordant lenses from a few inches to tens of feet thick. One of these lenses was mapped in the northwestern corner of Pittsville quadrangle. This gneiss is light greenish-gray to dark greenish-gray, fine to medium grained and is composed of hornblende, epidote, plagioclase, and chlorite. The amphibole gneiss may locally contain small (0.4 to 1.2 in.) ovoid masses of epidote and plagioclase which are interpreted as amygdules. Both Espenshade (1954) and Brown (1958) describe amygdules in greenstones along strike to the northeast. Conley (1981) has plotted titanium, zirconium, and yttrium contents of greenstones that are along strike to the southwest and has determined that the majority of these rocks plot in the ocean-floor basalt field of Pearce and Cann (1973).

DANVILLE BASIN

Dry Fork Formation

The Danville basin is a downfaulted trough that trends northeastward across the southeastern corner of Chatham quadrangle. In this area the basin is filled with a sequence of conglomerates, sandstones, siltstones, and mudrocks of Triassic age. Meyertons (1963) assigned these rocks to the Leaksville Formation, the time-equivalent Dry Fork Formation, and a younger Cedar Forest Formation. The Leaksville Formation was described as containing predominantly red and black claystones, shales, siltstones, sandstones, and a few conglomerates, whereas the Dry Fork Formation at its type locality in southeastern Chatham quadrangle contains graywackes and arkoses. Both of these units are overlain by a younger formation, previously called the Cedar Forest Formation, containing red shale and conglomerate. Thayer (1977) redefined the Dry Fork Formation to include basin-margin conglomerates previously assigned to the Cedar Forest Formation and described the Dry Fork as containing sandstone, mudrock and conglomerate facies. Later, Thayer (1980), removed the conglomerates from the Dry Fork Formation and referred to them informally as upper and lower conglomerate units. This report follows Thayer (1977) and considers the conglomerates and other rocks in this part of the Danville basin to belong to the Dry Fork Formation.

Sandstone Facies

Sandstone occurs as gray to greenish-gray, poorly sorted, coarse- to very coarse-grained arkose and lithic arkose. It is dominantly massive, crudely stratified, and is interbedded with subordinate mudrock and conglomerate. It is composed of clasts of quartz, potassic feldspar, and plagioclase with subordinate lithic fragments, micas, and arkosic matrix. The grains are cemented by authigenic chlorite and sparry calcite. Minor sedimentary structures include: channels, medium and large scale tabular and trough cross-stratification, thick parallel laminations, and ripple drift cross-laminations. The sandstones, conglomerates, and mudrocks are stacked in sets resembling fining upward fluvial cycles (Thayer, 1970).

Mudrock Facies

Mudrock is interlayered with sandstone. This facies consists of thinly-bedded, medium to dark gray mudrock and shale with minor granule and pebble lithic arkosic conglomerate. It is typically laminated, and contains thin carbonaceous films and pyrite. The mudstones are fine grained, and are composed chiefly of quartz, potassic feldspar, and plagioclase with subordinate amounts of detrital mica, lithic fragments, and finer-grained arkosic matrix.

Conglomerate Facies

The conglomerate facies of the Dry Fork Formation, (Thayer, 1977) crops out along both the northwest and southeast margins of the Danville basin. This conglomerate is light to medium gray, well indurated, and consists of multicolored clasts set in an arkosic sandstone matrix. The clasts are rounded to subrounded and consist of quartz, quartz-feldspar gneiss, augen gneiss, biotite gneiss, pegmatite, and potassic feldspar. The conglomerate is primarily clast supported and has an unordered fabric. Much of the conglomerate along the northwestern margin of the basin is extensively sheared, silicified, and cut by anastomosing quartz veins.

Cataclastic Rocks

Microbreccia

The cataclastic rocks are divided into microbreccia and cataclasite. The microbreccia is hard, medium light gray, and composed chiefly of unoriented, angular fragments consisting of intergrowths of quartz and microcline and dark gray to opaque aphanitic material, and angular fragments of quartz and feldspar ranging in size from 0.02 to 2 mm (these angular grains form the mortar between larger fragments). It is intensively fractured; many fractures are filled with light green, microcrystalline chlorite that contains numerous small crystals of pyrite that are mostly altered to limonite.

