COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES

GEOLOGY OF THE EAGLE ROCK, STROM, ORISKANY, AND SALISBURY QUADRANGLES, VIRGINIA

ODELL S. McGUIRE

REPORT OF INVESTIGATIONS 24

VIRGINIA DIVISION OF MINERAL RESOURCES
James L. Calver
Commissioner of Mineral Resources and State Geologist

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GEOLOGY OF THE EAGLE ROCK, STROM, ORISKANY, AND SALISBURY QUADRANGLES, VIRGINIA

By

ODELL S. MCGUIRE[1]

ABSTRACT

The Eagle Rock, Strom, Oriskany, and Salisbury quadrangles are located in northwestern Botetourt, northeastern Craig, and southeastern Alleghany counties in west-central Virginia, entirely within the Valley and Ridge physiographic province. The quadrangles are underlain by bedrock ranging in age from Cambrian to Mississippian and having a total stratigraphic thickness of more than 20,000 feet. Cambrian, Ordovician, Silurian, and Devonian carbonates, shales, and sandstones make up most of the thickness and areal extent.

The major structural features are elongate folds, which have northeastward-southwestward trending axes, and faults with the same general strike that typically involve thrust or reverse movement in a northwesterly direction. The trace of the Pulaski-Staunton thrust fault arcs across the mapped area from the southwest corner for a distance of about 17 miles to the eastern edge. It effectively separates outcrop areas of unlike Middle Ordovician facies and also marks a boundary between somewhat different structural styles. Other structural features include transverse faults and associated thrust faults, tectonic breccias, and refolded structures.

High-calcium and crushed limestone, iron ore, and barite have been mined from the quadrangles, although the only mineral commodity in current production is limestone for crushed stone and riprap. Other potential mineral resources include dolomite, clay and shale, sand and gravel, coal, and manganese.

INTRODUCTION

The Eagle Rock (Plate 1), Strom (Plate 2), Oriskany (Plate 3), and Salisbury (Plate 4) 7.5-minute quadrangles are located mainly in northwestern Botetourt County, with smaller portions in eastern Craig and Alleghany counties (Figure 1). The area lies between 37°30′ and 37°45′ north latitude and 79°45′ and 80°00′ west longitude.

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Woodward (1936a) mapped the area during the 1929-30 field seasons. Edmundson (1958) reported on the industrial limestone and dolomite in the area. Butts (1940) and the above authors included descriptions of rock units, stratigraphic sections, and discussions of various aspects of the geology. The first detailed geologic map in this area was produced by Lesure (1957) at a

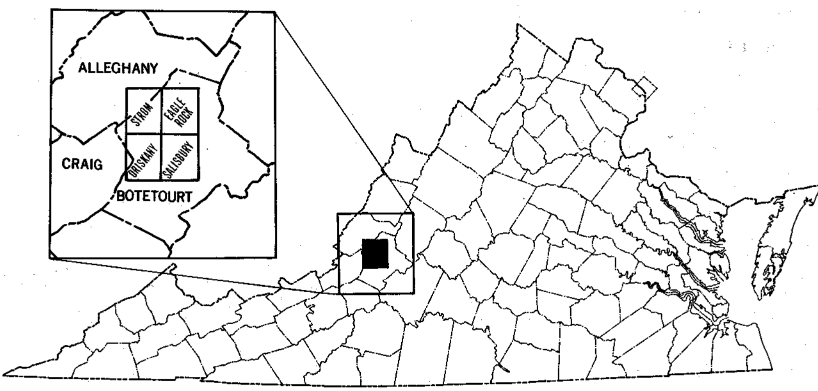

Figure 1. Index map showing location of the Eagle Rock, Strom, Oriskany, and Salisbury quadrangles.

scale of 1:31,680. It included a major portion of the Strom 7.5-minute quadrangle and smaller parts of the Oriskany and Eagle Rock quadrangles. The writer field checked Lesure's map in the more accessible areas, and no significant differences of interpretation were found. The bedrock portion of Lesure's geologic map has been transferred to the 7.5-minute bases used for this report (Plates 1, 2, 3). Discrepancies in the topographic bases made it desirable in a few instances to adjust contacts, and the stratigraphic terminology has been updated. It was necessary to remap the alluvium along Craig Creek (Plate 2) to conform with the writer's style of mapping such deposits. Talus deposits mapped by Lesure have not been transferred to the new bases, but dotted bedrock contacts in the covered areas have been retained.

Most of the field work was carried out during portions of the 1964, 1965, and 1968 seasons. Able assistance was given by James Bruton, William McClung, Andrew Raring, and Ralph Pearcy. E. W. Spencer and Samuel J. Kozak visited the writer in the field and discussed a variety of problems at length. The writer has also benefited from discussions or field visits by Harry Webb, Bruce Hobbs, Edward Nunan, E. K. Rader, and James Conley of the Virginia Division of Mineral Resources; Byron Cooper of Virginia Polytechnic Institute; and John Dennison of the University of North Carolina. Mata McGuire helped prepare the manuscript and maps for publication. The Virginia Division of Mineral Resources financed the field work.

Representative samples have been collected from the various stratigraphic units in the area of study and are indicated by numbers preceded by "R" (R-3951) which correspond to sample localities shown on Plates 1, 3, and 4; the location where fossil specimens were collected is preceded by "F" (F-858). These samples and fossils are on file in the repository of the Virginia Division of Mineral Resources where they are available for examination.

The area is included in the Valley and Ridge physiographic province and lies within the watershed of the James River. The highest elevation noted is 3728 feet in Rich Patch Mountains (Plate 2). The lowest elevation, less than 860 feet, is along the James River in the Salisbury quadrangle (Plate 4). The topography of the region is closely controlled by the lithologies and structural trends of the bedrock. Only the James River, in its general direction of flow, appears to have escaped this influence.

A prominent belt of mountains arcs across the area (Figure 2), bending from N. 40°E. at the southwest corner of the Oriskany quadrangle (Plate 3) to N. 75°E. at the east edge of the Eagle Rock quadrangle (Plate 1). These mountains are underlain mainly by Silurian clastic rocks, but strata of Mississippian age are exposed in the southwest. There is a notable wind gap in the Poplar Hill area (Plate 4) where the Silurian section is absent because of faulting, and a spectacular water gap in the gorge of the James River at Eagle Rock (Plate 1) where the Silurian section is repeated by faulting. For purposes of geographic orientation this mountain belt will be referred to as the "Rathole-Switzer mountain trend". The southeast flank of these mountains is drained mainly by Catawba Creek south of the James River. The lower valley of Catawba Creek, known locally as the Fincastle valley, and surrounding low ridges are underlain by Cambrian and Ordovician shales and carbonate rocks.

Northwest of the Rathole-Switzer mountain trend is a broad belt of northeastward-striking ridges and valleys underlain by

Devonian shales and sandstones. These ridges are thickly forested, mainly inaccessible by roads, and unpopulated except in the alluvial valleys of Craig Creek and the James River. The area is referred to in this report as the "Big Hill-Patterson mountain trend". Northwest of Craig Creek is another north-

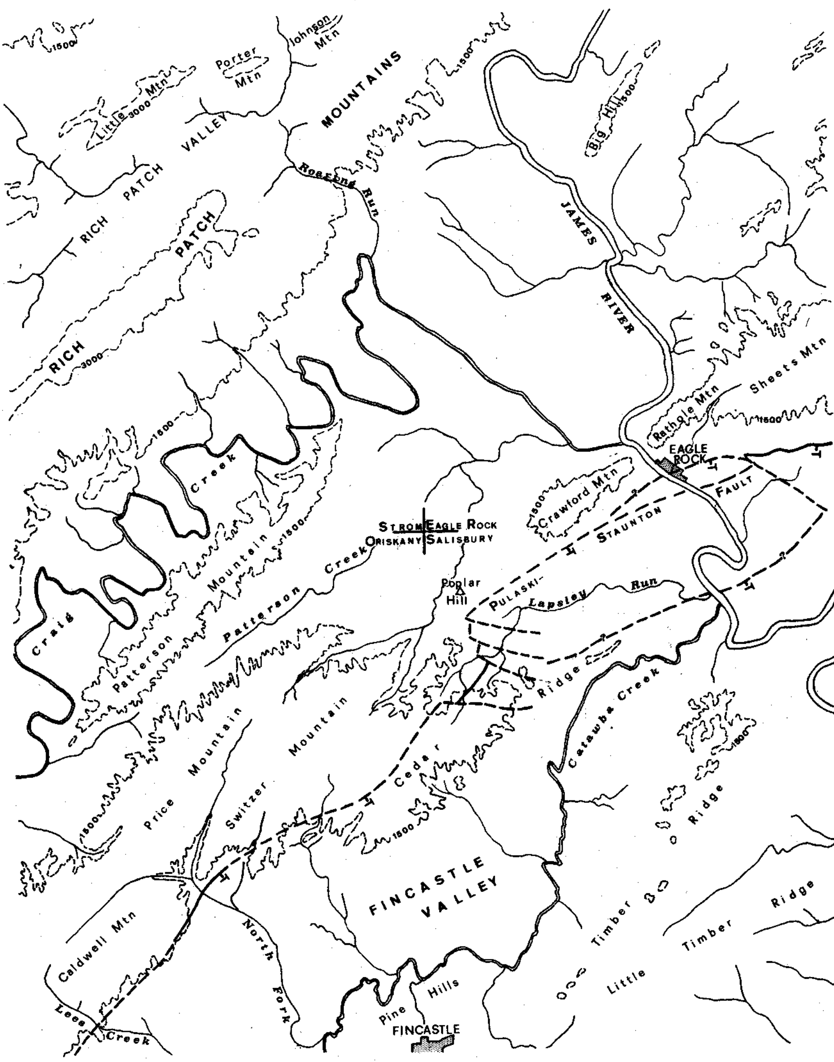

Figure 2. Sketch map showing main topographic features and location of Pulaski-Staunton fault.

eastward-striking mountain range called the Rich Patch Mountains. It is held up by Silurian sandstones and includes the higher elevations in the area, mainly in the Strom quadrangle (Plate 2). Ordovician rocks underlie the next valley to the northwest, known locally as Rich Patch valley. In the northwestern corner of the area, the "Johnson-Little mountain trend" is underlain by Silurian rocks.

STRATIGRAPHY

CAMBRIAN SYSTEM

Rome Formation

Scattered exposures of maroon and green shales occur about 1 mile northwest of Springwood (Plate 4). These were identified by Woodward (1936a) as belonging to the Lower Cambrian Rome Formation. The thickness of the portion exposed may be in excess of 300 feet (Table 1).

Table 1.—Geologic formations in the Eagle Rock, Strom, Oriskany, and Salisbury quadrangles.

Age	Name	Character	Approximate thickness in feet
Quaternary(?)	Alluvium	Stream deposits of sand and clay.	0-120
	Gravel	Coarse terrace gravel and colluvium.	
Mississippian	Price Formation	Quartz-pebble and cobble conglomerate, sandstone, mudrock, and dark-gray shale with carbonaceous material.	1800+
	Chemung Formation	Chocolate-brown, red, tan, and greenish-gray sandstone, shale, and mudrock; fossiliferous.	2500+
Devonian	Brallier Formation	Greenish-gray, hard, fissile shale with thin, greenish-gray sandstones and siltstones; sparsely fossiliferous.	2500+

Age	Name	Character	Approximate thickness in feet
	Millboro Shale	Black, fissile shale with ironstone concretions; fossiliferous.	800-1500
	Needmore Formation	Olive-drab, calcareous shale; fossiliferous.	
	Ridgeley Sandstone	Coarse-grained, calcareous, orthoquartzitic sandstone; fossiliferous.	300-500
Devonian	Licking Creek Limestone	Dark-gray, sandy, cherty, fossiliferous limestone.	
	Healing Springs Sandstone	Coarse-grained, calcareous sandstone and very sandy limestone.	
	New Creek Limestone	Light-gray to brownish-gray, coarse-grained, crinoidal limestone.	
	Keyser Formation	Gray, fossiliferous limestone and coarse-grained calcareous sandstone.	
	Tonoloway Formation	Dark-gray, thin-bedded limestone with calcareous, medium- and coarse-grained, cross-bedded sandstones.	
Silurian	Keefer Sandstone	Tan to pinkish-white, medium- and fine-grained, quartzose sandstone.	200-275
	Cacapon Formation	Tan to deep-red, hematitic sandstone with red and greenish micaceous shale; sparsely fossiliferous.	75-275
	Tuscarora Formation	White to light-gray, coarse-grained, quartzose sandstone with quartz-pebble conglomerate.	20-120

Age	Name	Character	Approximate thickness in feet
Ordovician	Juniata Formation	Red, fine-grained and gray, coarse-grained sandstone with gray and grayish-red shale and mudrock.	0-250
	Martinsburg Formation	Yellowish-weathering, gray shale with gray, thin-bedded, fossiliferous limestones and gray, ferruginous sandstones.	1200-2200
	Eggleston Formation	Gray, dense, argillaceous limestone and olive-gray shale; sparsely fossiliferous.	180-220
	Edinburg Formation	(a) Medium-gray, fine-grained limestone with closely spaced, irregular, argillaceous partings; in Rich Patch area; approximately 400 feet thick. (b) Black, fissile, silty shale with thin sandstones and a few thin, dark-gray to black limestones that are sandy in part and conglomeratic in part; includes polymictic conglomerate with argillaceous sandstone matrix; in area southeast of the Pulaski-Staunton fault; more than 1800 feet exposed. (c) Dark-gray to black, fine-grained limestone interbedded with black calcareous shale (Liberty Hall) and dark-gray to black, coarse-grained, fossiliferous limestone at base (Botetourt Member); in area between the Pulaski-Staunton fault and Rathole-Switzer mountain trend; 800 to 1100 feet thick.	400-1800+

Age	Name	Character	Approximate thickness in feet
	Lincolnshire Formation	Dark- to light-gray, fossiliferous limestone with nodular black chert.	40-300
	New Market Limestone	Dove-gray, massive, compact limestone with black chert; conglomeratic lower part contains cobbles of dolomite, limestone, and chert.	5-120
Ordovician	Beekmantown Formation	Light- and medium-gray, saccharoidal dolomite, with light-colored chert in thin beds and gnarly masses, and gray to grayish-blue compact limestone; sparsely fossiliferous.	700-1200
	Chepultepec and Conococheague formations	Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, light-gray dolomite, and coarse-grained calcareous sandstone; sparsely fossiliferous.	800-1200
Cambrian	Copper Ridge Formation	Medium- and light-gray dolomite with positive-weathering, siliceous laminae and coarse-grained, calcareous sandstone.	800-1100
	Elbrook Formation	Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, platy yellowish-brown to gray dolomite, and gray to green shale; sparsely fossiliferous.	2000-2500
	Rome Formation	Maroon and greenish shale with bluish-gray, fine-grained limestone.	300+

Elbrook Formation

The upper 150 to 200 feet of the Elbrook Formation consists of a medium-bedded alternation of platy to shaly, yellowish-brown to gray dolomite; bluish-gray limestones containing abundant gray, subhemispherical algal masses; and intraformational conglomerates composed of light-gray flat "pebbles" in a bluish-gray limestone matrix. The flat "pebbles" may be disrupted algal mats (Francis Stehli, personal communication). A few thin, fine- to medium-grained sandstone stringers are present. This unit is generally well exposed and is in marked lithologic contrast to the overlying Copper Ridge Formation.

