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Front Cover: View of a portion of South River Valley along State Route 716, looking northeast. South Mountain in distance is underlain by quartzite of the Antietam Formation. Slopes in front of South Mountain are capped with remnant fan deposits. Residual slopes in foreground are underlain by carbonate bedrock.
CONTENTS

INTRODUCTION .......................................................................................................................... 1
  Previous Investigations ........................................................................................................... 2
  Field Methods ......................................................................................................................... 2

STRATIGRAPHY ......................................................................................................................... 2
  Basement Rocks of the Blue Ridge Province ......................................................................... 2
  Younger Intrusive Rocks of the Blue Ridge Province ............................................................ 2
  Fault-related Rocks of the Blue Ridge Province .................................................................... 4
  Metasedimentary Rocks of the Blue Ridge Province ............................................................. 4
  Sedimentary Rocks of the Valley and Ridge Province .......................................................... 6
  Surficial Deposits ................................................................................................................... 7

METAMORPHISM ..................................................................................................................... 7

STRUCTURE ............................................................................................................................... 8
  Folds ......................................................................................................................................... 8
  Faults ....................................................................................................................................... 9
  Mesoscale Fabrics .................................................................................................................. 10

ECONOMIC GEOLOGY ............................................................................................................. 10
  Iron and Manganese ................................................................................................................ 10
  Clay ......................................................................................................................................... 12
  Travertine-Marl ....................................................................................................................... 12
  Crushed and Dimension Stone ............................................................................................... 12
  Mineral Resource Potential .................................................................................................... 13

GEOLOGIC FACTORS AFFECTING LAND USE ................................................................. 13
  Water Resources .................................................................................................................... 13
  Sinkholes ................................................................................................................................. 14
  Landslides ............................................................................................................................... 14

ACKNOWLEDGMENTS ............................................................................................................. 14

REFERENCES CITED ............................................................................................................ 15
FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Location of the Cornwall 7.5-minute quadrangle</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Gneissic basement rocks on the Cornwall quadrangle</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Metasedimentary rocks in the lower part of the Unicoi Formation</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Phyllite interlayered with thin-bedded metamorphosed quartz sandstone in the Harpers Formation</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Steeply overturned quartzite in Harpers Formation</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Massive quartzite outcrop in Antietam Formation</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Steeply dipping, thin-bedded purple shale in the Waynesboro Formation</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Vertical, thin-bedded dolomite with algal laminations in Elbrook Formation</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>Deeply weathered clast of quartzite in remnant fan deposit</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>Gently sloping elevated fan deposit</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>Fault breccia at the basement-Unicoi Formation contact</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>Equal area stereonets displaying Kamb-contoured mesoscale structural data</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>Brecciated quartzite of the Antietam Formation with iron and manganese oxide mineralization</td>
<td>12</td>
</tr>
<tr>
<td>14</td>
<td>Ore processing equipment in the vicinity of the former manganese mines southeast of Midvale</td>
<td>12</td>
</tr>
<tr>
<td>15</td>
<td>Travertine-marl deposition on west side of South River at Cypress Falls</td>
<td>13</td>
</tr>
</tbody>
</table>

PLATE

Plate 1. Geologic Map of the Cornwall quadrangle, Virginia
INTRODUCTION

The Cornwall 7.5-minute quadrangle is located in Rockbridge and Amherst Counties, Virginia (Figure 1). Prominent physiographic features in the quadrangle include the Blue Ridge Mountains, South Mountain, Timber Ridge, South River, Irish Creek, and Pedlar River. The quadrangle is named after the small community of Cornwall near the center of the quadrangle and contains a portion of the City of Buena Vista. A significant portion of the southwestern half of the quadrangle is within the Jefferson National Forest. Major roads are U.S. Highway 11, Interstate 81, South River Road (Route 608), and the Blue Ridge Parkway. The Norfolk Southern railroad runs along the South River. The sanitary landfill for Rockbridge County is located near the southwestern corner of the quadrangle.

Geologic mapping in the Cornwall quadrangle (Plate 1) was completed by the Virginia Department of Mines, Minerals, and Energy (DMME) as part of a long-term mapping effort along the Interstate 81 Corridor. This work was partially supported by two STATEMAP Awards from the National Cooperative Geologic Mapping Program, 08HQAG0091 and G09AC00179. Mapping in a two-mile-wide corridor along the Blue Ridge Parkway was completed by the U.S. Geological Survey (USGS) for a separate project to support the National Park Service (NPS) Geologic Resources Inventory within the NPS Inventory and Monitoring Program, under the auspices of the USGS National Cooperative Geologic Mapping Program.