Cataclasite

The cataclasite is aphanitic and structureless, with angular quartz and feldspar porphyroclasts. The unit is derived from metamorphic rocks lying along the west boundary of the Danville basin. Quartz veins up to several feet long and an inch wide commonly cut the unit.

Diabase Dikes

Northwest-trending, vertical diabase dikes intrude all rock units within the study area. These dikes average approximately twenty-five feet in width and some are thousands of feet in length. One remarkably persistent dike is over eleven miles long. The diabase is dark gray to black, fine to medium grained and has a subophitic to ophitic texture. It is composed of plagioclase, clinopyroxene, olivine, hornblende, epidote, chlorite, and magnetite.

Terrace Deposits and Alluvium

Terrace deposits occur as thin remnants of unconsolidated sediments and cover gentle slopes and flat-topped hills. These deposits are composed of a basal quartz gravel containing rounded to subrounded pebbles and cobbles overlain by unstratified sands and silts. The average thickness of this unit is usually a few tens of feet. Alluvial deposits underlie floodplains of major streams. The alluvium is composed of unconsolidated sand and clay with subrounded to rounded cobbles and pebbles. These deposits reach thicknesses of 30 feet along the Banister River in southern Chatham quadrangle.

STRUCTURE

SMITH RIVER ALLOCHTHON

The dominant structural feature of the area is the Smith River allochthon. The Smith River allochthon is a polydeformed, rootless structure that is bounded on the northwest by the Bowens Creek fault, and on the southeast by the Chatham fault. The allochthon is thrust northwestward over metasedimentary rocks of the Lynchburg Formation. Along this northwestern boundary the thin edge of the allochthon is broken by several high-angle reverse faults. The rocks within the allochthon display four distinct fold systems.

FOLDS

F_1 folds within the allochthon are extremely attenuated isoclines coplanar with regional foliation, which typically distort S_0 compositional layering into "Type 3", (hook-shaped fold) interference patterns (Ramsay, 1967). These folds lie within the plane of F_2 foliation. F_1 folds can be seen along Roaring Fork Creek, approximately one mile southeast of Climax in southeast Pittsville quadrangle.

Second generation F_2 folds are marked by a pronounced axial plane cleavage and form upright to overturned isoclines. These folds generally trend northeast-southwest, and their axial surfaces dip to the northwest. F_2 folds are exposed along State Road 760 in the northeastern part of Pittsville quadrangle.

Third generation folds, F_3, form the most conspicuous map structures within the study area. These folds are gentle, open folds, thousands of feet in size. These folds are discernible where F_2 foliation has been bent by these later folds into broad domal structures with intervening synclines. F_3 folding is discernible in southwestern Pittsville quadrangle, where domes of Bassett Formation rock have been produced by F_3 warping of F_2 structures.

F_4 fourth generation folds are large, open, northwest trending structures which have warped the axial surfaces of both F_2 and F_3 folds.

FAULTS

Bowens Creek Fault

The Bowens Creek fault (Conley and Henika, 1970) bounds the Smith River allochthon along its northwest side. To the southwest the fault is delineated by a band of phyllitic schist (Conley and Henika, 1970; Henika, 1971) and has a southeast dip ranging from 55 degrees to vertical (Conley and Henika, 1973). Northeast into the study area, the Bowens Creek fault is subhorizontal resulting in the formation of erosional reentrants of Blue Ridge rocks and salients of allochthon rocks as well as detached klippe of allochthon rocks that lie on the rocks of Blue Ridge.

A shear cleavage is particularly well developed on the southeast side of the fault. In the immediate area of the fault this cleavage is pervasive and oriented in the subhorizontal plane of the fault.

This fault is well exposed at two localities in Pittsville quadrangle. The first is a saprolite exposure located approximately 0.1 mile north of the intersection of State Road 771 and State Road 672 in the northeast part of Pittsville quadrangle. At this locality garnetiferous sillimanite schist of the Fork Mountain Formation overlies graphite schist of the Lynchburg Formation. The second exposure is located on the east bank of the Pigg River, 0.7 mile due west of the intersection of State Road 771 and State Road 608. Here sillimanite schist of the Fork Mountain Formation is thrust over highly deformed marble of the Lynchburg Formation.