Beneath this upper unit the thickness and sequence of lithologies in the Elbrook have not been determined due to poor exposures and much intraformational faulting and brecciation. However, platy, or shaly, buff-weathering, hard, calcareous dolomite; gray and greenish-gray shales; and blue to light-gray, rhythmically banded or laminated limestones constitute the predominant lithologic types seen in outcrop. Estimated thickness of the formation in this area is 2000 to 2500 feet. Algae and phosphatic brachiopod fragments were found in the Elbrook.

The Elbrook is the surface formation in much of the area southeast of the Rathole-Switzer mountain trend (Plates 1, 3, 4). Well-exposed, accessible outcrops of the upper unit are present east of Eagle Rock about 0.4 mile southeast of the junction of State Highway 43 and State Road 729 (R-3951, Plate 1), and 0.5 mile north of Lapsley Run Church east of State Road 681 about 5 miles north of Fincastle (Plate 4).

Copper Ridge Formation

The Copper Ridge dolomite was named for exposures in Tennessee (Ulrich, 1911) and has constituted the Upper Cambrian map unit of most authors in the more northwesterly belts of the Valley and Ridge province to the southwest of the Eagle Rock area. Exposures consist mainly of evenly thick-bedded, hard, medium- and light-gray, sandy dolomite with raised, lighter colored laminae on the weathered surface, and cross-bedded sandstone stringers as much as 4-inches thick. Several thick, covered zones occur within the unit. These are mantled by blocks of coarse-grained, friable, quartzose sandstone up to 8 inches in thickness. Near the base of the formation, especially southeast of the Pulaski-Staunton fault, the dolomites are medium to thin bedded, darker, and contain dark-gray shaly partings. Northwest of the fault, the base is marked in places by one of the thicker sandstone-mantled, covered zones. The unit may be predominantly sandstone in this area. In the Chesapeake and Ohio Railway cut along the James River 0.5 mile west of New Hope Church (Plate 4), more than 550 feet of nearly continuous exposures, consisting of sandy dolomite and sandstones up to 20 feet thick, were measured. Only three beds, having an aggregate thickness of 12 feet, reacted to acid. Thickness of the Copper Ridge is estimated to be 800 to 1100 feet.

The Copper Ridge can be traced into the lower part of the unit mapped as Conococheague (Spencer, 1968) in several places along the east boundary of the area (Plates 1, 4). E. W. Spencer and E. K. Rader (personal communications) have noted that the lower part of the Conococheague in the areas of Natural Bridge and Staunton, respectively, is mainly dolomitic but they did not map Copper Ridge as a separate unit. Butts (1940, p. 90) reported that to the south and west the Conococheague and Copper Ridge formations grade laterally into each other in continuous outcrop around the northeast end of Tinker Mountain. Woodward (1932) mapped Conococheague in belts extending as much as 20 miles west and southwest of that point. Cooper (1944) has designated rocks as Copper Ridge over much of the same area and reported up to 150 feet of Chepultepec limestone directly overlying the Copper Ridge dolomites.

Exposures are limited to the area southeast of the Rathole-Switzer mountain trend and are accessible in and around the village of Springwood on the east edge of the Salisbury quadrangle (Plate 4); along State Road 655 north of Flatwoods on the east edge of the Oriskany quadrangle (Plate 3); and along U. S. Highway 220 between its junctions with State Roads 681 and 726 southwest of Owens in the north part of the Salisbury quadrangle (R-3952, Plate 4).

CAMBRIAN AND ORDOVICIAN ROCKS

Conococheague and Chepultepec Formations

In the area of this report the Conococheague and Chepultepec formations have been considered as a single unit for the purpose of mapping because of poor exposures and the lack of distinctive lithologic differences. Rocks assignable on a lithologic basis to the Conococheague and on a faunal basis to the Chepultepec are both present. The formations have been mapped separately northeast of the map area, however, but the distinction is made with difficulty in Augusta County and southward (E. K. Rader, S. J. Kozak, E. W. Spencer; personal communications). The unit mapped by the writer correlates with the upper half of the Conococheague and the entire Chepultepec as mapped by Spencer (1968).

According to Stose (1908), the Conococheague has as its most distinguishing character blue limestones with positive-weathering crinkly or wavy light-colored laminae. Such limestones are also found in the Rome and Elbrook formations, and occasionally, in the Beekmantown Formation. Butts (1940, p. 87) emphasized the occurrence of coarse-grained sandstone beds in the Conococheague. In the writer's experience the only reliable criterion for field identification of the unit is the presence of both the characteristic limestones and sandstones in abundance. Dolomites of the Copper Ridge type are also present and may locally constitute 25 to 50 per cent of the rock, but dolomitic zones unbroken by limestone through thicknesses in excess of about 25 feet have not been noted to occur in the area. Intraformational conglomerates similar to those in the upper Elbrook unit are common. In the area of this report, Conococheague lithologies grade upward into less sandy, somewhat finer grained, more poorly exposed limestones and dolomites that are otherwise like the underlying rocks except for occasional occurrences of a unique, mottled, gray to flesh-colored, compact limestone. Faint outlines of coiled molluscs, otherwise unidentifiable, are present in a few places and appear to be concentrated in the upper 200 to 300 feet of the map unit. Fragment zones and algal masses rarely occur. Well-preserved brachiopods, *Finkelnburgia roanokensis* (Young), occur about 200 feet stratigraphically below the base of rocks mapped as Beekmantown north of State Road 606 and east of the bridge over Catawba Creek (F-858, Plate 3). This fossil was named for specimens collected near Salem in rocks mapped by Woodward (1932) as Chepultepec.

The Conococheague has been considered Late Cambrian in age (Butts, 1940), and the Chepultepec contains an Early Ordovician fauna. The formations have a thickness of 800 to 1200 feet, the maximum of which occurs southeast of the Pulaski-Staunton fault. The most complete natural exposures of the upper part of the Conococheague and the overlying Chepultepec are about 1 mile west of Fincastle, north of State Road 606 (R-3953, Plate 3).

ORDOVICIAN SYSTEM

Beekmantown Formation

The characteristic lithology of the Beekmantown Formation in this area is thick-bedded to massive, light- to medium-gray, fine-grained dolomite, some of which after weathering yields gnarly, light-colored chert. An irregular cross-hatch pattern is typically present on weathered surfaces of the dolomite. The other abundant lithology consists of dove-gray to grayish-blue, fine-grained or compact limestone that may resemble some limestones in the underlying Conococheague and Chepultepec formations; in the upper part it may have blebs of sparry calcite (birdseyes) and look like the overlying New Market Limestone. Bedded chert and slightly sandy dolomites with laminae that stand in relief on weathered surfaces, similar to those of the Copper Ridge and Conococheague, occur in some parts of the formation. Sandstone has been rarely reported in the unit, but none was mapped within it in this area.

The gradational contact with the underlying Chepultepec is exposed in only a few places. A few beds of Beekmantown-type dolomite are mapped in the upper part of the Chepultepec; the contact is drawn either at the point where such dolomites become the predominant lithology or, more commonly, in a 100- to 200-foot covered zone that separates the predominantly dolomitic section from Conococheague-type limestones.

A thickness of 700 to 1200 feet is estimated for the Beekmantown. This is thinner and more variable than reported by most authors. Erosional relief of 75 to 100 feet may be traced out where the upper contact is continuously exposed for about 150 yards 0.3 mile west of Slate Branch just off State Road 635, 4 miles north of Fincastle (Plate 4). Chert molds of low-spired and hyperstrophic gastropods are present in the unit, and at some localities brachiopod fragments occur in the upper part. The formation is considered to be Early Ordovician in age (Butts, 1940).

The Beekmantown is well exposed over much of the area southeast of the Rathole-Switzer mountain trend, and a few poor exposures are present in Rich Patch valley to the northwest. The upper 450 feet of the formation is almost completely exposed in the creekbed north of State Road 630 about 0.75 mile east of Fincastle (R-3954, Plate 4). The unit is thin in that area, perhaps due to erosion, and the exposures may represent the middle and lower portions of the formation.

New Market Limestone

The New Market Limestone (Elway limestone of Lesure, 1957) consists mainly of massive, dove-gray, birdseye calcilutite with zoned, nodular black chert. The base of the unit is commonly marked by a coarse pebble or cobble conglomerate containing clasts of Beekmantown lithologies in a calcilutite matrix and overlying the eroded upper surface of the Beekmantown. Some of the birdseyes are fossil fragments, as previously suggested by several authors, but many of them are not. Rather, they have the appearance of small shrinkage cavities later healed by sparry calcite. Similar lithologies occur in the upper part of the Beekmantown in some areas.

The New Market ranges in thickness from 5 to 120 feet in the area. In thicker sections the conglomerate is better developed and may occur in zones throughout an interval of 75 feet. The New Market has been combined with the Lincolnshire Formation for the purpose of mapping. The age of the New Market was considered by Cooper and Cooper (1946) to be Middle Ordovician. The formation is well exposed in the creekbed north of State Road 630 about 0.75 mile east of Fincastle (R-3955, Plate 4), and 0.3 mile west of Slate Branch just off State Road 635 about 4 miles north of Fincastle (Plate 4).

Lincolnshire Formation

The Lincolnshire Formation has two major lithologies in the area. One consists of medium- to thick-bedded, dark-gray, medium-grained, fossiliferous limestone with irregular shaly partings; black nodular chert occurs in this facies, being fairly abundant northwest of the Pulaski-Staunton fault and most especially in Rich Patch valley. The other facies is massive to thick-bedded, medium- to coarse-grained, light-gray calcarenite that contains abundant bryozoan fragments; it appears to be mainly restricted to outcrops in the belt northwest of the Pulaski-Staunton fault and southeast of the Rathole-Switzer mountain trend. Cooper and Cooper (1946) revived the name Murat as a facies term for similar rocks in the area of Rockbridge County and northward. Their correlation of Murat to Lincolnshire was based primarily on the local intercalation of Lincolnshire faunas and lithologies with the coarser calcarenites in that area. This relationship also occurs in the Eagle Rock area. Although the Murat facies, where it occurs, generally predominates in the upper part of the sequence, the more typical Lincolnshire lithologies are scattered throughout the formation and dominate the basal beds.

The partial thickness of the Lincolnshire Formation, including Murat lithologies, at the Eagle Rock Limestone Corporation quarry (R-3957, Plate 1, No. 2) is 160 feet (Edmundson, 1958, p. 62). This is probably within 50 feet of the complete thickness, and the thickest section, in the Eagle Rock belt of outcrops. Lesure (1957, p. 23) reported a thickness of 278 feet for the dark facies (including a 30-foot zone of lighter colored limestone) in Rich Patch valley. Edmundson (1958, p. 59) measured 176 feet of Lincolnshire 2 miles southwest of Fincastle. In the mapped area of the Fincastle valley, however, the formation is for the most part less than 100 feet thick, although it has a maximum thickness of 120 feet. In this area, the formation is dominated by a relatively chert-free, dark facies, but some light-colored calcarenites are present and calcilutites occur near the base.

The Lincolnshire-New Market contact is sharp in some areas, but gradational in others with a thin zone of mixed calcilutite and dark Lincolnshire-type beds. The Lincolnshire and New Market have been combined for purposes of mapping because the units are thin and typically have steep dips. Their combined thickness ranges from 50 to about 375 feet. The dark facies of the Lincolnshire is well exposed in the creekbed north of State Road 630 about 0.75 mile east of Fincastle (R-3956, Plate 4). Both the dark and Murat facies may be seen in the quarries west of Eagle Rock (Plate 1, Nos. 1, 2, 3). A section along Karnes Creek north of Rich Patch (Plate 2) was measured by Lesure (1957, p. 23).

Edinburg Formation

The Edinburg Formation between the Pulaski-Staunton fault and the Rathole-Switzer mountain trend (Plates 1, 3, 4) consists of dark-gray to black, fine-grained limestone interbedded with black, calcareous shale (Liberty Hall). A thickness of 800 to 1100 feet is estimated for these rocks, but many sections appear thinner, probably due to faulting; the most complete, accessible exposures are on the mountain slope northwest of Sugartree Hollow near the northeast end of Switzer Mountain (Plate 3).