The Cornwall quadrangle straddles the boundary between the Blue Ridge and Valley and Ridge Provinces. The northwestern half of the quadrangle is underlain by Cambrian to Ordovician sedimentary rocks of the Valley and Ridge.

The southeastern half of the quadrangle is underlain by Mesoproterozoic-age, felsic to intermediate composition metagneous basement rocks of the Blue Ridge Province, which are intruded by Neoproterozoic-age, felsic to mafic composition metagneous rocks. Basement rocks are overlain by Neoproterozoic to Cambrian clastic metasedimentary rocks and lesser metavolcanic rocks.

Numerous regional faults displace map units, including the Staunton-Pulaski, Fairfield, South River, and Blue Ridge faults. Major folds include the Donaldsburg syncline in the central part of the map and an anticline that parallels South Mountain in the northern half of the quadrangle.

There are no active mines on the quadrangle. Past mineral production includes manganese, iron, clay, travertine-marl, and minor crushed and dimension stone.
PREVIOUS INVESTIGATIONS

The Cornwall quadrangle was previously mapped at 1:62,500-scale by Bick (1960) and at 1:50,000-scale by Wilkes and others (2007). Published 1:24,000-scale maps of adjacent quadrangles by Wilkes (2007; 2010) and Spencer (2000) were reviewed during mapping, as well as an unpublished DMME map by Scott Williams of the Vesuvius 7.5-minute quadrangle. Unpublished DMME field data in the Cornwall quadrangle collected by Nick Evans was also reviewed during mapping, and some of these data were incorporated into the final map.

FIELD METHODS

Geologic mapping was completed between 2008 and 2013, with the majority of field work occurring between 2008 and 2010. Numerous foot and vehicle traverses were completed. Field data were recorded in field notebooks or digital databases with topographic map or GPS location control. Structural measurements were also plotted on field maps. Data collected include lithology and the attitude of bedding, foliation, and joint surfaces. Representative samples of significant formations were submitted for whole rock geochemical analysis. The results of these analyses are available upon request from DMME.

STRATIGRAPHY

BASEMENT ROCKS OF THE BLUE RIDGE PROVINCE

In the southeastern portion of the Cornwall quadrangle, several distinct Mesoproterozoic-age basement rock units have been mapped. These include an orthopyroxene-bearing meta-granodiorite (Ygd), layered dioritic gneiss (Ydg), leucogranitic gneiss (Ylg), porphyroblastic leucogranitic gneiss (Ygt), granitic gneiss (Yg), megacrystic granodioritic gneiss (Ygg), and migmatite (Ym) (Figure 2). Felsic to intermediate composition igneous protoliths are inferred for these map units, based on mineralogy and relict textures. Most map units are interpreted to be meta-plutonic, but the Ydg and Ym units may have meta-volcanic protoliths because they are strongly layered. Cross-cutting field relationships suggest that original intrusive relationships between most basement map units have been modified by subsequent deformation.

Ages provided by sensitive high-resolution ion microprobe (SHRIMP) U-Pb zircon crystallization analyses from basement rocks in this part of the Blue Ridge support these cross-cutting field observations (Carter and others, 2012; 2013). These data indicate that orthopyroxene-bearing meta-granodiorite (Ygd), with preliminary crystallization ages of ~1.04 and ~1.03 Ga, intruded older basement rocks with well-developed Mesoproterozoic foliation. These gneissic rocks range in age from 1.19 to 1.14 Ga (Carter and others, 2016, 2017; Southworth and others, 2017); older Mesoproterozoic gneissic layering in these rocks is locally truncated and cross-cut by the younger suite of 1.04-1.03 Ga Mesoproterozoic metagranitoid rocks. Detailed descriptions of basement map units are provided on Plate 1.