Chatham Fault Zone

The Chatham fault (Meyertons, 1963) bounds the Smith River allochthon along its southeastern side and also forms the northern boundary of the Danville basin. It was originally described as a narrow feature with movement along a single fault plane (Meyertons, 1963). However Henika (1977) and Price and others (1980A, 1980B) describe the fault as a zone composed of small shears, and fractures consisting of several intersecting normal faults. These faults are parallel and have a trend of approximately N42°E which approximates the trend of the Danville basin. The general dip of this zone is 65°SE (Meyertons, 1963). An excellent exposure of cataclasite and microbreccia is located in Dry Fork community in the southeast corner of Chatham quadrangle approximately 0.1 mile (0.2 km) west of the intersection of the Southern Railway and State Road 718.

Minor Faults

In the northwest part of Pittsville quadrangle the leading edge of the Smith River allochthon is broken by numerous vertical and high-angle reverse faults. These faults trend approximately N35 E and dip steeply to the southeast.

ECONOMIC GEOLOGY

BARITE

Barite has been mined along a northeast trending zone beginning 0.1 mile south of the intersection of Virginia Highway 40 and State Road 605 and extending 1.2 miles northeast of Pittsville. The barite occurs as fragments, fissure fillings, breccia matrix, and replacement veins in highly fractured micaceous quartzites and deformed marble. All of these barite deposits occur in zones of high angle faults (Marr, 1979). Barite mining began in the area in the early 1870's and ceased by the mid-1930's (Watson, 1907). A detailed history and production figures from these mines can be found in Watson (1907), Edmundson (1938), Espenshade (1954) and Brown (1958). The genesis of the barite deposits is complex. Watson (1907) and Edmundson (1938) offer conflicting evidence concerning their origin. Watson (1907) believed these deposits to be replacement bodies in limestone beds. Edmundson (1938) pointed out the low barium oxide content of both the marble beds and surrounding rocks as one of his arguments favoring a hydrothermal origin. Espenshade (1954) believed that the genesis of these barite deposits was obscure and that several geologic processes were involved.

Espenshade states (p. 78), "the barite may be hydrothermal in origin, or it, or some other barium mineral, may have been an original sedimentary constituent of the limestone and occurred locally in greater amounts in the southwestern part of the belt. These barium minerals may have been transported and deposited as barite veins in marble under favorable metamorphic conditions, and locally mixed with minor hydrothermal solutions to form the association with tourmaline or with pegmatitic solutions to form the few occurrences of barite in pegmatite. As a final step, some transportation and deposition of barium by ground waters in the residual clay may have taken place during the long weathering process that has affected the region."

Recent work by Skrzyniecki and Nordstrom (1975) has revealed the existence of barite mineralization along lineaments shown by ERTS imagery. These deposits in Shelby County, Alabama are associated with thrust faults in carbonate rocks. Also Holland (1967) has demonstrated that barite solubility increases with temperature and that precipitation takes places upon cooling. As previously stated all of the barite deposits in Pittsylvania County are associated with high-angle faults. These faults formed along the leading edge of the Smith River allochthon either during or immediately following emplacement of the allochthon. The association of barite with accessory tourmaline, hornblende, biotite, pyrite, and calcite as well as the silicification and propylitization of the wall rock within the faults and the presence of unaltered granitic pegmatites within the fault zone indicate that some hydrothermal activity took place. Also barite is associated with manganiferous wad resulting from the weathering of the marble. As Espenshade (1954) suspected, the barite deposits appear to have a complex history. The barite was originally deposited in sediments. Upon emplacement of the Smith River allochthon the marbles, being extremely incompetent, deformed and the associated micaceous quartzites were fractured. The barite was remobilized during this interval of elevated temperature and pressure. Then hydrothermally emplaced within these fractures and recrystallized as fissure fillings and replacement veins. Following the emplacement of the remobilized barite the deposits were subjected to a prolonged period of quiescence which resulted in the formation of weathered wad containing nodules of barite.

