VIRGINIA MINERALS

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
Richmond, Virginia

Published quarterly by the DIVISION OF MINERAL RESOURCES, James L. Calver, Commissioner
Natural Resources Building, McCormick Road, Charlottesville, VA. 22903

Vol. 17 MAY, 1971 No. 2

ROAD LOG OF THE GEOLOGY OF FREDERICK COUNTY, VIRGINIA

W. E. Nunan

The following road log is a guide to geologic features along or near main roads in Frederick County, Virginia. Distances and cumulative mileages between places where interesting and representative lithologies, formational contacts, structural features, fossils, and geomorphic features occur are noted. At least one exposure for nearly each formation is included in the log. Brief discussions of the geological features observable at the various stops is included in the text.

A comprehensive report of the geology of the County is presented in "Geology and Mineral Resources of Frederick County" by Charles Butts and R. S. Edmundson, Bulletin 80 of the Virginia Division of Mineral Resources. The publication has a 1:62,500 scale geologic map in color, which is available from the Division for $4.00 plus sales tax.

The user of this road log should keep in mind that automobile odometers vary in accuracy. Distances between stops and road intersections should be checked frequently, especially at junctions or stream crossings immediately preceding stops. The Frederick County road map of the Virginia Department of Highways, and the U. S. Geological Survey 7.5-minute topographic maps are recommended for use with this road log. Topographic maps covering Frederick County include Boyce, Capon Bridge, Capon Springs, Glengary, Gore, Hayfield, Inwood, Middletown, Mountain Falls, Ridge, Stephens City, Stephenson, Wardensville, White Hall, and Winchester. The route of the road log (Figure 1) shows U. S. and State Highways and those State Roads traveled or needed for reference at intersections. Pertinent place names, streams, and railroad crossings are indicated. Permission should always be obtained before entering private property.

Cumulative Mileage	*Distance*	*Explanation*
0.0	*0.0*	Begin road log in Stephens City at the intersection of U.S. Highway 11, State Highway 277, and State Road 631. Travel west on State Road 631.
0.5	*0.5*	Quarries are in the New Market Limestone. Calcined lime and materials used for steel flux and for the manufacture of glass are produced.
1.8	*1.3*	Junction with State Road 629; turn right on State Road 629.
3.9	*2.1*	Junction with State Road 628; turn left on State Road 628.
3.95	*0.05*	Junction with State Road 629; turn right on State Road 629.