YOUNGER INTRUSIVE ROCKS OF THE BLUE RIDGE PROVINCE

Basement map units have been intruded by greenstone dikes (Zgd) and granitoid bodies (Zg). These intrusive rocks cut basement rock contacts and Mesoproterozoic-age gneissic foliation preserved in most of the
Figure 2. Gneissic basement rocks exposed on the Cornwall quadrangle: (A) migmatite (Ym) (37.80484, -79.25623); (B) megacrystic granodioritic gneiss (Ygg) (37.82407, - 79.23408; outcrop on the adjacent Montebello quadrangle); (C) porphyroblastic garnet-biotite leucogranitic gneiss (Ygt) (37.75085, -79.28265); (D) layered dioritic gneiss (Ydg) (37.5546, -79.28355); (E) layered leucogranitic gneiss (Ylg) (37.80402, - 79.2532); (F) layered granitic gneiss (Yg) (37.76961, -79.27026). Photographs by Mark W. Carter.
basement units. In the vicinity of some dikes, an alteration of basement rocks to a unakitic composition consisting primarily of orthoclase feldspar, epidote, and quartz has been observed. Detailed descriptions of these map units are provided on Plate 1.

FAULT-RELATED ROCKS OF THE BLUE RIDGE PROVINCE

Mylonite derived from granitic basement rock (gmy) was observed on the southeastern side of the Pedlar River. This mylonite is in the immediate hanging wall of an unnamed mapped thrust fault. The age of the mylonitization is unknown, but is likely Paleozoic based on regional studies by Jenkins and others (2012). A detailed description of the mylonite is provided on Plate 1.

METASEDIMENTARY ROCKS OF THE BLUE RIDGE PROVINCE

Metamorphosed sedimentary rocks of the Chilhowee Group unconformably overlie, or are in fault contact, with basement and associated intrusive and fault-related rocks. These rocks are largely exposed between the Blue Ridge Parkway and the northwest flank of South Mountain and other mountains along strike to the southwest. Large road cuts along the Blue Ridge Parkway are mostly in the Unicoi Formation, except near the eastern edge of the quadrangle, where basement rocks are exposed. The Chilhowee Group is also well exposed along Irish Creek Road (State Route 603) in road cuts and stream outcrops.

Map units from oldest to youngest are the Unicoi Formation (Zul and Zu), Harpers Formation (h), and Antietam Formation (a). Detailed descriptions of these map units are provided on Plate 1.

Figure 3. Metasedimentary rocks in the lower part of the Unicoi Formation: (A) pebble metaconglomerate (37.80495, -79.25827); (B) rhythmically bedded purplish metasiltstone and greenish-gray fine-grained metasandstone (37.78867, -79.27026). Photographs by Mark W. Carter.

The formations in this sequence consist of clastic metasedimentary rocks including slate, phyllite, metamorphosed arkosic and lithic sandstone, and quartzite (Figures 3 and 4). The Chilhowee Group rocks were likely deposited in fluvial to nearshore marine environments during and shortly after a period of continental-scale rifting (Simpson and Eriksson, 1989; Smoot and Southworth, 2013). Quartzite is present in the upper part of the Unicoi and Antietam Formations, and is mapped as a separate unit in the Harpers (Snowden Member, h; Figure 5; Plate 1).
In the field, the upper portion of the Unicoi can usually be distinguished as coarse-grained quartzite that sometimes contains pebbly layers, and does not contain the trace fossil *Skolithos*. Within the Harpers and Antietam, quartzite can have an identical appearance. The trace fossil *Skolithos* is sparse in the Harpers, but more common in the Antietam (Figure 6). Quartzite in the Harpers sometimes has a conspicuous manganese oxide staining, which is rare in the Antietam.

The contact between the Unicoi and the Harpers Formations is placed at the first occurrence of phyllite above quartzite of the Unicoi Formation. The contact between the

Figure 4. Phyllite interlayered with thin-bedded metamorphosed quartz sandstone in the Harpers Formation along Irish Creek Road (37.79876, -79.27794). View to southwest.

Figure 5. Steeply overturned quartzite in the Harpers Formation (37.82287, -79.26084). View to the southwest.

Figure 6. Massive quartzite outcrop in the Antietam Formation (37.79521, -79.28813) exhibits well-developed joints (green line) and *Skolithos* trace fossils (blue line). Bedding (red line) dips moderately into photograph. View is to west.
Harpers and the Antietam Formations in most places is a fault. In Irish Creek Gorge it is placed above the last observed interval of phyllite and/or thin-bedded quartzite, and below thick-bedded quartzite.

Quartzite in the Harpers Formation (R-10529 and R-10530) contains somewhat more alkali and plagioclase feldspar and white mica and/or chlorite, and what appear to be secondary iron- and manganese-oxide minerals that may have originally filled interstitial spaces. Quartzite in the upper part of the Unicoi Formation is generally coarser grained and contains more abundant and better aligned white mica and/or chlorite.