IRON

Iron deposits composed of either magnetite or hematite occur in northwestern Pittsylvania County in the northwestern corner of Pittsville quadrangle, near Pittsville. These deposits are in graphitic mica schists and quartzites. Magnetite also occurs in association with spinel near the town of Whittles (see emery section). The mining of the Pittsville iron deposits began in the early 1870's and ceased by the early 1900's (Watson, 1907). Furcron (1935) abstracted contemporary descriptions of the iron deposits and mining operations from Campbell (1882) and Frazer (1883). Espenshade (1954) divided deposits near Lynchburg into two distinct types: magnetite and specular hematite. The Pittsville area also contains magnetite and hematite. Espenshade (1954) felt that the deposits near Lynchburg were originally formed as thin accumulations of iron-rich sediments that were later altered by metamorphic processes. He cites the occurrence in a restricted stratigraphic interval as evidence. Because the Pittsville deposits occur along strike with the Lynchburg deposits and have similar characteristics it is believed that they have had a similar history.

PEGMATITE MINERALS

Granite pegmatites are widespread throughout the study area. A few have been prospected and one mine is reported (Sterrett, 1923; Brown, 1962). The pegmatites consist of coarsely crystalline masses of feldspar, muscovite, and quartz, which occur in lenticular lenses that are concordant with the existing foliation. These pegmatites are southeast along strike from those reported in the Sycamore pegmatite area by Brown (1962) and the Altavista area by Pegau (1932). Sterrett (1923) describes the Easly mica mine as being in Pittsylvania County 3.25 miles S25°W of Chatham. This area is now covered by a thick pine forest and the location could not be confirmed. Due to the limited size of the pegmatites in this area it is doubtful that there will be any significant commercial production of pegmatite minerals in the near future.

EMERY

Emery consisting of an intergrowth of spinel, corundum, and magnetite has been found at several localities within the study area. Only two of these deposits have had any commercial importance. One deposit is located one mile east of Chatham Church and approximately 0.3 mile north of the intersection of Virginia Highway 57 and State Road 605. Little remains of this excavation; however, Watson (1923) reports five tons of ore was shipped to Chatham from this deposit.

The largest deposit of emery is located 1.8 miles (2.9 km), due west of Whittles. This deposit has been reclaimed as part of a golf course, and few of the original cuts are available for study. The deposit at Whittles was described by Watson (1923 and 1925) and Friedman (1951 and 1956). The genesis of these deposits is obscure. Watson (1923) stated that the emery deposits were developed in schist near the granite-schist contact and were of contact metasomatic replacement origin.

Friedman (1956) disagreed with this proposal and postulated that the emery formed in altered gabbro along the granite-gabbro contact and was the result of granitic emanations. Field observation of better exposed emery occurrences has lead to another interpretation. Emery occurs in completely recrystallized schist which is immediately adjacent to gabbroic intrusives. Granite or pegmatitic material may be associated with the deposit. At Whittles the gabbro intrusive is surrounded by a contact metamorphic aureole which consists of an inner sillimanite zone progressing outward into a staurolite zone, a garnet zone, and an outer chloritoid zone. The intimate association of intrusive gabbro and recrystallized schist indicates that the emery deposits formed at the time of gabbro intrusion as a result of increased temperature and pressure.

VERMICULITE

Vermiculite was reported in the Toshes-Museville area of northwestern Pittsylvania County by Gooch (1957). The exposures referred to by Gooch could not be located. Vermiculite, commonly associated with ultramafic intrusions which occur in hornblende and biotite gneiss of the Bassett Formation, is an alteration product of the ultramafic rocks. Because most of the deposits are limited in extent, the economic potential for vermiculite in this area is low (Gooch 1957).

URANIUM

Dribus (1978) reported that uranium-bearing rocks occur in Triassic strata and associated rocks along the boundaries of the Danville basin. On July 22, 1982, Marline Uranium Corporation announced that it had discovered reserves of thirty million pounds of uranium oxide (Sweet, 1983). The uranium was found about six miles northeast of Chatham in intimate association with faulted granitic rocks along the northwest side of the Danville basin.

GEOLOGIC AND ENVIRONMENTAL FACTORS AFFECTING LAND MODIFICATION

UNIT CHARACTERISTICS

Bassett Formation

Bassett Amphibolite

The Bassett amphibolite weathers to a sticky, highly plastic, clay residum which is moderately impermeable and has high shrink-swell potential. Excavations made in this unit are relatively stable; however, some slumping may occur during prolonged wet periods because of liquefaction. Septic tank drainage is poor to fair because of high clay content of the B-horizon of the soil.