Massive, dark-gray to black, coarse-grained, shaly, fossiliferous limestone that conforms to lithologic descriptions of the Botetourt Member is present at the base of the Edinburg northwest of the Pulaski-Staunton fault; this unit is up to 25 feet thick.

In the Rich Patch area (Plate 2), rocks mapped as Edinburg Formation are lighter colored and less shaly, and consist of medium-gray, fine-grained limestone with closely spaced, irregular, argillaceous partings. Lesure (1957, p. 26) reported a thickness of 422 feet for the formation in Rich Patch valley.

Southeast of the Pulaski-Staunton fault in the area of this report (Plates 3, 4), the dominant lithology in the Edinburg Formation is black, noncalcareous, fissile, silty shale that contains thin interbeds of siltstone, especially in the upper part. About 0.7 mile north of Pierce Chapel, on the hill just east of U. S. Highway 220, limestone beds occur within a 50-foot zone about 250 feet above the base of the formation (R-3958, Plate 4). The limestone is dark gray to black, fine grained, and sandy in part; portions of it are conglomeratic and contain subrounded pebbles of white calcite and limestone similar to that in the matrix. Woodward (1936a) noted similar lithologies in the area south of Flatwoods (Plate 3). Thickness of the exposed Edinburg southeast of the Pulaski-Staunton fault is estimated to be about 1800 feet. Numerous outcrops are present along U. S. Highway 220 north of Fincastle (Plate 4).

The Edinburg lithologies southeast of the Pulaski-Staunton fault do not resemble in important details those to the northwest nor those described by Cooper and Cooper (1946) at the type area. No correlative fossils have been found, and no interfingering relationship between these and better known Edinburg lithologies has been noted. The unit mapped in this report as Edinburg lies above beds that are correlated to the Lincolnshire Formation and contains fossils at the top which have been judged basal Trenton or older. Thus, the unit approximates the Edinburg in age but has only a gross lithologic similarity to the Liberty Hall in its abundance of dark argillaceous matter.

In the Pine Hills area north of Fincastle (Plates 3, 4) a polymictic conglomerate occurs in the Edinburg. The significance of this exceptional rock, informally called the "Fincastle conglomerate", has been widely discussed (Stow and Bierer, 1937; Decker, 1952; Kellberg and Grant, 1956; Cooper, 1960). The unit consists of sandstones, sandy shales, and thick beds of coarse pebble and cobble conglomerate in which it is possible to identify lithologies from a number of older formations. These formations have a stratigraphic range of Unicoi (Lower Cambrian to Beekmantown (Lower Ordovician) which includes approximately 8000 to 10,000 feet of section. The cobbles include Middle, and perhaps Lower, Cambrian carbonate rocks and Unicoi or older greenstones (Kellberg and Grant, 1956), along with more resistant Chilhowee lithologies. The implication is that at the time of deposition of the conglomerate there was considerable structural relief in a nearby source area. The nearest apparent source for the older cobbles is in the Blue Ridge about 12 miles to the southeast, but thrust faults separate the outcrop area of the conglomerate from potential sources.

The conglomerate occurs in a syncline where Kellberg and Grant (1956) reported thicknesses of 25 feet on the overturned south limb and 72 feet on the north limb along U. S. Highway 220 north of Fincastle. Westward along strike the zone becomes thinner in both outcrop belts; conglomeratic beds grade into argillaceous sandstones and are replaced by silty shales in the area west of Town Branch (Plate 3). The shales stratigraphically beneath, and structurally above, the conglomerate on the south limb of the fold are overridden by overturned Cambrian and Ordovician carbonate rocks having southeasterly dips. The leading edge of this thrust sheet does not override the conglomeratic beds. To the east the zone appears to become thicker, and a thickness of 300 feet is estimated for the conglomerates and coarse sandstones near the east limit of exposure. Brachiopods that occur in the shales above the conglomerate have been studied by G. A. Cooper who considers the age to be basal Trenton or perhaps older (Byron Cooper, personal communication).

Eggleston Formation

Lesure (1957) mapped a unit, the Eggleston Formation, in Rich Patch valley (Plate 2) between the Edinburg and the Martinsburg formations. The unit is composed mainly of olive-gray shales and compact limestones; in some areas, cuneiform fracturing is present in thin zones that may represent silicified limestone layers underlying thin beds of altered volcanic ash. Only non-diagnostic gastropods have been found, but the formation is lithologically similar to the type Eggleston in Giles County where it is considered to be of Trenton age. Exposures of the unit are present above the quarry west of State Road 616 about 0.5 mile north of Rich Patch (Plate 2, No. 9), and on the northwest slopes of Bearwallow Mountain north of Hooks Mill (Plate 2). The Eggleston Formation is not present in the general area of the Pulaski-Staunton fault where equivalent rocks are mapped as lowermost Martinsburg Formation.

Martinsburg Formation

Immediately above the Edinburg in the area just northwest of the Pulaski-Staunton fault and on the southeast slopes of the Rathole-Switzer mountain trend, the Martinsburg Formation is composed of buff-weathering, compact, gray to olive-gray, thin beds of brachiopod-rich limestone intercalated with calareous gray shale and a few thin beds of medium-grained sandstone. The Edinburg-Martinsburg contact typically occurs on ridges and knobs and is easily mapped. The main thickness of the Martinsburg is probably shale, with a few zones of thin limestone interbeds. In the upper part there are slabby, impure, fossiliferous limestones overlain by a section composed predominantly of sandstones. The sandstones are calcareous, fine grained, greenish gray or brown, and contain glauconite, phosphate nodules, clay galls, and molds of fossils including *Orthorhynchula,* the Late Ordovician Maysville guide (W. D. Hall, personal communication). These upper sandstones are intercalated with olive-gray shale.

In the Rathole-Switzer mountain trend, a few feet of medium-bedded, medium- to coarse-grained, bluish- to greenish-gray, cross-bedded sandstones with rust-colored mottles occur above the *Orthorhynchula* zone. Although these beds are probably equivalent to the Juniata Formation, they are included in the Martinsburg for mapping purposes. The Martinsburg contains Trenton fossils at the base and Maysville fossils at the top and is therefore of Late Ordovician age (Butts, 1940).

The Martinsburg is, for the most part, poorly exposed and internally deformed. The width of outcrop, however, suggests a thickness of 1200 to 2200 feet. Characteristic yellowish-weathering shale chips occur in areas of poor exposure. The lower part of the Martinsburg, including the Martinsburg-Edinburg contact, is exposed 0.2 mile north of State Highway 43, 1.5 miles east of Eagle Rock (R-3961, Plate 1). Other good exposures of the same contact are present along State Road 682 about 0.9 mile northwest of its intersection with State Road 681 (Plate 4). Good exposures of the upper part of the formation are at the south end of Eagle Rock gorge on either side of the James River (Plate 1), and along the northeast side of State Road 621 where Roaring Run cuts through the Rich Patch Mountains just southeast of Hooks Mill (Plate 2).

Juniata Formation

The Juniata Formation was mapped by Lesure (1957) in the northwestern part of the area of study (Plates 1, 2). He described it as a grayish-red, very fine-grained, thin-bedded and cross-bedded sandstone with interlayered grayish-red, silty shale. In some areas, especially near Roaring Run just southeast of Hooks Mill (Plate 2), the formation contains gray, coarse-grained sandstone. A thickness of 233 feet was reported for a measured section of Juniata at Cliff Dale Chapel just west of the Strom quadrangle along State Road 616 (Lesure, 1957, p. 31). In the Rathole-Switzer mountain trend, 10 to 60 feet of brown-weathering, gray sandstones separate the *Orthorhynchula* zone in the Martinsburg Formation from white Tuscarora quartzite and conglomerate. These beds are lithologically equivalent to the gray sandstones in the Juniata Formation, but they have been included in the Martinsburg map unit. In addition to the section at Cliff Dale Chapel, the Juniata is also well exposed where Roaring Run cuts through the Rich Patch Mountains just southeast of Hooks Mill (Plate 2).

SILURIAN SYSTEM

Tuscarora Formation

The Tuscarora Formation consists of massive to thick-bedded, white to light-gray, coarse-grained, cross-bedded, quartzose sandstone and quartz-pebble conglomerate. Contacts with the gray and red sandstones of the underlying Juniata Formation are sharp at some localities and gradational at others. Along the Rathole-Switzer mountain trend the unit ranges in thickness from 20 to 75 feet; elsewhere, it is estimated to be as much as 120 feet thick. The Tuscarora is well exposed in numerous mountain outcrops; more accessible outcrops are located at the south end of Eagle Rock gorge (R-3962, Plate 1), at the north end of Switzer Mountain (Plates 3, 4), and in the gap where Roaring Run cuts through the Rich Patch Mountains southeast of Hooks Mill (Plate 2).

Cacapon Formation

The Cacapon Formation is composed of deep-red hematitic sandstones, brown to tan medium-grained sandstones with clay galls, and red and green sandy and micaceous shales. The shales and hematitic sandstones are distinctive and permit ready identification of the unit. The formation has a thickness range of 200 to 270 feet in the Rich Patch area according to Lesure (1957) who mapped it as the Rose Hill Formation. In the Rathole-Switzer mountain trend, the only well-exposed sections are in the southern part of Eagle Rock gorge where the thicknesses are somewhat less than 200 feet (Plate 1); in many mountain exposures, however, the Cacapon appears to be less than 80 feet thick, but it may be structurally thinned. Lesure (1957, p. 36-37) reported Clinton (Middle Silurian) ostracodes and trilobites from the upper portion of the Rose Hill (Cacapon) at the gap where Roaring Run crosses the Rich Patch Mountains southeast of Hooks Mill (Plate 2). The most readily accessible good exposures of Cacapon are in Eagle Rock gorge (R-3963, Plate 1).

Keefer Sandstone

The Keefer Sandstone consists of evenly thick-bedded, fine- to medium-grained, partly clayey, pinkish, tan, and white sandstones, some of which are red on the weathered surface. A variety of primary structures including worm tubes, ripple marks, mud cracks, and cross-bedding are present. The bedding characteristics, greater thickness, finer grain sizes, and pinkish colors of the Keefer permit distinction from the Tuscarora, but the two units are easily confused unless several criteria are considered.

Lesure (1957) reported that the formation has thicknesses of 218 feet in the gorge of the Jackson River north of Iron Gate (4 miles north of Plate 1) and 250 feet along Stony Run about one mile north of Horton (Plate 2). These thicknesses are similar to those observed in the Rathole-Switzer mountain trend. Except for vertical *Scolithus-type* tubes, no fossils have been found. Good exposures of the Keefer may be seen in the gorge at Eagle Rock (R-3964, Plate 1) and along Roaring Run southeast of Hooks Mill (Plate 2).

LOWER DEVONIAN AND UPPER SILURIAN ROCKS

The Tonoloway Formation and successively younger units through the Ridgeley Sandstone are combined by the writer as a map unit, Lower Devonian and Upper Silurian rocks. Lesure (1957) mapped a contact within this unit between the Keyser Formation and the New Creek Limestone (Coeymans), but in order to be consistent throughout the mapped area, this contact is not shown on the maps. Spencer (1968, Plates 2, 3) included all of these rocks plus the Keefer in the Lower Devonian and Upper Silurian rocks unit.

Tonoloway Formation

The Tonoloway Formation has as its dominant lithology a thin-bedded, dark-gray, clayey limestone that forms a light-gray patina on weathered surfaces. Sandy and silty zones, gray shale, and occasional calcareous sandstone occur in the lower part of the unit. At the base there is a zone of medium-bedded, calcareous, coarse-grained sandstone that has a distinctive cross-bedded pattern of black to dark-brown staining. A few leperditiid ostracodes and a rhynchonellid brachiopod of the *Camarotoechia* type are present in the Tonoloway.

A complete section of Tonoloway is nowhere exposed in the mapped area, but a 100-foot thickness of the upper part is present along the Chesapeake and Ohio Railway at the south end of Big Hill, 1.5 miles northwest of Gala (Plate 1) (Lesure, 1957, p. 41). The maximum thickness is probably not over 200 feet. On mountain slopes the contact with the underlying Keefer is usually picked at the highest topographic occurrence of the characteristic calcareous, coarse-grained, sandstone float.

Exposures are generally poor except at the location 1.5 miles northwest of Gala (Plate 1). The unit is structurally incompetent, and complex folding may be observed at Eagle Rock gorge (Plate 1). An outcrop of Tonoloway, 6 to 8 feet thick and 15 feet long, occurs at the south end of Switzer Mountain on the west flank a few yards north of State Road 606 (Plate 3) and appears to be a detached mass in sheared and contorted Middle or Upper Devonian shales. This outcrop is interpreted as an exotic structural block in the shear zone between the Silurian and Upper Devonian rocks.

Keyser Formation

The Keyser Formation is well exposed along the Chesapeake and Ohio Railway at the south end of Big Hill about 1.5 miles northwest of Gala (Plate 1) where a 116-foot-thick section was measured (Lesure, 1957, p. 45). At this location the upper part of the Keyser is mainly of medium-gray, nodular, shelly limestone with some well-bedded, shaly limestone; the lower part is dominated by coarse-grained, calcareous sandstone. The Keyser thins eastward and has not been positively identified along the Rathole-Switzer mountain trend. It is estimated to be 70 to 120 feet thick in the Rich Patch area (Lesure, 1957, p. 43). The lower part of the Keyser is Late Silurian in age (Bowen, 1967); the upper part is Early Devonian (Swartz, 1929; Bowen 1967).

New Creek Limestone

The New Creek Limestone (Bowen, 1967) is used in this report as a replacement for the Coeymans Limestone of Lesure (1957). It consists of massive, light-gray, coarse-grained, crinoidal limestone at Prices Bluff, 1.5 miles northwest of Gala (Plate 1), where it is 12 feet thick. The formation was not seen in the Rathole-Switzer mountain trend. The New Creek is of Early Devonian age.