In thin section, a granoblastic texture is moderately well developed in quartzite in both the Harpers and Antietam Formations (R-10527 and R-10528). Quartzite in the Antietam Formation ranges from 90 to 98% quartz with lesser feldspar, and accessory secondary white mica +/- tourmaline and opaque minerals.

**SEDIMENTARY ROCKS OF THE VALLEY AND RIDGE PROVINCE**

The northwestern two-thirds of the Cornwall quadrangle are underlain by Cambrian and Ordovician sedimentary rocks. Limestone and dolostone are the dominant rock types, with lesser shale and sandstone.

Map units from oldest to youngest are: Shady Dolomite (_s), Waynesboro Formation (_wb), Elbrook Formation (_e), Conococheague Formation (O_co), Stonehenge Limestone (Ost), Beekmantown Formation (Ob), New Market and Lincolnshire Limestones (Oln), and Edinburg Formation (Oe). Most contacts between these units are conformable and transitional. The Waynesboro-Elbrook and Beekmantown-New Market contacts are not exposed, but are reported to be unconformable (Read and Eriksson, 2016). Detailed descriptions of these map units are provided on Plate 1.

In general, the sedimentary rocks of the Valley and Ridge Province in this area record the development of a stable low-relief continental margin after a period of Neoproterozoic rifting (Read and Eriksson, 2016). Abundant shale and sandstone interbeds are present in the Waynesboro Formation and indicate a significant input of siliciclastic sediment in that part of the section (Figure 7). Siliciclastic sediment diminishes in the Elbrook (Figure 8) and Conococheague, and is largely absent in the overlying Stonehenge Limestone, Beekmantown Formation, and New Market Lincolnshire Limestones. In this part of the section, lithologic changes are controlled largely by periodic changes in sea level that caused shifts in depositional environments (Read and Eriksson, 2016).

Figure 7. Steeply dipping, thin-bedded purple shale in the Waynesboro Formation interbedded with gray, tan-weathering dolomitic shale and dolomite, along State Route 757 (37.79512, -79.32175).
Figure 8. Vertical, thin-bedded dolomite with algal laminations in Elbrook Formation along State Route 631 (37.78482, -79.36358).

The Edinburg Formation, at the top of the Cambrian-Ordovician carbonate sequence was likely deposited at the beginning of a period of subsidence and increased input of siliciclastic sediment due to loading of the margin by accreted terranes during the Taconic orogeny.

SURFICIAL DEPOSITS

Alluvial and colluvial deposits overlie bedrock in portions of the Cornwall quadrangle. Mappable deposits include alluvium (a) in the flood plains of active streams and rivers, alluvial-colluvial (ac) deposits within some stream valleys that drain mountainous terrain, fluvial terraces (t1-3) along the South River, debris- or alluvial fan deposits at or near the base of slopes (f1), remnant fan deposits that cap lower slopes (f2-4), and concentrated colluvial deposits on steep slopes (c). Large areas of modified land (m) are also shown on the geologic map.

Widespread residual and colluvial soils are not shown. The Soil Survey of Rockbridge County, Virginia (Cook, 2014) contains soil descriptions and maps for the area. Detailed descriptions of surficial map units are provided on Plate 1.

Three generations of terrace deposits were mapped along the South River, based on elevation above the modern flood plain and relative degree of weathering and soil development. Within each map unit, it is likely that more than one level of terrace development is preserved. Nearly all of the terrace deposits are on the southeast side of the river.

Four generations of fan deposits were also mapped. Youngest fans occur within modern stream valleys. Older fan surfaces are mostly preserved as moderately to deeply dissected deposits on hills and ridges on the northwestern flank of South Mountain, and mountains along strike to the southwest. Closer to South River, it was difficult to differentiate old fan deposits from terrace deposits, and some deposits may be incorrectly assigned or have a mixed origin. Many older fan deposits (f3 and f4) are deeply weathered, with quartzite clasts being completely saprolitized in some cases (Figure 9).

A large dissected fan is suggested by widespread dissected deposits of map unit f3 that extend more than 4 km from a point northwest of McClure Peak to near the southwestern corner of the quadrangle (Figure 10). Such a fan would have covered more than 9 km² prior to incision and erosion, is inconsistent.