Cumulative Mileage	*Distance*	*Explanation*
4.85	*0.8*	*STOP 1.* The Conococheague Formation is well exposed in the fields on both sides of the road. The dominant lithology is silty laminated limestone; minor amounts of dolomite and friable and hard sandstone are present. The sandstones support the ridges to the north and south of the road. Continue west on State Road 629; note the steep topography developed over this formation.
6.35	*1.5*	Intersection with State Road 622; continue on State Road 629. Funkhouser Knob, about one mile to the southwest is a part of Little North Mountain, the crest of which is supported by sandstones of Silurian age.
6.8	*0.45*	*STOP 2.* Bifurcation of the North Mountain fault; stop along the crest of the hill. In the roadcut a five foot fault slice of sandstone from the Tuscarora Formation is exposed with the Martinsburg Formation thrust over it on the east. To the west the Tuscarora is in fault contact with the Marcellus Shale (Figure 2). The trace of the North Mountain fault extends across the road about 900 feet east of this bifurcation (Butts and Edmundson, 1966, p. 85, pl. 1). Turn around and return to the beginning of the road log in Stephens City.
13.6	*6.8*	Intersection with U. S. Highway 11; turn left on U. S. Highway 11.
15.4	*1.8*	*STOP 3.* Edinburg Formation; about 300 feet east and to the right of U. S. Highway 11 in an abandoned quarry are outcrops of blue-weathering, cobbly, dark-gray limestones with buff-gray weathering, shaly partings of the Lantz Mills facies of the Edinburg. Trilobites, brachiopods, gastropods, bryzoans, pelmatozoans, and several other fossils abound in some layers. Siltstones in the Oranda Formation and upper part of the Edinburg crop out on the low ridge just east of the quarry. Continue north on U. S. Highway 11.
15.6	*0.2*	Cross over Opequon Creek.
17.5	*1.9*	Cross railroad tracks.
19.6	*2.1*	Intersection with State Road 622 at the Montgomery Ward Plaza in the outskirts of Winchester; continue on U. S. Highway 11 along Valley Avenue.
20.9	*1.3*	Division of U. S. Highway 11 along Valley Avenue into U. S. Highway 11-S (Braddock Street) and U. S. Highway 11-N at "Y" (Valley Avenue). Turn right on U. S. Highway 11-N (Valley Avenue).
21.0	*0.1*	Junction of Valley Avenue with Gerrard Street. Turn right and continue on U. S. Highway 11-N.
21.1	*0.1*	Intersection of U. S. Highway 11-N with U. S. Highways 50-E and 522-S (Millwood Avenue) and U. S. Highways 11-N, 50-W, and 522-N (Cameron Street). Turn left and continue on U. S. Highway 11-N (Cameron Street).
21.4	*0.3*	Intersection with Cecil Street; turn left on Cecil Street.
21.65	*0.25*	*STOP 4.* Stonehenge Limestone and Rockdale Run Formation (Chepultepec and lower Beekmantown of Butts and Edmundson, 1966). On the southwest corner of the intersection with Washington Street is a wall-like exposure of the basal limestone beds of the Rockdale Run in which several species of gastropods can be seen (Figure 3). Just beneath these beds to the west lie the uppermost limestones of the Stonehenge. Continue west on Cecil Street.
21.7	*0.05*	Intersection with Stewart Street; turn left on Stewart Street.
21.8	*0.1*	*STOP 5.* Stonehenge Limestone; a wall-like exposure of the lower part of the Stonehenge, which consists of laminated, fine-grained limestones and some coarse-grained, "channel" limestones with broken fossil shells, is present on the northeastern corner of the intersection with Monmouth Street. Turn left on Monmouth Street.
21.85	*0.05*	Intersection with Alternate U. S. Highway 50 (Washington Street), turn left on Alternate U. S. Highway 50.
22.4	*0.55*	Intersection with U. S. Highway 522 (West Picadilly Street); turn left on U. S. Highway 522.
24.8	*2.4*	State Highway 37 underpass.
24.9	*0.1*	*STOP 6.* Elbrook Formation; stop at junction with State Road 739 at Apple Pie Ridge. Good exposures can be seen in the roadcuts to the west of the junction. This is probably the middle part of the formation as evidenced by red shales. Fractures filled with white calcite are common in the carbonates; the fractures were possibly formed during movement along the Apple Pie Ridge fault, which is located a few hundred yards to the west. Apple Pie Ridge is underlain by the Elbrook. Continue west on U. S. Highway 522.
27.55	*2.65*	Intersection with State Road 654; continue on U. S. Highway 522.
28.3	*0.75*	*STOP 7.* A transitional contact between the Brallier and Chemung formations is exposed in the roadcut. The Brallier consists of intercalated, thin-bedded, micaceous, gray, fine-grained sandstone and micaceous, greenish-gray shale. The Chemung contains thicker sandstone beds and fewer shale beds than the underlying Brallier. Occasional quartz-pebble conglomerates and fossiliferous "shell limestones" and red beds in the Chemung help to distinguish it from the Brallier. Continue west on U. S. Highway 522.
28.5	*0.2*	Exposures of the Chemung Farmation in the eastern limb of the Mt. Pleasant syncline.
28.9	*0.4*	Trough of the Mt. Pleasant syncline.
29.3	*0.4*	Chemung exposures in the roadcuts have an easterly dip in the western limb of the Mt. Pleasant syncline. The ridge ahead is supported by Chemung sandstones.
30.3	*1.0*	*STOP 8.* Unconformable contact between the Brallier and Hamilton formations. An unconformable contact between the relatively unfossiliferous green and tan siltstones and shales of the Brallier Formation and the underlying fossiliferous dark-gray, fine-grained sandstones of the upper part of the Hamilton Formation is well exposed in the roadcuts. Continue west on U. S. Highway 522.
30.5	*0.2*	Cross over Hogue Creek.
31.6	*1.1*	Gainesboro community.
32.4	*0.8*	*STOP 9.* Marcellus Shale. Needmore Formation (Onondaga Formation of Butts and Edmundson, 1966), Oriskany Formation, and New Scotland Formation. Stop in the "pull-off" just south of Back Creek. About 700 feet to the southeast across the highway, the black, fissile shales of the Marcellus are exposed. Beneath and to the west of the Marcellus the gray to olive shales of the Needmore can be seen in an abandoned quarry; trilobites and ostracodes occur in these shales. The Oriskany Formation lies beneath the Needmore and is exposed in the roadcut west of the

Figure 2. A fault that is a bifurcation from the North Mountain fault; hammer rests on five feet of Tuscarora sandstone; view is to the northeast.

Figure 3. Gastropods in basal Rockdale Run limestone.

Cumulative Mileage	*Distance*	*Explanation*

quarry. At this locality the formation is highly calcareous, consisting of beds of conglomeratic quartz-pebble limestones interbedded with arenaceous limestones. Though both lithologies contain many fossils, the arenaceous layers are more fossiliferous. West of the Oriskany, the New Scotland limestone crops out in the roadcut and low bluffs south of Back Creek about 2000 feet southwest of the highway. The latter unit is also fossiliferous and is characterized by an abundance of black chert. Turn around and travel easterly on U. S. Highway 522.