Healing Springs Sandstone

The Healing Springs Sandstone consists of light-colored, calcareous, coarse-grained sandstone and irregularly thin-bedded, sandy limestone at Prices Bluff where it is 14 feet thick (Plate 1). Exposures were not seen in the Rathole-Switzer mountain trend.

Licking Creek Limestone

The Licking Creek Limestone consists of sandy and finely fragmental, dark-gray limestone containing much nodular chert in the lower half at Prices Bluff (Plate 1) where it is 104 feet thick. It has not been positively identified in the Rathole-Switzer Mountain trend.

Ridgeley Sandstone

The Ridgeley Sandstone is a mature, medium- to coarse-grained, calcareous orthoquartzite with molds of large spirifers and other fossils; weathered outcrops are characteristically stained with iron oxide. The unit typically grades downward into the sandy limestones of the Licking Creek but is in rather sharp contact with that unit at the south end of Big Hill (Lesure, 1957, p. 52-53). Along the Rathole-Switzer mountain trend, sporadic occurrences of float of Ridgeley-type sandstone are present in the intervals mapped as Lower Devonian and Upper Silurian rocks, and exposures thought to be Ridgeley occur in the isolated belt of that unit south of Daggers Springs (Plate 1). The unit is well exposed at the south end of Big Hill (Plate 1) where it is about 2 feet thick; outcrops in the Rich Patch area are as much as 25 feet thick (Lesure, 1957). The formation contains fossils of Devonian age characteristic of the Oriskany Sandstone of New York.

DEVONIAN SYSTEM

Needmore Formation

The Needmore Formation in the northwestern part of the area consists of medium- and olive-gray, calcareous, fossiliferous shale containing thin, lenticular, argillaceous limestones; the thickness ranges from 15 to 50 feet (Lesure, 1957). In the Rathole-Switzer mountain trend, a Needmore fauna has not been identified, but lithologically similar shales occur in a few places. For mapping purposes the Needmore is combined with the overlying Millboro Shale. Good exposures of the unit may be seen along State Road 622 at the south end of Big Hill (Plate 1).

Millboro Shale

The Millboro Shale consists of black, fissile shale that contains abundant small pyrite crystals and zones of large, subspherical to ellipsoidal, ironstone concretions. Lesure (1957, p. 55) reports that the concretionary zones grade laterally into thick-bedded, argillaceous limestones. Due to internal deformation, the thickness of the Millboro is difficult to estimate but probably ranges from 800 to 1500 feet. Fossils in the Millboro include tentaculitids; conulariids; poorly preserved, thin-shelled, coiled cephalopods; and a variety of tiny brachiopods, pelecypods, and gastropods. The concretions, fauna, and general character of the unit may be seen in cuts along U. S. Highway 220 north of Rathole Mountain about 1 mile north of Eagle Rock (R-3965, Plate 1). The Millboro is of Middle Devonian age.

Brallier Formation

The Brallier Formation is composed of a thick sequence of greenish-gray to dark-gray, stiff, fissile, micaceous, silty shale with abundant thin- to medium-bedded blocky-jointed, brownish- to reddish-weathering, gray siltstone and fine-grained sandstone interbeds. The contact with the underlying Millboro is picked above the highest black fissile shale. Thickness of the Brallier is estimated to be more than 2500 feet. Outcrops of Brallier are numerous in the Big Hill-Patterson mountain trend. Particularly good exposures occur in cuts along the old railroad bed north of State Road 682 (Plates 1, 2). Fossils are rare in the unit. Fragments of small brachiopods were noted near Poplar Hill (Plate 4) and northwest of Sulfur Spring (Plate 3).

Chemung Formation

The Chemung Formation consists of a thick sequence of irregularly bedded, greenish-gray sandstone and lumpy, greenish-gray shale grading in the upper several hundred feet to predominantly red, reddish-brown, and chocolate-brown sandstone, shale, and mudrock with occasional thin beds of quartz-pebble conglomerate. Most of the sandstones and conglomerates are feldspathic. The unit is probably more than 2500 feet thick.

Large brachiopod molds are common in many of the sandstones, and faunas dominated by echinoderm stems or pelecypods occur in some. The lower contact is customarily mapped below the first sandstones bearing large, Chemung-type brachiopods, and this procedure has been followed by the writer. This necessitates inclusion of a lower zone of several hundred feet of mixed Brallier- and Chemung-type lithologies. The upper, red portion of the Chemung was mapped by Woodward (1936a) as "Catskill". Although red is the dominant color in the upper portion of this unit, gray beds and conglomeratic layers typical of the Chemung occur throughout, and fossils are present within 100 feet of the top.

The Chemung is exceptionally well exposed on the northwest slope of Price Mountain along State Road 606 (Plate 3). The upper exposures are probably near the top of the unit, and the lower ones are near outcrops identified as Brallier. The intervening beds are almost completely exposed.

MISSISSIPPIAN SYSTEM

Price Formation

The Price Formation consists of a sequence of thick-bedded, quartz-pebble and cobble conglomerates; grayish-white to purplish-gray, coarse-grained, hard, cross-bedded, quartzose and feldspathic sandstones; medium- and coarse-grained, ferruginous, reddish and brownish, cross-bedded sandstones; light- and dark-gray lumpy shales and mudrock with weathered coal; and highly limonitic, silty, yellow to gray claystone. The light-colored sandstones are predominant in outcrops. The conglomerates are distributed throughout the exposed thickness of the unit. Several zones in the lower 200 feet of the formation contain 4- to 8-foot-thick, massive beds of conglomerate with quartz cobbles that are about 4 inches in diameter. Beds of conglomerate higher in the sequence are thinner and contain quartz pebbles and a few small cobbles. A thickness of 1800 feet is estimated for the exposed Price.

The most complete exposures of the formation are in Lees Gap in the southwest part of the Oriskany quadrangle (Plate 3). The coarse conglomerates and limonitic beds are well exposed in the gap. A more accessible location is along Stone Coal Creek and the U. S. Forest Service road just beyond the southwest corner of the quadrangle (Plate 3) where impure, weathered coal is common in the shale cuts, but conglomerates are not so well developed.

QUATERNARY(?) SYSTEM

Craig Creek, Catawba Creek, James River, and a few of their tributaries have developed alluvial plains underlain by as much as 100 feet of sand, clay, and gravel over portions of their courses. Lesure (1957) mapped large areas of terrace gravels in Rich Patch valley (Plate 2). Other gravel deposits, which were not mapped, consist of small, thin terrace gravels near the James River at elevations as much as 200 feet above its present level, and discontinuous areas of terrace gravels in the low hills above North Fork east of Caldwell and Switzer mountains (Plate 3). Colluvial deposits are common on mountain slopes; they have not been mapped, however, as they are generally discontinuous and thin.

STRUCTURE

PULASKI-STAUNTON THRUST SHEET

The Pulaski-Staunton thrust sheet includes all of the structures in the area of study southeast of the Pulaski-Staunton fault (Plates 1, 3, 4; Figure 2). In the southeast portion of the Salisbury quadrangle (Plate 4), along a fault that has moderate to steep southeasterly dips, the Elbrook Formation has been thrust over younger rocks. The Elbrook southeast of the fault trace is brecciated and contorted over large areas. Northwest of this fault is a northeastward-trending, nearly isoclinal, syncline that is overturned on the southeast limb as evidenced by primary sedimentary structures and map pattern of the units. Northwest of this syncline there is a broad southwestward-plunging anticline in which the Rome Formation is exposed. An overturned sequence of older units has been thrust over the Edinburg in the vicinity of Fincastle (Plates 3, 4) and the fault probably connects, to the south, with the fault just discussed. The nearest apparent origin for the sequence of rocks in the thrust sheet (Plate 3, cross section B-B′) is a southwesterly extension of the overturned southeast limb of the syncline that extends beneath the fault near the southern boundary of the Salisbury quadrangle (Plate 4). The minimum lateral movement involved in this fault is about 2.5 miles. The fault is easily traced in the Fincastle area, where the dip of the fault plane ranges from 10°N. to 40°S.

Just north of the thrust fault near Fincastle, the "Fincastle conglomerate" is exposed in the overturned portion of the southeast limb of a syncline. The axial trace of this structure is deflected as indicated by the change of its strike from about N. 30°E. to N. 70°E where it becomes subparallel to the fault. Northwest of this syncline a northeastward-trending anticline is indicated by the attitude of beds in the Edinburg south of Flatwoods and the sigmoidal map pattern near Camp Montgomery (Plate 3). About 0.4 mile to the northwest is a parallel northeastward-trending syncline (Plate 3). The three folds, which form a small synclinorium, merge northeastward into a single syncline.

Northeast of North Fork Church (Plate 3) the beds on the northwest flank of the synclinorium dip steeply southeastward or are slightly overturned. A thrust fault traverses this belt of anomalously overturned beds from the vicinity of Salisbury (Plate 4) southwestward to join the Pulaski-Staunton fault

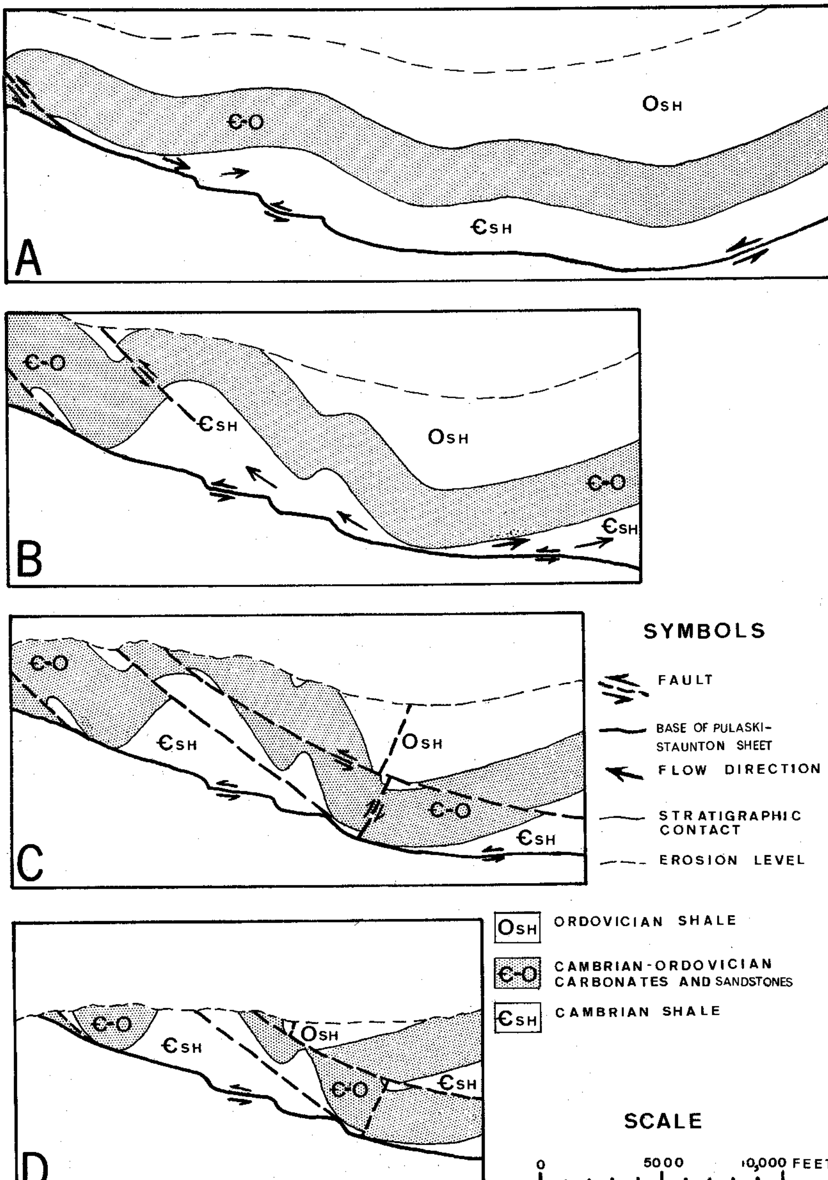

Figure 3. Postulated sequential development of structure in the northwestern part of the Pulaski-Staunton thrust sheet looking northeast. (A) Initial thrusting across competent beds as décollement zone is torn from beneath the leading part of the thrust sheet. (B and C) More thrusting and folding of competent beds continued from the southeast. (D) Present structure along line from Kyles Mill northwest to edge of the Salisbury quadrangle (Plate 4).

southeast of Caldwell Mountain (Plate 3). The fault plane has a sinuous trace and low-angle dips, as is evident in the area about 1 mile northeast of North Fork Church (Plate 3) where Middle Ordovician limestones are thrust onto the Elbrook Formation. About 2 miles south of Owens the fault trace is partially lost in the Elbrook but may continue as a bifurcation to the east of the James River where two faults are present in the vicinity of Salisbury. A subsidiary fault is present along the left bank of Catawba Creek northeast of Pierce Chapel (Plate 4) (Woodward, 1936a). As can be seen in an exposure in the bluff of Catawba Creek where the dirt road leading southeastward from U. S. Highway 220 reaches the creek, the fault is high angle and the northwest side is upthrown (Plate 4, cross section B-B′).

Northwest of the fault system just described the Pulaski-Staunton thrust sheet is folded into a series of narrow anticlines and synclines that mainly involve Middle and Upper Cambrian rocks at the surface. Most folds have steep limbs, a few being overturned; plunge reversals are fairly common. These structures are cut by a number of faults that have steep southeasterly dips and the southeast sides of which are upthrown. The structural development of the northwestern part of the Pulaski-Staunton thrust sheet is illustrated in Figure 3. The sheet is considered to be based in Cambrian shales and to be emplaced over the eroded surface of pre-existing Valley and Ridge structures. All minor structures within the thrust sheet and the large synclinorium of the Fincastle valley are interpreted to result from this emplacement and not to correspond directly to structures beneath the sheet.