METAMORPHISM

Rocks in the southeastern part of the Cornwall quadrangle have been subjected to regional metamorphism, with the intensity of metamorphism generally increasing to the southeast. Within the metasedimentary rocks of the Blue Ridge Province, metamorphism is most evident within fine-
Petrographic analyses of six thin sections of quartzite and metamorphosed quartz sandstone from the upper portion of the Unicoi (R-10533 and R-10534), Harpers (R-10529 and R-10530) and Antietam (R-10527 and R-10528) Formations show variable development of triple points between quartz grains, serrated grain boundaries, and areas of quartz regrowth. The Unicoi Formation thin sections are from rocks collected in the immediate footwall of the faulted basement-cover contact. Here, brittle-to-ductile deformation is observed, with reduced grain size and mica recrystallization in clearly defined bands.

STRUCTURE

Every bedrock map unit in the Cornwall quadrangle has been affected to some extent by structural deformation. Most faults and folds observed in the area are the result of brittle-to-ductile deformation associated with the Alleghanian orogeny. This event is also associated with the development of fold-related cleavage within some sedimentary and metasedimentary rocks, and a penetrative regional mica foliation in the basement rocks. Older basement rocks also preserve gneissic compositional layering that is interpreted to be an older Proterozoic-age foliation associated with the 1.14 Ga Shawinigan orogeny (Carter and others, 2013, 2017).

FOLDS

Folds within Sedimentary Rocks of the Valley and Ridge Province

In the northwestern half of the quadrangle, portions of two regional folds can be observed. The western limb of an unnamed syncline is exposed to the...
northwest of the Staunton-Pulaski fault. The map pattern of this fold is complicated by faulting and subsidiary folding, but it appears to plunge to the southwest, based on the exposure of younger strata along strike to the southwest of the map area (Wilkes, 2007).

Further southeast, the well-developed north-plunging Donaldsburg syncline is exposed, cored by the Beekmantown Formation. The axial trace of this fold nearly parallels State Route 706 and passes near the crossroads of Donaldsburg. The southeastern limb of this fold is steeply dipping to overturned, and is truncated by the South River fault.

Folds within Metasedimentary Rocks of the Blue Ridge Province

Rocks in the central portion of the Cornwall quadrangle are tightly folded, based on outcrop-scale observations. The southeastern limbs of synclines and northwestern limbs of anticlines are commonly overturned. Intraformational faults are common and complicate the fold pattern; as a result relatively few map-scale folds are identified on the map.

In the Antietam Formation, structural data suggest a well-developed anticline north of Irish Creek, with the axial trace of the fold closely paralleling the ridgeline of South Mountain. The hinge of an outcrop-scale anticline was observed in an iron prospect pit (Fe-616) near the axial trace of the map-scale structure. South of Irish Creek, structural data suggests the presence of smaller amplitude folds.

FAULTS

Several major faults have been mapped in the Cornwall quadrangle. These major faults are interpreted to be thrust or reverse faults that dip moderately to steeply to the southeast, based on map pattern or direct observation.

The Staunton-Pulaski fault in the northwestern corner of the quadrangle is a regionally extensive structure that has been shown to have significant displacement in other areas (Evans and others, 2017). Here, the fault juxtaposes the west limb of the Donaldsburg syncline against west limb of an unnamed syncline to the northwest.

The South River fault truncates the southeastern limb of the Donaldsburg syncline. The map pattern in the southwestern part of the quadrangle suggests that displacement along the South River fault is significant.

Map pattern and structural data suggest additional intraformational folding and faulting, and the truncation of stratigraphy and folds along boundaries between map units between the South River fault and basement to the southeast. Each contact in this sequence is interpreted to be a fault. One of these faults, the Blue Ridge fault, separates the Antietam Formation from the overlying Shady Dolomite, and serves as the boundary between rocks assigned to the Blue Ridge and Valley and Ridge Provinces. Further east within the Unicoi and Harpers Formations, many intraformational faults were observed. Most of these smaller faults are steep and show reverse offset of a few feet. Breccia was observed as float along a portion of the faulted contact between basement rocks and the lower part of the Unicoi Formation in the headwaters of Big Branch, southeast of the Blue Ridge Parkway (Figure 11).

Mylonite is associated with mapped faults that juxtapose basement rocks and metasedimentary rocks of the Unicoi Formation in the southeastern corner of the quadrangle.
ECONOMIC GEOLOGY

There are no active mines in the Cornwall quadrangle, but mining activity in the past was significant, including commercial operations to extract iron, manganese, clay, limestone, travertine-marl, dimension stone, and fill.