Biotite Gneiss

Biotite gneiss weathers to a deep sandy loam. Its soil is well-drained, moderately permeable and has a low shrink-swell potential. The soft loamy saprolite is extremely susceptible to erosion if denuded of vegetation and soil cover.

Talc-Tremolite Schist

Talc-tremolite schist weathers to a thin viscous clay residum that is impermeable and has a high shrink-swell potential. Excavations made in saprolite of this unit are subject to slumping during wet periods.

Fork Mountain Formation

Mica Schist

These rocks underlie upland areas because they are composed predominantly of muscovite which is resistant to chemical weathering. They weather to a reddish-orange clayey loam that has a moderate permeability and low to moderate shrink-swell potential. Construction cuts are stable except where pervasive foliation is undercut. Thin soil containing residual schist blocks hampers, but does not prohibit, agriculture endeavors.

Biotite Gneiss

The gneiss weathers to a deep, sandy loam saprolite. Soils are well drained, moderately permeable, and have low shrink-swell potential. Soft loamy saprolite is susceptible to heavy erosion. The unit has adequate drainage for septic tanks. The sandy loam is well suited for agricultural purposes, because it can be easily worked and is well drained.

Quartzite

Both the quartzite and the quartz-epidote fels lenses are resistant to weathering and form thin sandy saprolites over bedrock. These rocks are impermeable, therefore poorly drained and have low shrink-swell potential. Some exposures show limited potential for sources of crushed stone.

Rich Acres Formation

Rocks of the Rich Acres Formation form residual soil of variable thickness which weathers to a sticky, plastic clay that has high shrink-swell potential and slow percolation. Excavations in this unit are subject to slumping, and foundations may become unstable during wet periods because of liquefaction. The unit locally contains large spheroidally weathered boulders that may require heavy machinery to remove.

Leatherwood Granite

The Leatherwood Granite weathers to sandy loam that has moderate permeability and low to moderate shrink-swell potential. Complete denudation of large areas of saprolite will result in intensive erosional and siltation problems due to rapid weathering of unit.

Pegmatites

Weathered pegmatites are permeable and would provide good septic tank drainage. Fresh construction cuts are moderately stable, but the rock weathers rapidly and is then subject to sloughing. Some of the larger pegmatites offer minor potential for mining of feldspar, muscovite, kaolin, and quartz aggregate.

Lynchburg Formation

Schist and Gneiss

Fine- to medium-grained biotite schist and gneiss are permeable, moderately well drained, have a low shrink-swell potential, and a moderate load bearing capacity. They are suited to the construction of single and multiple-family housing as well as small to moderate industrial facilities. Deep cuts for construction purposes would be relatively stable as long as care is taken to avoid undercutting the local foliation and jointing. Total denudation of vegetation may lead to erosional and siltation problems because of rapid weathering of unit.

Graphitic Metasiltstone

The fine-grained graphitic metasiltstone occurs as thin discontinuous lenses and layers within the Lynchburg schists and gneisses. When weathered it is moderately permeable, has a low shrink-swell potential, and high load bearing capacity. Construction cuts would be relatively stable. Use of this unit for solid and liquid waste disposal is limited by its restrictive occurrence.

Quartzites

The quartzites are generally resistant to weathering and form topographic highs. This resistance to weathering makes the unit unsuitable for agriculture due to thin soils overlying hard bedrock and the presence of steep slopes. The unit provides excellent stability for construction cuts and foundations but would require blasting to be excavated. Its shallow soil profile and impermeability would make it unsuitable for either solid or liquid waste disposal.

Marble

Marble occurs as thin intermittent lenses within the schist and gneiss unit. This unit has potential to form solution cavities which pose a high potential for groundwater pollution.

Amphibole Gneiss

Amphibole gneiss is limited in its occurrence and weathers to an impermeable, highly plastic clay, with high shrink-swell characteristics, and fairly low load-bearing capacity. The amphibole gneiss is closely jointed and cuts that undermine joint planes are susceptible to slides and rock falls. Foundations may settle during wet periods because of liquefaction of plastic clay. Septic tank drainage is poor to fair because of the high clay content.

Dry Fork Formation

Conglomerate

Residuum formed on the conglomerate unit forms a thin, stony, sandy loam that has good surface drainage. Steeper slopes require blasting for construction because of the proximity of bedrock to the surface. The conglomerate may be sheared which increases the potential for rockfalls or landslides if shear surfaces, joint surfaces, or bedding planes are undercut.