PULASKI-STAUNTON FAULT

The Pulaski-Staunton fault (Plates 1, 3, 4) can be traced from 0.7 mile north of Shiloh Church to a point approximately 1 mile east of Eagle Rock (Plate 1) where a southeastward-striking transverse fault occurs. From this point southwestward a thrust fault continues into the town of Eagle Rock and is probably present in shales west of the James River. Woodward (1936a, 1936b) interpreted the Pulaski-Staunton fault to lie on and near the line of this fault. Cooper (1960, p. 26, Figure 6) suggested that the Pulaski-Staunton fault lies in brecciated Elbrook outcrops along U. S. Route 220, 4 miles southwest of Woodward's location at Eagle Rock. The writer, however, prefers the location of the Pulaski-Staunton fault as indicated on Plates 1 and 4 because it appears to be more compatible with the patterns of transverse faulting east of Eagle Rock (Plate 1) and south of Poplar Hill (Plate 4), and because it effectively separates outcrop areas of unlike mid-Ordovician facies.

Near Poplar Hill (Plate 4) the Pulaski-Staunton fault can be definitely located and is associated with a complexly faulted, northwestward-trending syncline. Apparent strike-slip movement along the transverse faults is indicated by small-scale northwestward-southeastward shearing along vertical surfaces in individual outcrops, northwesterly-southeasterly zones of breccia, northwesterly strikes, inconsistent widths of outcrop belts of adjacent stratigraphic units, and lateral offsetting of the Pulaski-Staunton fault. Also, vertical movement along the fault is indicated by the map pattern, resulting in a graben-like feature. The geological events that formed this unusual feature may be interpreted as follows: the lower beds of the Pulaski-Staunton thrust sheet were detached locally near the advancing front by a subsheet obstruction to the southeast; after the obstruction was passed, the thinned segment sank relative to other areas of the sheet and formed the "syncline-graben"; the thinning and faulting of the segment provided a zone of weakness through which stresses in that area of the sheet were relieved by transverse faulting.

Southwestward from Zion Hill Church in the poorly exposed Cambrian and Lower Ordovician rocks (Plates 3, 4), the Pulaski-Staunton fault has not been precisely located. Better stratigraphic control exists along the fault trace near North Fork where Cambrian units have been thrust over younger rocks. Southwestward, much of the area is covered by colluvial material derived from Caldwell Mountain and there are few exposures.

RATHOLE-SWITZER MOUNTAIN TREND

A natural cross section of the Rathole-Switzer mountain trend occurs in the gorge at Eagle Rock where Butts (1940, Plate 61) interpreted the structure as consisting of a pair of recumbent anticlines having northwestward-dipping limbs (Figure 4, A). The writer's interpretation is illustrated in Figure 4(B), and a possible sequence of events leading to its formation is shown in Figure 5. From excellent outcrop control the displacements along the faults are shown in Figure 5 (A,B) and the subsequent

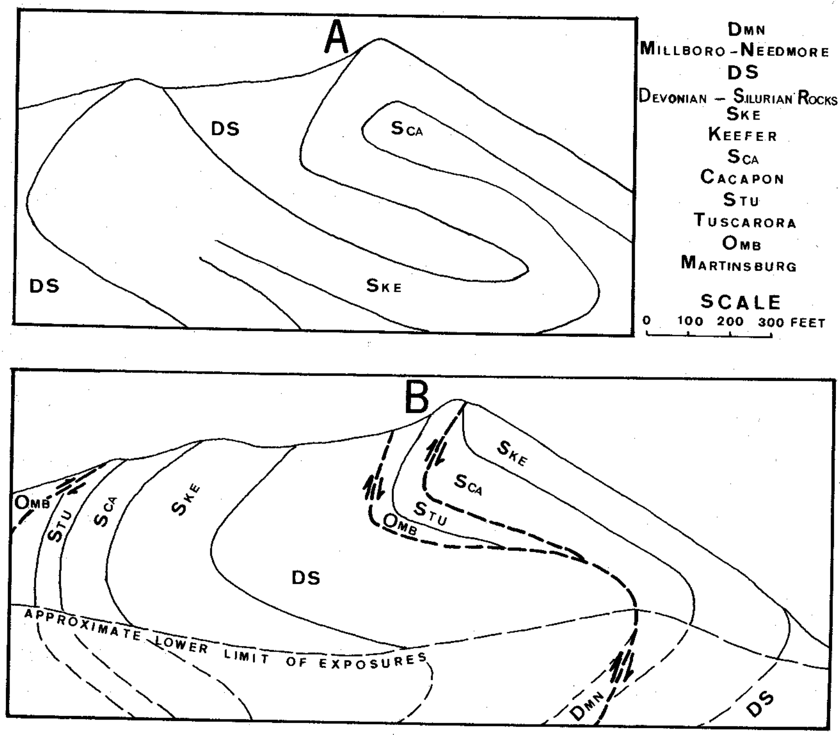

Figure 4. Interpretations of structure looking southwest across gorge of James River at Eagle Rock. (A) Butts (1940); (B) McGuire (this report).

sigmoidal folding in Figure 5(C). The large sigmoidal fold (Figure 5, C) is thought to have been developed by drag along the overlying Pulaski-Staunton overthrust, which now crops out 0.7 mile to the southeast, and a lower thrust fault. Under this interpretation the central limb of the sigmoidal fold has not been much rotated and the early faults had gentle northwesterly dips; these faults were probably large gravity slumps.

The structural style observed in Eagle Rock gorge is helpful in interpreting the structure of surrounding parts of the mountain trend (Plates 1, 3). The structure may be similar, as the trend consists of lens-shaped blocks up to ¾ mile long that are separated by faults having dips within 30° of bedding.

BIG HILL-PATTERSON MOUNTAIN-CALDWELL MOUNTAIN AREA

The Big Hill-Patterson Mountain-Caldwell Mountain area is a synclinorium that plunges gently to the southwest. Big Hill (Plate 1) is an anticlinal structure in which Silurian Keefer Sandstone is exposed along the axial trace (Lesure, 1957). Pat-

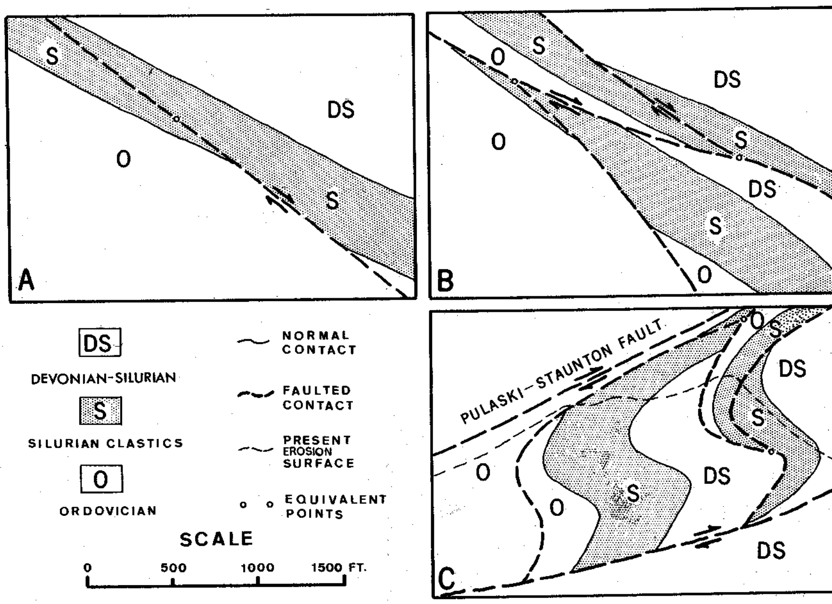

Figure 5. Postulated sequential development of the Eagle Rock structure (Figure 4). (A) Slump or normal faulting. (B) Tilting and further faulting. (C) Thrust faulting and sigmoidal folding.

terson Mountain, to the southwest (Plates 2, 3), is synclinal, and the Chemung Formation is exposed in the central portion. Price Mountain (Plate 3) is another synclinal fold in which Chemung Formation is exposed along the axial trace; to the southwest rocks as young as Mississippian are exposed on the southeast flank of Caldwell Mountain.

RICH PATCH AREA

The Rich Patch area (Plate 2) has been called a northeastward-trending anticlinorium by Lesure (1957) who described the structure in detail. The oldest rocks exposed are of the Beekmantown Formation. Map patterns are more complex than those in the Big Hill-Patterson Mountain-Caldwell Mountain area; this is probably due to the thinner, more distinctive map units in the Rich Patch area. (Structural cross sections on Plate 2 have been modified slightly from those prepared by Lesure because use of a larger scale base map permitted more accurate representation of the topography.)

ECONOMIC GEOLOGY

INDUSTRIAL LIMESTONE AND DOLOMITE

Limestone has been quarried from the Lincolnshire and Edinburg formations of Middle Ordovician age west of Karnes Creek and State Road 616 about 0.7 mile north of Rich Patch (Plate 2, No. 9). This quarry was originally opened in 1958 and worked until 1965; it was reopened in the latter part of 1968 by Vulcan Materials Company, Mideast Division, for the production of crushed stone and riprap.

Middle Ordovician limestone has been quarried at several locations in the Eagle Rock area (Plate 1, Nos. 1-3); the Eagle Rock Limestone Corporation quarry (Plate 1, No. 2), north of U. S. Highway 220, was active until the summer of 1964. The rocks in these quarries are overturned and have southeasterly dips. The main quarry rock is the Murat facies of the Lincolnshire Formation which is a high-calcium limestone. Edmundson (1958, p. 62) reported a thickness of 112 feet for the Murat about 1 mile southwest of Eagle Rock, but it is generally less than 100 feet thick in the area of study. Thicknesses up to 85 feet are present in the structurally complex Poplar Hill region (Plate 4) and along the southeast flank of Switzer Mountain (Plate 3). These are thought to be the most favorable localities for high-calcium limestone in the area.

Carbonate rocks underlie much of Rich Patch valley and the region southeast of the Rathole-Switzer mountain trend. Zones of relatively chert-free limestone and dolomite, more than 100 feet thick and suitable for the production of crushed stone, could be located within the stratigraphic range of upper Elbrook through Lincolnshire. Lithographic limestone in the Chepultepec-Conococheague unit has been prospected near Beaverdam Creek about 0.6 mile north of Wheatland Church (Plate 4, No. 19). The limestone is exposed in the creek valley near this prospect.

IRON ORE

A flourishing iron-mining industry was located in the Rich Patch area (Plates 1, 2) between 1827 and 1925. Lesure (1957) discussed the occurrence of the ores, and the following information is taken from his report. The "Oriskany" ores which consist mainly of goethite, clay, and sand occur in the upper, sandy portion of the Licking Creek Limestone and the overlying Ridgeley Sandstone. The footwalls of the mines are cherty Licking Creek and the hanging walls consist of brecciated, ferruginous Ridgeley sandstone. The ore bodies are tabular or lenticular; the larger ones extend about 0.5 mile along strike and generally range in thickness from 10 to 35 feet. The iron in these ores was probably derived from the weathering of pyrite in the overlying Millboro shales and redeposited in the underlying sandy limestone and sandstone (Lesure, 1957).

About 10,000,000 tons of ore were removed from the Clifton Forge iron district between 1832 and 1925 (Lesure, 1957, p. 11); drilling has indicated the presence of an additional 3,000,000 tons of potential reserves that are uneconomic at the present time. The main producers in the mapped area, for which production figures are available, were Rich Patch mines (Plate 2, Nos. 10, 11) and Big Hill mine (Plate 1, No. 6). The locations of other mines that produced iron ore are shown on Plates 1 and 2. Additionally, "Clinton" iron ores, consisting of thin hematite beds in the Cacapon Formation, have also been mined near Roaring Run Furnace and on Johnson and Porter mountains (Plate 2); but these ores appear to have been of relatively little importance, although production or reserve data are not available (Lesure, 1957, p. 12).

MISCELLANEOUS MATERIALS

Evaluation data for clay and shale samples collected in the area of study have been reported by Calver, Smith, and Le Van (1964). Potential uses of raw materials from six localities are shown in Table 2.

The Horton manganese prospect (Plate 2, No. 8) is located on a low spur of Bearwallow Mountain about 0.7 mile southeast of Hooks Mill (Lesure, 1957). It consists of several shallow pits and a small cut in the lower part of the Keyser Formation; psilomelane has been deposited in the sandstone and has partially replaced the quartz grains.

Many locations that are potentially suitable for the production of sand and gravel are present along the James River and Craig Creek (Plates 1, 2) and along Catawba Creek (Plates 3, 4). This material is of Quaternary(?) age and occurs in deposits up to 100 feet thick.

Barite has been prospected along the southern part of Cedar Ridge (Plate 3). The Williamson mine (Plate 3, No. 18), located approximately 1.8 miles northwest of Flatwoods, was first

Table 2.—Potential uses of clay materials from the Eagle Rock, Storm, and Oriskany quadrangles (data modified from Calver, Smith, and Le Van, 1964.)