IRON AND MANGANESE

Iron was mined at several locations on the Cornwall quadrangle (Fontaine, 1883; McCrea, 1883; Watson, 1907). Most of the mines were located on the northwestern flank of South Mountain. South of Midvale, workings included shafts, adits, trenches, and pits developed in strata-bound residual limonite deposits in the Shady Dolomite, west of the Blue Ridge fault. Several prospects and one pit were also located near the crest of South Mountain, within the Antietam Formation. At these sites, the limonite appears to be hosted by fractured and brecciated quartzite of the Antietam Formation (Figure 13). This brecciation occurs near the hinge of the mapped anticline in this area.

In addition, iron was mined in the vicinity of Buck Hill, from limonite deposits associated with the Beekmantown Formation. Between 1896 and 1898, a total of 30,000 tons of ore were produced at this mine (Watson, 1907).

Manganese was also mined from prospects southeast of Midvale (Stose and others, 1919). These mines are at the same stratigraphic interval as iron mines on the southwestern flank of South Mountain. The ores occur as strata-bound residual and replacement deposits in the Shady Dolomite. Gooch (1955) reported the installation of a processing plant near Midvale (Figure 14), with plans to service mines in this area.
Figure 12. Equal area stereonets displaying Kamb contoured mesoscale structural data in the Cornwall 7.5-minute quadrangle. Best fit great circle and pole to great circle (black dot) are shown for bedding data. Contour interval is 2σ. Stereonets were produced using Stereonet 9.5 (Allmendinger and others, 2012; Cardozo and Allmendinger, 2013).
CLAY

Clay was mined along Chalk Mine Run near the southern boundary of the quadrangle for use in manufacturing fire brick during the late 19th and early 20th centuries by the Dickinson Fire Brick Company (Upchurch, 1998; DMME unpublished data). This operation mined clay residuum developed in the Shady Dolomite.

TRAVERTINE-MARL

According to Sweet and Hubbard (1990), “The earliest documented economic use of Valley and Ridge Province travertine-marl materials was a marl from Marl Run (now Marl Creek)…which was used as a flux in iron production at the Buena Vista Furnace (Ruffner, 1889; Gilham, circa 1858). This furnace was in operation between 1848 and 1864 (Capron, 1967).” This mining location is near Cypress Falls (Figure 15). Travertine-marl was also mined near Marlbrook (t-304) in the northeastern corner of the quadrangle, and approximately one mile west of Riverside (t-701) during the early part of the twentieth century (Sweet and Hubbard, 1990). Marlbrook Lime Company produced more than 109,000 tons of agricultural lime between 1913 and 1931. A company brochure stated a guaranteed analysis of 96.5% carbonate of lime.

CRUSHED AND DIMENSION STONE

Two small inactive dimension stone quarries were observed during mapping in Cambrian-age carbonate rock near Riverside (ds-707) and Stewardsburg (ds-706). Additional small quarries in carbonate rock near Marlbrook (ls-303), and along Irish Creek Road in quartzite (cs-630) and shale (f-631), were probably used for crushed stone or fill.

Figure 13. Brecciated quartzite of the Antietam Formation with iron- and manganese-oxides, exposed in wall at mineral resource site Fe-619 (37.81793, -79.27524).

Figure 14. Ore processing equipment in the vicinity of former manganese mines southeast of Midvale.
limits to mineral collecting and mineral resource development. In other areas, mineral collecting or mineral resource development would require property owner permission and may require a permit.

GEOLOGIC FACTORS AFFECTING LAND USE

The diverse geology within the Cornwall quadrangle provides natural resources and allows for the safe and productive use of land for a variety of purposes. The topography, soil type and thickness, potential for minerals, springs, sinkholes, and landslides, are directly related to the underlying geology. The soil map of Rockbridge County (Cook, 2014) provides information on soil as it relates to agricultural use and site development.

WATER RESOURCES

Several springs were observed during mapping. Most of these springs are spatially associated with the New Market or Lincolnshire Limestone, a known fault, or the toe of a fan or alluvial-colluvial deposit. Most of the springs observed had low discharge (<10 gallons per minute) and only a few are being actively used. Undoubtedly there are many more springs in the quadrangle than those observed during mapping.