Sandstone

The sandstone in this area is a massive rock, but it is extensively jointed. Residuum formed on this unit is a thin stony loam that has good surface drainage. The sandstone is resistant to weathering and underlies ridges with moderate to steep slopes. Cuts for construction purposes are moderately stable if care is taken to avoid undercutting joint surfaces or bedding planes. Unit has moderate potential as a source of crushed stone.

Mudrock

Mudrock of the Dry Fork Formation forms a fine sandy loam soil which increases in clay content to a plastic clay at 14 to 20 inches in depth. The mudrock is subject to sliding and sloughing in construction cuts. The subsoil is relatively impermeable and is not well suited for septic tank drainage. The unit weathers rapidly and freshly graded slopes require cover to prevent erosion.

Cataclastic Rocks

The microbreccia and cataclasite are structureless and are composed of an aphanitic matrix with unoriented angular porphyroclasts (0.5 mm) of quartz and feldspar. The cataclasite is commonly cut by quartz veins. It consists of sheared and broken rocks. Minor fault planes are common. Sliding and sloughing may occur in cuts and deep excavations. The units have moderate potential as a source of crushed stone.

Diabase Dikes

Diabase dikes weather to produce long narrow zones of dense poorly-drained soils, that become sticky and highly plastic when wet. The contact between these dikes and the surrounding rocks provides a pathway for water seepage. Excavations in saprolite are subject to slumping and slides due to liquefaction during wet periods. Spheroidally weathered boulders, common in the saprolite, may require heavy machinery or blasting to remove. Some of the wider dikes may have potential as a source of dimension or facing stone.

Terrace Deposits and Alluvium

Terrace deposits are generally less than five feet thick which limits their potential as a source of sand and gravel. Intermittent clay layers may produce perched water tables which limits their usefulness for septic tank drainage fields. Seepage around structural foundations may be another result of perched water tables.

Unconsolidated alluvial deposits occur in all major stream valleys. These deposits are generally well drained and easily excavated. However, the water table is close to the surface, and excavations erode easily and are subject to slumps and slides when wet. Development is limited because of periodic flooding. Although the soil is good for septic tank drainage, contamination of surface water and groundwater supplies may result.

REFERENCES

Brown, W. R., 1958, Geology and mineral resources of the Lynchburg quadrangle, Virginia: Virginia Division Mineral Resources Bull. 74, 99 p.

______, 1962, Mica and feldspar deposits of Virginia: Virginia Division of Mineral Resources Min. Res. Rept. Report 3, 195 p.

Campbell, J. L., 1882, Geology and mineral resources of the James River Valley, Virginia, U.S.A.: New York, G. P. Putnam's Sons, 119 p.

Conley, J. F., 1981, Stratigraphic relationships between rocks of the Blue Ridge anticlinorium and the Smith River allochthon in the southwestern Virginia Piedmont, *in* Conley, J. F., Marr, J. D., Jr., and Berquist, C. R., Jr., Stratigraphic relationships between rocks of the Blue Ridge anticlinorium and the Smith River allochthon: Virginia Division of Mineral Resources, Thirteenth Annual Virginia Geologic Field Conference, p. 1-28.

Conley, J. F., and Henika, W. S., 1970, Geology of the Philpott Reservoir quadrangle, Virginia: Virginia Division of Mineral Resources Rept. Inv. 22, 46 p.

______, 1973, Geology of the Snow Creek, Martinsville East, Price, and Spray quadrangles, Virginia: Virginia Division of Mineral Resources Rept. Inv. 33, 71 p.

Dribus, J. R., 1978, Preliminary study of the uranium potential of the Dan River basin system, North Carolina and Virginia: U. S. Department of Energy Rept. EY-76-C-13-1664 26 p.

Edmundson, R. S., 1938, Barite deposits of Virginia: Virginia Geol. Survey Bull. 53, 85 p.

Espenshade, G. S., 1954, Geology and mineral deposits of the James River-Roanoke River Manganese District, Virginia: U. S. Geol. Survey Bull. 1008, 155 p.

Frazer, P., Jr., 1883, The iron ores of the middle James River, Virginia: Am. Inst. Min. Eng. Trans., vol. 11, p. 201-216.