Repository Number	Location	Formation	Sample Interval	Potential Use
R-1715	Exposure on the east side of U.S. Highway 220 just north of Gala and southeast of the intersection with State Road 622 (Plate 1)	Brallier	Sample across 95 feet of shale	Possibly low-grade common brick
R-1716	Roadcut on the north side of State Road 621 approximately 1.4 miles north of Strom (Plate 2)	Millboro	Representative of exposure of shale, 7 feet high and sampled for a distance of 120 feet	Possibly low-grade common brick
R-1770	Exposure on the northeast side of State Road 615 just south of Strom (Plate 2)	Millboro	Sample across 50 feet of shale	Possibly lightweight aggregate
R-1771	Exposure along the inactive right-of-way of the Chesapeake and Ohio Railway 2.1 miles west of Eagle Rock (Plate 1)	Brallier	Sample across approximately 25 feet of shale	Common brick and probably sintered aggregate
R-1777	Roadcut on the north side of State Road 606, 5.8 miles northwest of Fincastle (Plate 3)	Chemung	Sample across 45 feet of shale	Possibly common brick or quarry tile
R-1815	Exposure on a logging road on the east slope of Bald Mountain approximately 1.0 mile north of Lignite (Plate 2)	Quaternary(?) residual clay and weathered shale	Representative of exposure, up to 2 feet in height, that extends for a distance of 65 feet	Decorative brick and tile, and quarry tile

operated about 1850; attempts to reopen the mine were made in 1917, and during 1936 about 350 tons of barite were recovered from an open cut (Edmundson, 1938, p. 59). The barite at this locality was associated with Copper Ridge dolomite.

Coal probably occurs in the Price Formation in the southwestern part of the mapped area as it has been mined (Campbell and others, 1925, p. 273-282) on a small scale a few miles to the southwest off the Oriskany quadrangle (Plate 3). Samples appear to be low grade and high rank; seam thickness could not be determined.

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COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES
James L. Calver
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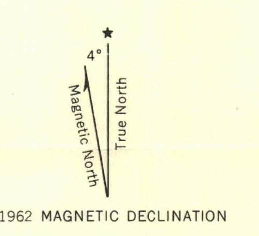
REPORT OF INVESTIGATIONS 27
PLATE 1
Eagle Rock
C.5

Base from U.S. Geological Survey 1962, Eagle Rock Quadrangle, 7½-Minute Series

GEOLOGIC MAP OF THE EAGLE ROCK QUADRANGLE, VIRGINIA

Geology by Odell S. McGuire

Williams & Heintz Map Corporation



1962 MAGNETIC DECLINATION

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1 ½ 0 1 MILE

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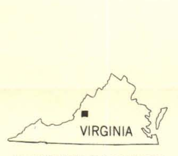
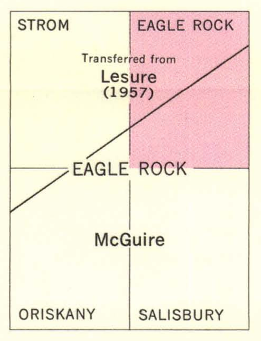
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET

1970



QUADRANGLE LOCATION



EXPLANATION

CENOZOIC — QUATERNARY

Qal — Alluvium
Stream deposits of sand and clay.

PALEOZOIC — DEVONIAN

Db — Brallier Formation
Greenish-gray, hard, fissile shale with thin, greenish-gray sandstones and siltstones; sparsely fossiliferous.

Dmn — Millboro Shale and Needmore Formation
Millboro: black, fissile shale with pyritic concretions; fossiliferous. Needmore: olive-drab, calcareous shale; fossiliferous.

DS — Lower Devonian and Upper Silurian Rocks
Ridgeley Sandstone: coarse-grained, calcareous, orthoquartzitic sandstone; fossiliferous. Licking Creek Limestone: dark-gray to black, sandy, cherty, fossiliferous limestone. Healing Springs Sandstone: coarse-grained, calcareous sandstone. New Creek Limestone: light-gray to brownish-gray, coarse-grained, crinoidal limestone. Keyser Formation: medium-gray, fossiliferous limestone and coarse-grained, calcareous sandstone. Tonoloway Formation: dark-gray, thin-bedded limestone with calcareous, medium- and coarse-grained, cross-bedded sandstones.

SILURIAN

Ske — Keefer Sandstone
Tan to pinkish-white, medium- and fine-grained, quartzose sandstone.

Sca — Cacapon Formation
Tan to deep-red, hematitic sandstone with red and greenish micaceous shale; sparsely fossiliferous.

Stu — Tuscarora Formation
White to light-gray, coarse-grained, quartzose sandstone with quartz-pebble conglomerate.

ORDOVICIAN

Oj — Juniata Formation
Red, fine-grained and gray, coarse-grained sandstone with gray and grayish-red shale and mudrock. In the southeastern part of the quadrangle this unit is probably represented by gray sandstone in the upper part of the Martinsburg Formation.

Omb — Martinsburg Formation
Yellowish-weathering, gray shale with gray, thin-bedded, fossiliferous limestones and gray, ferruginous sandstones.

Oeg — Eggleston Formation
(In cross section only)

Oe — Edinburg Formation
Dark-gray to black, fine-grained limestone interbedded with black calcareous shale (Liberty Hall); Botetourt Member (at base): dark-gray to black, coarse-grained, fossiliferous limestone.

Oln — Lincolnshire Formation and New Market Limestone
Lincolnshire: dark- to light-gray, fossiliferous limestone with nodular black chert. New Market: dove-gray, massive, compact limestone with black chert; conglomeratic lower part contains cobbles of dolomite, limestone, and chert.

Ob — Beekmantown Formation
Light- and medium-gray, saccharoidal dolomite, with light-colored chert in thin beds and gnarly masses, and gray to grayish-blue compact limestone; sparsely fossiliferous.

O€c — Chepultepec-Conococheague Formations
Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, light-gray dolomite, and coarse-grained calcareous sandstone; sparsely fossiliferous.

CAMBRIAN

€cr — Copper Ridge Formation
Medium- and light-gray dolomite with positive-weathering siliceous laminae and coarse-grained, calcareous sandstone.

€e — Elbrook Formation
Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, platy yellowish-brown to gray dolomite, and gray to green shale; sparsely fossiliferous.

Breccia

CONTACTS

exposed
approximate
covered or inferred

FOLDS

Anticline—trace of axial plane
Syncline—trace of axial plane
Overturned anticline—trace of axial plane
Overturned syncline—trace of axial plane

FAULTS
THRUST

approximate
covered or inferred
T — overthrust side

NORMAL OR REVERSE

approximate
covered or inferred
U — upthrown side
D — downthrown side

TRANSVERSE

approximate
covered or inferred
Arrows indicate inferred movement

ATTITUDE OF ROCKS

25 Strike and dip of beds
85 Strike and dip of overturned beds
Strike of vertical beds
Horizontal beds

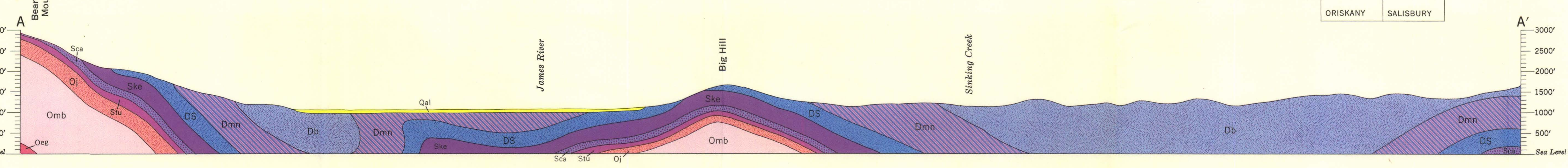
MINES AND QUARRIES

1 Abandoned mine or quarry

1. Limestone quarry
2. Eagle Rock Limestone Corporation quarry (limestone)
3. Limestone quarry
4. Iron-ore mine
5. Iron-ore mine
6. Big Hill mine (iron ore)

SAMPLE LOCATIONS

△ R-3951 Representative samples of lithologies mapped or raw materials that have potential use in the ceramic industry.



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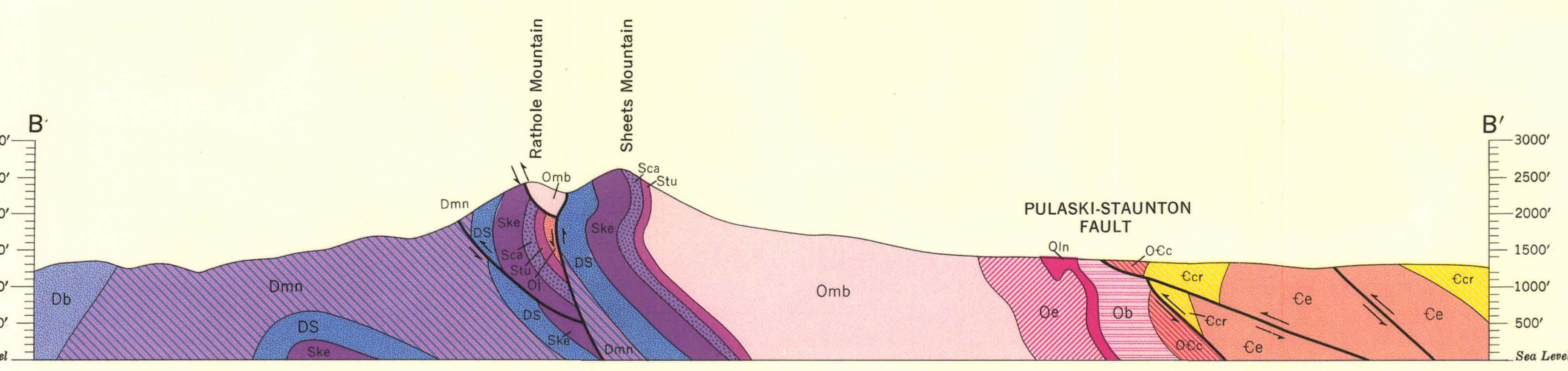

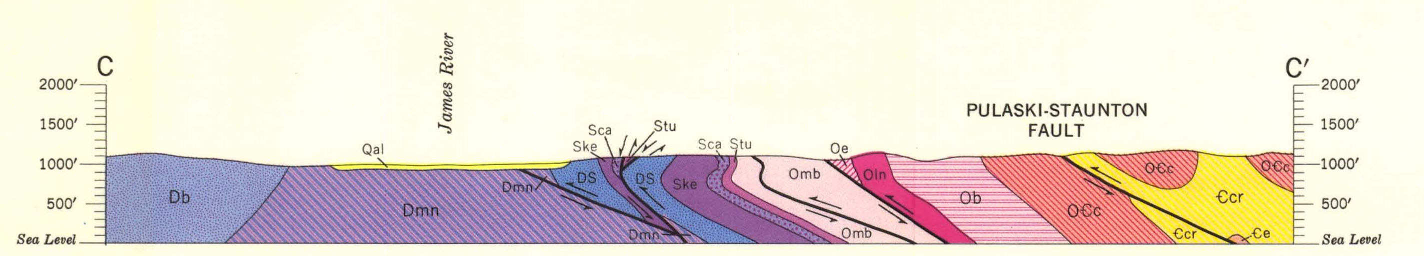

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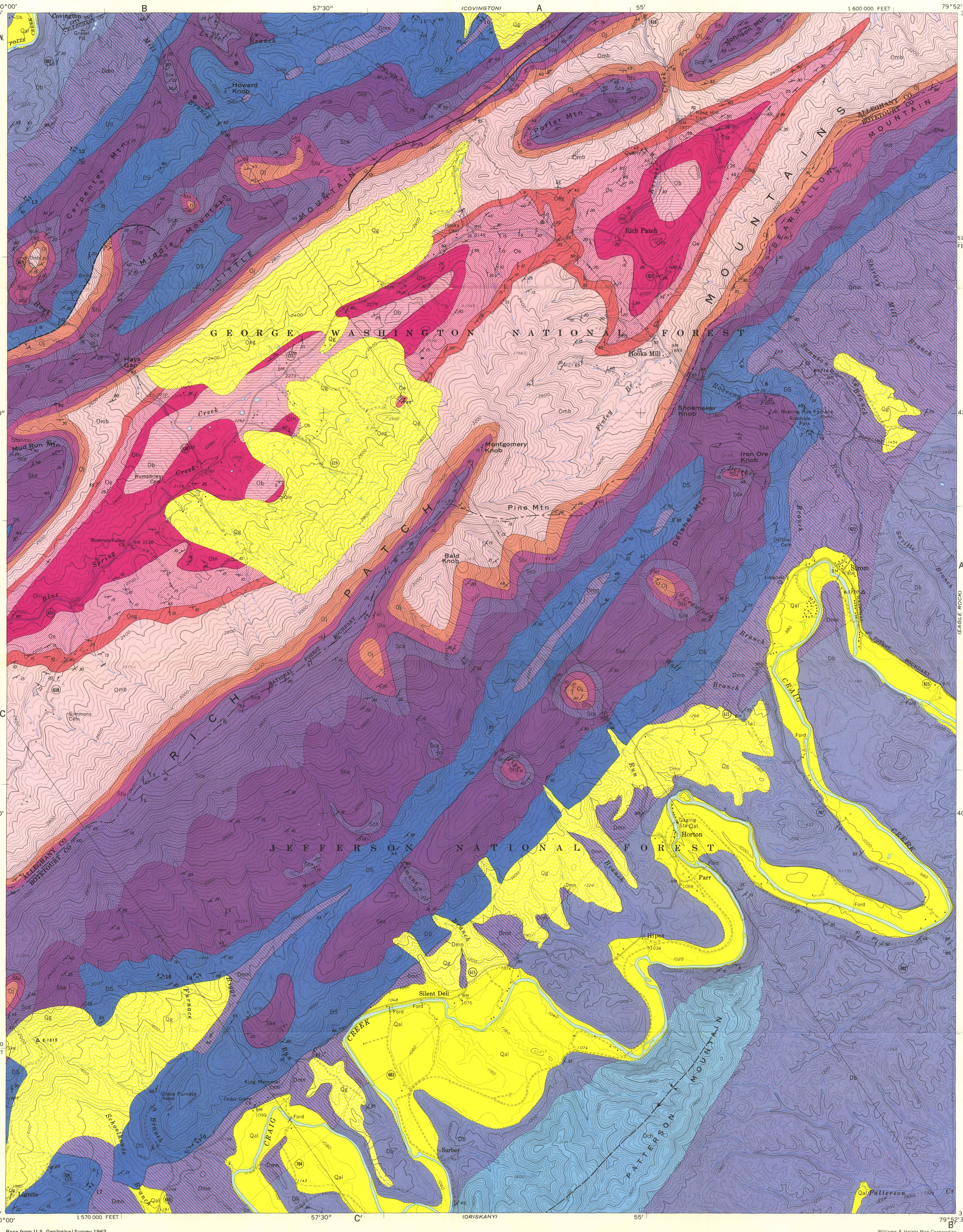
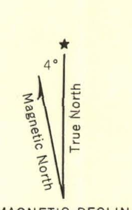


Base from U.S. Geological Survey 1962, Strom Quadrangle, 7½-Minute Series

Williams & Heintz Map Corporation

GEOLOGIC MAP OF THE STROM QUADRANGLE, VIRGINIA

Geology by Odell S. McGuire



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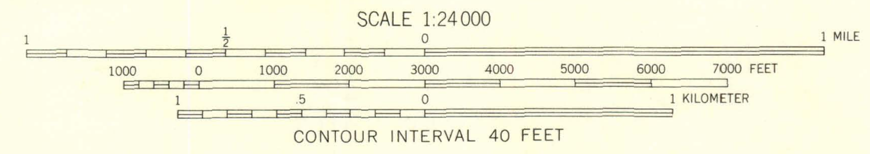

CONTOUR INTERVAL 40 FEET

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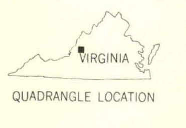
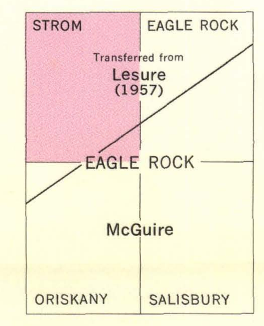


QUADRANGLE LOCATION



EXPLANATION

CENOZOIC — QUATERNARY

Qal — Alluvium
Stream deposits of sand and clay.