Water well yield and quality in Virginia varies by bedrock type (Heller, 2008). In general, wells installed into carbonate bedrock have a higher potential for yield, water with a higher pH, and more variable water quality than wells drilled into other rock types. Sufficient water supply for residential use can be obtained in most locations by installing a drilled well. A sufficient supply of water for commercial or industrial use may require multiple or larger
diameter wells, or connection to a municipal water supply.

SINKHOLES

All of the carbonate sedimentary map units of the Valley and Ridge Province in the Cornwall quadrangle have some potential to develop voids through the natural process of dissolution. Voids that form close to the surface can eventually collapse to form sinkholes. Within the quadrangle, sinkhole clusters are observable in areas underlain by purer limestone such as the Stonehenge Limestone north of Paxton Hill, in the vicinity of fold hinges such as the Donaldsburg syncline, in areas that are or were overlain by coarse-grained surficial deposits such as north of Stewardsburg, south of Mountain View school, and near faults such as the South River fault.

Many existing sinkholes are relatively stable. Sinkholes that develop suddenly or increase in size over a short period of time are often responding to a change in surface drainage or groundwater level related to site development, well pumping, or drought. This change does not necessarily dissolve the bedrock, but may dislodge and remove soil that is plugging or overlying an existing void or water pathway.

LANDSLIDES

The potential for landslides varies by location within the Cornwall quadrangle. Northwest of the South River, the potential on natural slopes is generally low. Steeper slopes with greater potential for landslides in this region include the flanks of hills and ridges covered by chert residuum in areas underlain by the Beekmantown Formation, and prominent bluffs along the South River. Rock or debris fall, debris or earth slump, and soil creep are the most likely types of mass movements to occur in these areas. No mappable landslide deposits were identified in this portion of the quadrangle.

Southeast of the South River, the potential for occurrence of landslides is higher. The steep mountain slopes are most prone to landslides, but local steep slopes, including those developed along the edges of fan and terrace deposits, are also susceptible. Rock or debris fall, debris or rock slide, debris or earth slump, and soil creep are all possible on steep slopes. Mapped deposits of colluvium were likely formed from a combination of these processes. Future landslides are not limited to areas of mapped deposits.

Debris flows are another type of mass movement that may originate on steep slopes. Areas considerably downslope of steep mountainous areas may also be at risk from debris flows and related movement of sediment during periods of heavy rainfall. Areas within stream valleys draining these areas are at greatest risk. Alluvial-colluvial and fan deposits were likely created at least in part by pre-historic debris-flow events.

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Plate 1 is in layered PDF format. This format allows the user to turn data and base map layers off in order view a specific aspect of the geology more clearly or to create a custom version of the map product. To view the layers in the map, click the layers button in the PDF viewer and then expand the item labeled Plate_1.pdf.
Detailed description of the geological map of the Cornwall Quadrangle, Virginia, including formation names, symbols, and symbols for faults, and other geological features.

- **Faults**
  - South River Fault: Dark grayish-green, light grayish-yellow, fine-grained, thin- to thick-bedded quartz to lithic metasandstone, interlayered with thin beds of white quartzose to lithic metasandstone, with minor amounts of other sedimentary rock.

- **Deposits**
  - Alluvium: Light to dark gray, fine-grained, thin- to thick-bedded quartz to lithic metasandstone, interlayered with thin beds of white quartzose to lithic metasandstone, with minor amounts of other sedimentary rock.

- **構造**
  - Antiform (uplifted) and synform (downfolded): Light grayish-yellow weathering, granoblastic, lepidoblastic to polycrystalline, medium- to coarse-grained feldspar, some quartz, feldspar, white mica (sericite and muscovite), chlorite, biotite, and muscovite

- **年代**
  - Upper Ordovician: Clastic rocks, undivided

- **MAP SYMBOLS**
  - Faults
  - Alluvium
  - Channel deposits
  - Syncline

- **DESCRIPTION OF UNITS**
  - Shady Dolomite: Beekmantown Formation (Middle and Lower Ordovician)
  - Whitehead Dolomite: Calcite veining and deformed bedding are common. Only the lower beds are shown. Deposits are up to approximately 200 feet (60 meters) thick.

- **CORRELATION OF UNITS**
  - Middle and Lower Ordovician: Whitehead Dolomite

- **REFERENCES**
  - Spencer (1968) reports a thickness of 1,300 feet (400 meters) for the partial weathering of some deposits, cobbles form a cap at land.

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