Friedman, G. M., 1951, The origin of emery deposits (abs.): Econ. Geol., vol. 46, p. 113.

______, 1956, The origin of spinel-emery deposits with particular reference to those of the Cortland Complex, New York: New York St. Mus. Bull. 351, 68 p.

Furcron, A. S., 1935, James River iron and marble belt, Virginia: Virginia Geol. Survey Bull. 39, 124 p.

Gooch, E. O., 1957, Vermiculite: Virginia Division of Mineral Resources, Virginia Minerals, vol. 3, no. 1, p. 1-5.

Henika, W. S., 1971, Geology of the Bassett quadrangle, Virginia: Virginia Division of Mineral Resources Rept. Inv. 26, 43 p.

______, 1977, Geology of the Blairs, Mount Hermon, Danville, and Ringgold quadrangles, Virginia: Virginia Division of Mineral Resources Pub. 2, 45 p.

Holland, H. D., 1967, Gangue minerals in hydrothermal deposits, *in* Barnes, H. L., ed., Geochemistry of hydrothermal ore deposits: New York, Holt, Rinehart and Winston, p. 382-436.

Marr, J. D., Jr., 1979, Barite mineralization associated with high-angle faults along the northwestern boundary of the Smith River allochthon, south-central, Virginia (abs.): Geol. Soc. America Abs. with Prog. vol. 11, no. 4, p. 188.

Meyertons, C. T., 1963, Triassic formations of the Danville basin: Virginia Division of Mineral Resources Rept. Inv. 6, 65 p.

Odom, A. L., and Russell, G. S., 1975, The time of regional metamorphism of the inner Piedmont, North Carolina and Smith River allochthon: Inference from whole-rock ages: Geol. Soc. America Abs. with Prog., Vol. 7. No. 4, p. 522-523.

Pearce, J. A., and Cann, J. R., 1973, Tectonic setting of basic volcanic rocks determined using trace element analyses: Earth and Planetary Science Letters, vol. 19, no. 2, p. 190-300.

Pegau, A. A., 1932, Pegmatite deposits of Virginia: Virginia Geol. Survey Bull. 33, 123 p.

Rankin, D. W., 1975, The continental margin of eastern North America in the southern Appalachians, the opening and closing of the proto-atlantic Ocean: American Jour. Sci., vol. 275-A, p. 298-336.

Ramsay, J. G., 1967, Folding and fracturing of rocks: New York, McGraw-Hill Book Co. (International Series Earth and Planetary Science), 568 p.

Skrzyniecki, A. F., and Nordstrom, H. E., 1975, Geochemical anomalies associated with barite mineralization and ERTS-1 derived lineaments in Alabama: Geol. Soc. America, Abs. with Prog., vol. 7, no. 4, p. 534.

Sterrett, D. B., 1923, Mica deposits of the United States: U. S. Geol. Survey Bull. 740, 341 p.

Thayer, P. A., 1970, Stratigraphy and geology of Dan River Triassic basin, North Carolina: Southeastern Geology, vol. 12, no. 1, p. 1-31.

______, 1977, Danville basin, *in* Henika, W. S., Geology of the Blairs, Mount Hermon, Danville, and Ringgold quadrangles, Virginia: Virginia Division of Mineral Resources Pub. 2, 45 p.

______, 1980, Danville basin, *in* Price, Van and others, Geology of the Axton and Northeast Eden quadrangles, Virginia: Virginia Division of Mineral Resources Pub. 22, one sheet.

Price, Van and others, 1980, Geology of the Axton and Northeast Eden quadrangles, Virginia: Virginia Division of Mineral Resources Pub. 22, one sheet.

______, 1980b, Geology of the Whitmell and Brosville quadrangles, Virginia: Virginia Division of Mineral Resources Pub. 21, one sheet.

Sweet, P., 1983, Mineral resources; Virginia Division of Mineral Resources, Virginia Minerals, vol. 29, no. 1, p. 11.

Watson, T. L., 1907, Mineral resources of Virginia: Lynchburg, Virginia, J. P. Bell Co., 618 p., illus.

______, 1923, A contribution to the geology of the Virginia emery deposits: Econ. Geol., vol. 18, no. 1, p. 53-76.

______, 1925, Hoegbomite from Virginia: American Min., vol. 10, no. 1, p. 1-9.