Qg — Gravel
Coarse terrace gravel and colluvium.

PALEOZOIC

DEVONIAN

Dch — Chemung Formation
Chocolate-brown, red, tan, and greenish-gray shale and mudrock; fossiliferous.

Db — Brallier Formation
Greenish-gray, hard, fissile shale with thin, greenish-gray sandstones and siltstones; sparsely fossiliferous.

Dmn — Millboro Shale and Needmore Formation
Millboro: black, fissile shale with pyritic concretions; fossiliferous. Needmore: olive-drab, calcareous shale; fossiliferous.

DS — Lower Devonian and Upper Silurian Rocks
Ridgeley Sandstone: coarse-grained, calcareous, orthoquartzitic sandstone; fossiliferous. Licking Creek Limestone: dark-gray to black, sandy, cherty, fossiliferous limestone. Healing Springs Sandstone: coarse-grained, calcareous sandstone. New Creek Limestone: light-gray to brownish-gray, coarse-grained, crinoidal limestone. Keyser Formation: medium-gray, fossiliferous limestone and coarse-grained, calcareous sandstone. Tonoloway Formation: dark-gray, thin-bedded limestone with calcareous, medium- and coarse-grained, cross-bedded sandstones.

SILURIAN

Ske — Keefer Sandstone
Tan to pinkish-white, medium- and fine-grained, quartzose sandstone.

Sca — Cacapon Formation
Tan to deep-red, hematitic sandstone with red and greenish micaceous shale; sparsely fossiliferous.

Stu — Tuscarora Formation
White to light-gray, coarse-grained, quartzose sandstone with quartz-pebble conglomerate.

ORDOVICIAN

Oj — Juniata Formation
Red, fine-grained and gray, coarse-grained sandstone with gray and grayish-red shale and mudrock.

Omb — Martinsburg Formation
Yellowish-weathering, gray shale with gray, thin-bedded, fossiliferous limestones and gray, ferruginous sandstones.

Oeg — Eggleston Formation
Gray, dense, argillaceous limestone and olive-gray shale; sparsely fossiliferous.

Oe — Edinburg Formation
Medium-gray, fine-grained limestone with closely spaced, irregular, argillaceous partings.

Oln — Lincolnshire Formation and New Market Limestone
Lincolnshire: dark- to light-gray, fossiliferous limestone with nodular black chert. New Market: dove-gray, massive, compact limestone with black chert; conglomeratic lower part contains cobbles of dolomite, limestone, and chert. This unit was mapped as Lincolnshire and Elway limestones by Lesure (1957, Plate 1).

Ob — Beekmantown Formation
Light- and medium-gray, saccharoidal dolomite, with light-colored chert in thin beds and gnarly masses, and gray to grayish-blue compact limestone; sparsely fossiliferous.

O€c — Chepultepec-Conococheague Formations
(In cross section only)

CAMBRIAN

€cr — Copper Ridge Formation
(In cross section only)

CONTACTS

exposed

approximate

covered or inferred

FOLDS

Syncline—trace of axial plane and direction of plunge of axis

FAULTS

THRUST

approximate

T — overthrust side

NORMAL OR REVERSE

exposed

U — upthrown side
D — downthrown side

ATTITUDE OF ROCKS

25 Strike and dip of beds

85 Strike and dip of overturned beds

Strike of vertical beds

Horizontal beds

MINES, QUARRIES, AND PROSPECTS

9 Active quarry

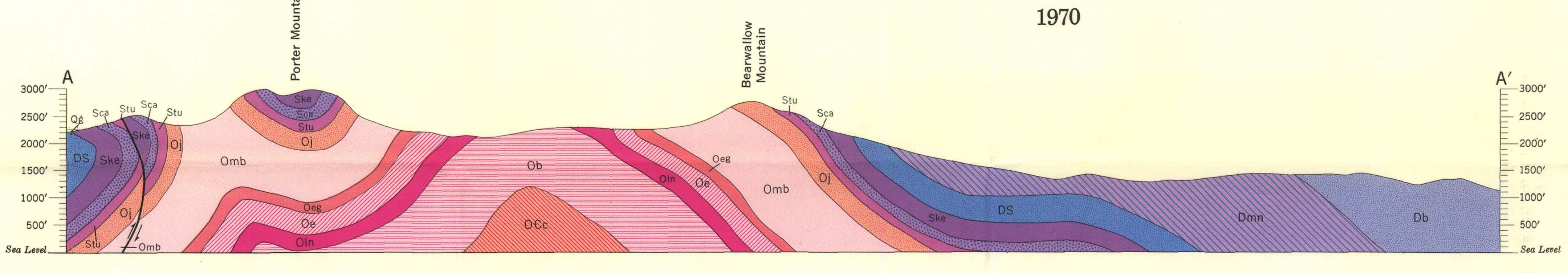
7 Abandoned mine

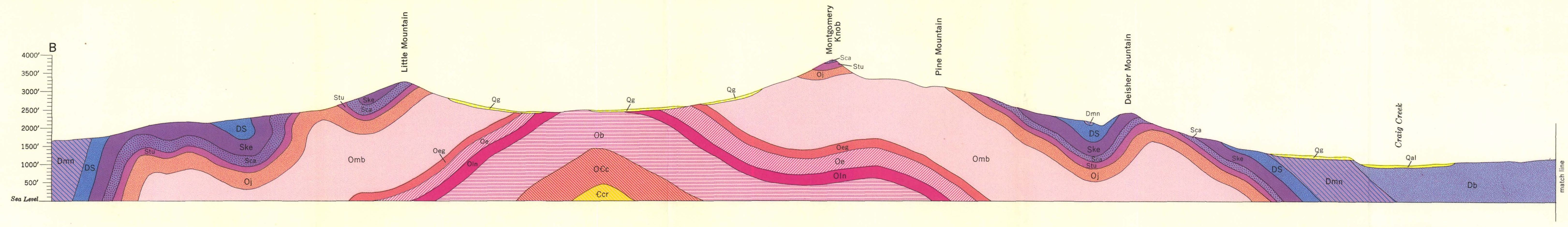
8 Prospect

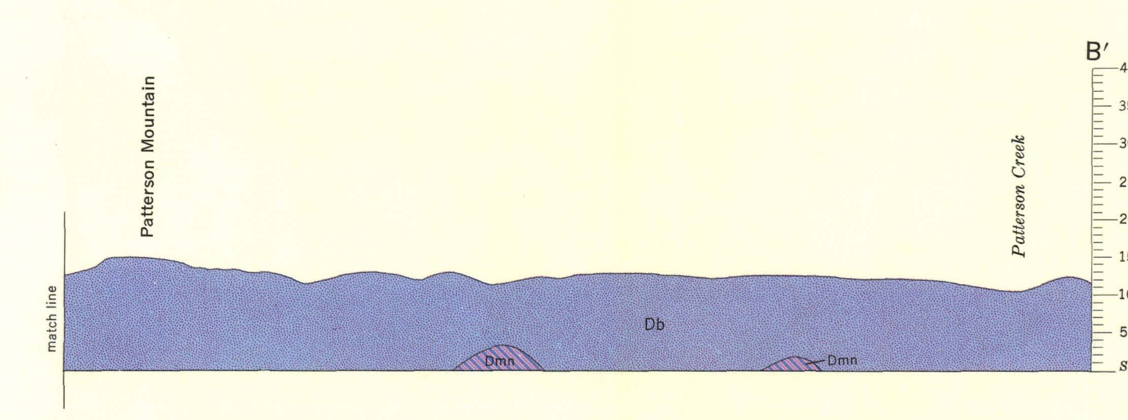
7. Roaring Run mine (iron ore)
8. Horton prospect (manganese)
9. Vulcan Materials Co., Mideast Division, Lowmoor quarry (limestone)
10. Rich Patch mine (iron ore)
11. Rich Patch mine (iron ore)
12. Iron-ore mine
13. Iron-ore mine
14. "Q" mine (iron ore)
15. Grace mine (iron ore)
16. Peanut mine (iron ore)
17. Old Pit mine (iron ore)

SAMPLE LOCATIONS

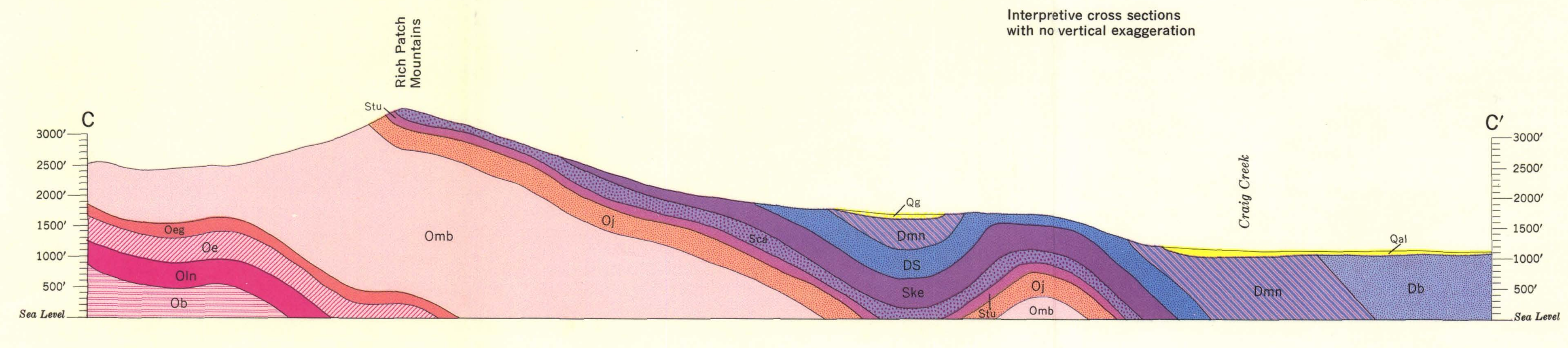
R-1716 Raw materials that have potential use in the ceramic industry.







Interpretive cross sections with no vertical exaggeration



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DIVISION OF MINERAL RESOURCES
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Commissioner of Mineral Resources and State Geologist

REPORT OF INVESTIGATIONS 24
PLATE 3

Base from U.S. Geological Survey 1962, Oriskany Quadrangle, 7½-Minute Series

GEOLOGIC MAP OF THE ORISKANY QUADRANGLE, VIRGINIA

Geology by Odell S. McGuire

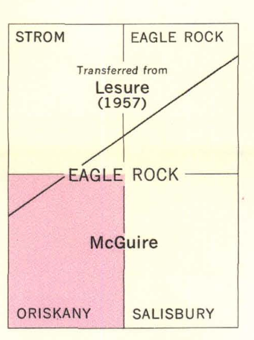
SCALE 1:24 000

CONTOUR INTERVAL 40 FEET

1970

1962 MAGNETIC DECLINATION

QUADRANGLE LOCATION



EXPLANATION

CENOZOIC — QUATERNARY

Qal — Alluvium
Stream deposits of sand and clay.

PALEOZOIC

MISSISSIPPIAN

Mpr — Price Formation
Quartz-pebble and cobble conglomerate, sandstone, mudrock, and dark-gray shale with carbonaceous material.

DEVONIAN

Dch — Chemung Formation
Chocolate-brown, red, tan, and greenish-gray shale and mudrock; fossiliferous.

Db — Brallier Formation
Greenish-gray, hard, fissile shale with thin, greenish-gray sandstones and siltstones; sparsely fossiliferous.

Dmn — Millboro Shale and Needmore Formation
Millboro: black, fissile shale with pyritic concretions; fossiliferous. Needmore: olive-drab, calcareous shale; fossiliferous.

DS — Lower Devonian and Upper Silurian Rocks
Ridgeley Sandstone: coarse-grained, calcareous, orthoquartzitic sandstone; fossiliferous. Licking Creek Limestone: dark-gray to black, sandy, cherty, fossiliferous limestone. Healing Springs Sandstone: coarse-grained, calcareous sandstone. New Creek Limestone: light-gray to brownish-gray, coarse-grained, crinoidal limestone. Keyser Formation: medium-gray, fossiliferous limestone and coarse-grained, calcareous sandstone. Tonoloway Formation: dark-gray, thin-bedded limestone with calcareous, medium- and coarse-grained, cross-bedded sandstones.

SILURIAN

Ske — Keefer Sandstone
Tan to pinkish-white, medium- and fine-grained, quartzose sandstone.

Sca — Cacapon Formation
Tan to deep-red, hematitic sandstone with red and greenish micaceous shale; sparsely fossiliferous.

Stu — Tuscarora Formation
White to light-gray, coarse-grained, quartzose sandstone with quartz-pebble conglomerate.

ORDOVICIAN

Omb — Martinsburg Formation
Yellowish-weathering, gray shale with gray, thin-bedded, fossiliferous limestones and gray, ferruginous sandstones. Map unit includes gray sandstone at the top (Juniata Formation?).

Oe, c — Edinburg Formation
Dark-gray to black, fine-grained limestone interbedded with black calcareous shale (Liberty Hall); Botetourt Member (at base): dark-gray to black, coarse-grained, fossiliferous limestone. In the Fincastle vicinity and its contiguous valley area—black, fissile, silty shale with thin sandstones and a few thin dark-gray to black limestones that are sandy in part and conglomeratic in part; c, polymictic conglomerate with argillaceous sandstone matrix.

Oln — Lincolnshire Formation and New Market Limestone
Lincolnshire: dark- to light-gray, fossiliferous limestone with nodular black chert. New Market: dove-gray, massive, compact limestone with black chert; conglomeratic lower part contains cobbles of dolomite, limestone, and chert.

Ob — Beekmantown Formation
Light- and medium-gray, saccharoidal dolomite, with light-colored chert in thin beds and gnarly masses, and gray to grayish-blue compact limestone; sparsely fossiliferous.

O€c — Chepultepec-Conococheague Formations
Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, light-gray dolomite, and coarse-grained calcareous sandstone; sparsely fossiliferous.

CAMBRIAN

€cr — Copper Ridge Formation
Medium- and light-gray dolomite with positive-weathering siliceous laminae and coarse-grained, calcareous sandstone.

€e — Elbrook Formation
Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, platy yellowish-brown to gray dolomite, and gray to green shale; sparsely fossiliferous.

s — Shear zone

CONTACTS

exposed

approximate

covered or inferred

FOLDS

Anticline—trace of axial plane and direction of plunge of axis

Syncline—trace of axial plane and direction of plunge of axis

Overturned anticline—trace of axial plane

Overturned syncline—trace of axial plane

FAULTS

THRUST

approximate

covered or inferred

T — overthrust side

NORMAL OR REVERSE

approximate

covered or inferred

U — upthrown side

D — downthrown side

TRANSVERSE

approximate

covered or inferred

Arrows indicate inferred movement

ATTITUDE OF ROCKS

25 — Strike and dip of beds

85 — Strike and dip of overturned beds

Strike of vertical beds

MINE

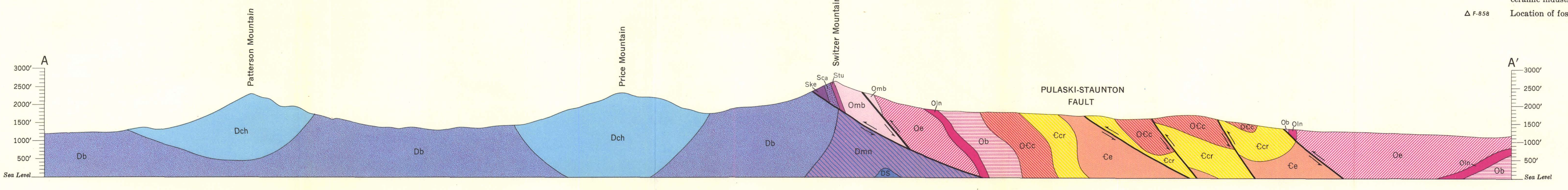
1 — Abandoned mine

18. Williamson mine (barite)

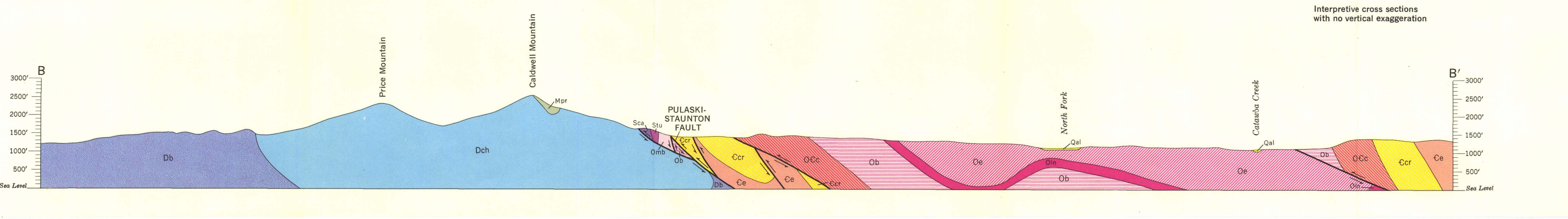
SAMPLE LOCATIONS

△ R-1777 — Representative samples of lithologies mapped or raw materials that have potential use in the ceramic industry.

△ F-858 — Location of fossils collected.



Interpretive cross sections with no vertical exaggeration

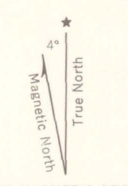


COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES
James L. Calver
Commissioner of Mineral Resources and State Geologist

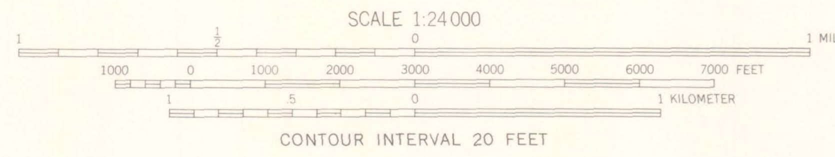
Base from U.S. Geological Survey 1962, Salisbury Quadrangle, 7½-Minute Series

GEOLOGIC MAP OF THE SALISBURY QUADRANGLE, VIRGINIA

Geology by Odell S. McGuire



1968 MAGNETIC DECLINATION



CONTOUR INTERVAL 20 FEET

1970

Williams & Heintz Map Corporation

QUADRANGLE LOCATION

EXPLANATION

CENOZOIC — QUATERNARY

Qal — Alluvium
Stream deposits of sand and clay.

PALEOZOIC — DEVONIAN

Db — Brallier Formation
Greenish-gray, hard, fissile shale with thin, greenish-gray sandstones and siltstones; sparsely fossiliferous.

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Millboro: black, fissile shale with pyrite concretions; fossiliferous. Needmore: olive-drab, calcareous shale; fossiliferous.

DS — Lower Devonian and Upper Silurian Rocks
(Not exposed)

SILURIAN

Sk — Keefer Sandstone
Tan to pinkish-white, medium- and fine-grained, quartzose sandstone.

Sc — Cacapon Formation
Tan to deep-red, hematitic sandstone with red and greenish micaceous shale; sparsely fossiliferous.

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White to light-gray, coarse-grained, quartzose sandstone with quartz-pebble conglomerate.

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Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, light-gray dolomite, and coarse-grained calcareous sandstone; sparsely fossiliferous.

CAMBRIAN

Ccr — Copper Ridge Formation
Medium- and light-gray dolomite with positive-weathering siliceous laminae and coarse-grained, calcareous sandstone.

Ce — Elbrook Formation
Bluish-gray, fine-grained, laminated limestone with intraformational conglomerate, platy yellowish-brown to gray dolomite, and gray to green shale; sparsely fossiliferous.

Cr — Rome Formation
Maroon and greenish shale with bluish-gray, fine-grained limestone.

CONTACTS

exposed
approximate
covered or inferred

FOLDS

Anticline—trace of axial plane and direction of plunge of axis
Syncline—trace of axial plane and direction of plunge of axis
Overturned anticline—trace of axial plane
Overturned syncline—trace of axial plane

FAULTS

THRUST
approximate
covered or inferred
T — overthrust side

NORMAL OR REVERSE
approximate
covered or inferred
U — upthrown side
D — downthrown side

TRANSVERSE
approximate
covered or inferred
Arrows indicate inferred movement

In cross section
T/A Horizontal movement:
T - relative movement toward observer
A - relative movement away from observer

ATTITUDE OF ROCKS

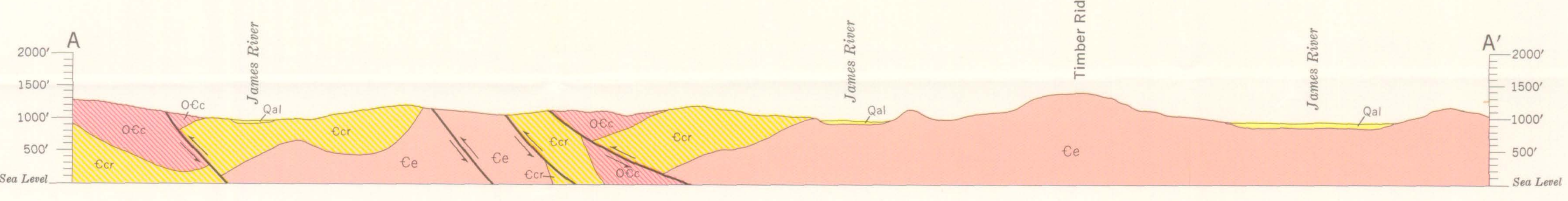
Strike and dip of beds
Strike and dip of overturned beds
Strike of vertical beds
Horizontal beds

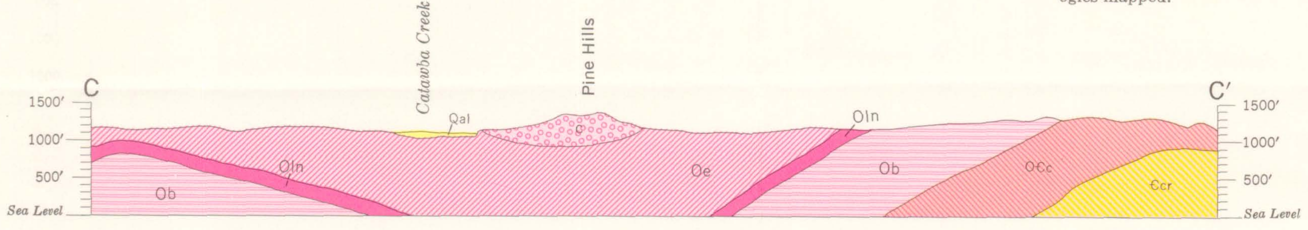
PROSPECT

Prospect
19. Limestone prospect

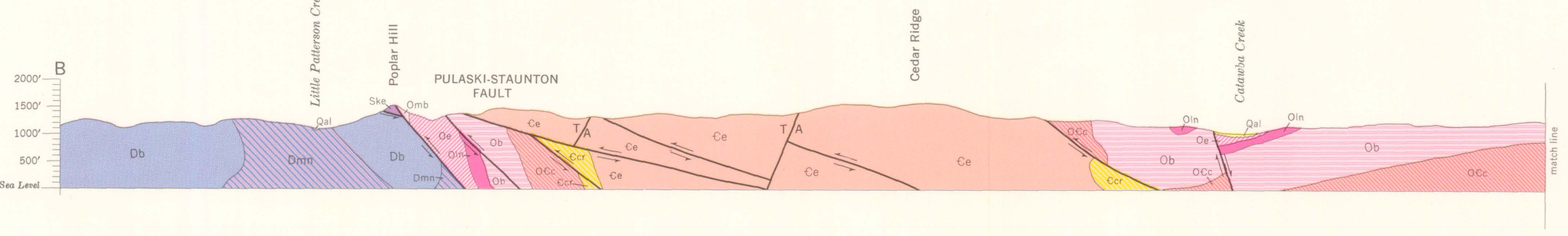
SAMPLE LOCATIONS

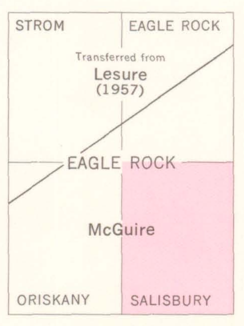
Representative samples of lithologies mapped.

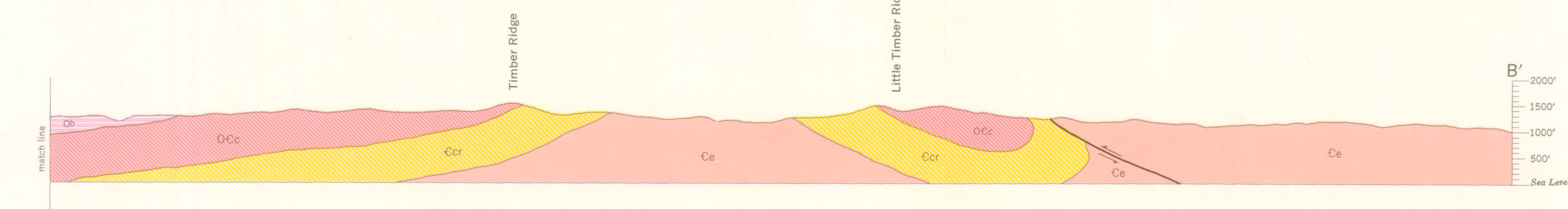




Interpretive cross sections with no vertical exaggeration







ERRATA ON GEOLOGIC MAPS

1. Plate 3: the synclinal symbol along Patterson Creek should read as an anticlinal symbol.

2. In the Explanation, Quaternary should read Quaternary (?) (all plates).