34.2 *1.8* Junction with State Road 681, turn left on State Road 681. The next portion of the road log passes through areas underlain by Middle and Upper Devonian bedrock. Along most of the major stream valleys a thin blanket of alluvial material covers the bedrock. In a few places the bedrock has been exposed by the erosional action of the rejuvenated streams.

35.9 *1.7* *STOP 10.* Alluvial deposits. Along Back Creek the stream has cut through the alluvial material and into the bedrock. Suggestions of terracing can be seen and natural levees bound the creek on both sides. Continue north on State Road 681.

36.2 *0.3* *STOP 11.* Relic fluvial features. In this creek valley, where Isaacs Creek joins Back Creek, alluvial deposits blanket the valley floor and several relic fluvial features can be observed. To the northwest of the road is a former stream meander with its associated meander scar just to the northwest. The meander may be intermittently filled with water. Other relic fluvial features are visible in the immediate vicinity of Camp Sheemar. Continue north on State Road 681.

38.8 *2.6* Junction with State Road 608; turn left and continue on State Road 681.

39.6 *0.8* Junction with State Road 685 near Chestnut Grove Church; turn left on State Road 685.

40.7 *1.1* Junction with State Road 600; turn right on State Road 600.

43.5 *2.8* Junction with State Road 690 at Siler community; turn right on State Road 690.

43.7 *0.2* *STOP 12.* Hampshire Formation, natural exposures of red sandstone and shale crop out on the hillside north of the road (Figure 4); green-mottled, red sandstones occur in the roadcut. Alluvial deposits cover the valley floor south of the road. Continue east on State Road 690 where the Hampshire is exposed in many roadcuts; shallow-water depositional features can be seen.

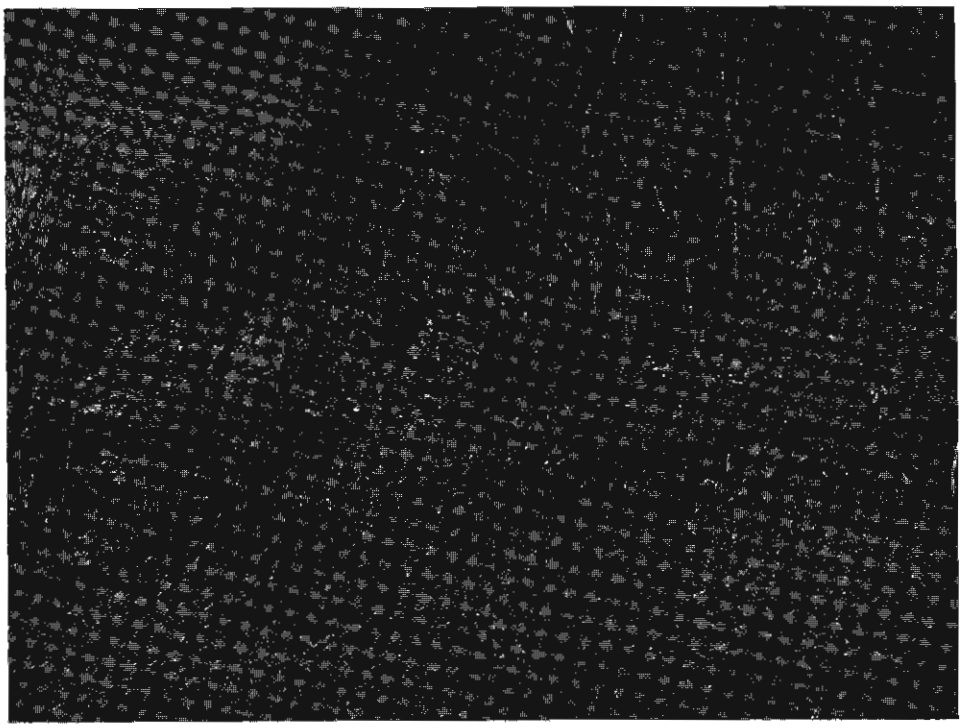


Figure 4. Exposures of the Hampshire Formation; view is to the north.

45.2 *1.5* Junction State Road 671; turn right on State Road 671.

45.3 *0.1* Junction State Road 681; turn right and continue on State Road 671.

46.5 *1.2* Exposures of the Hamilton Formation in the west limb of the Bailey Ford anticline.

46.8 *0.3* Cross over Back Creek.

48.5 *1.7* Junction with State Road 653, continue on State Road 671. Ahead are roadcut exposures of the Chemung, Brallier, Hamilton, and Marcellus formations in the eastern limb of the Mt. Pleasant syncline.

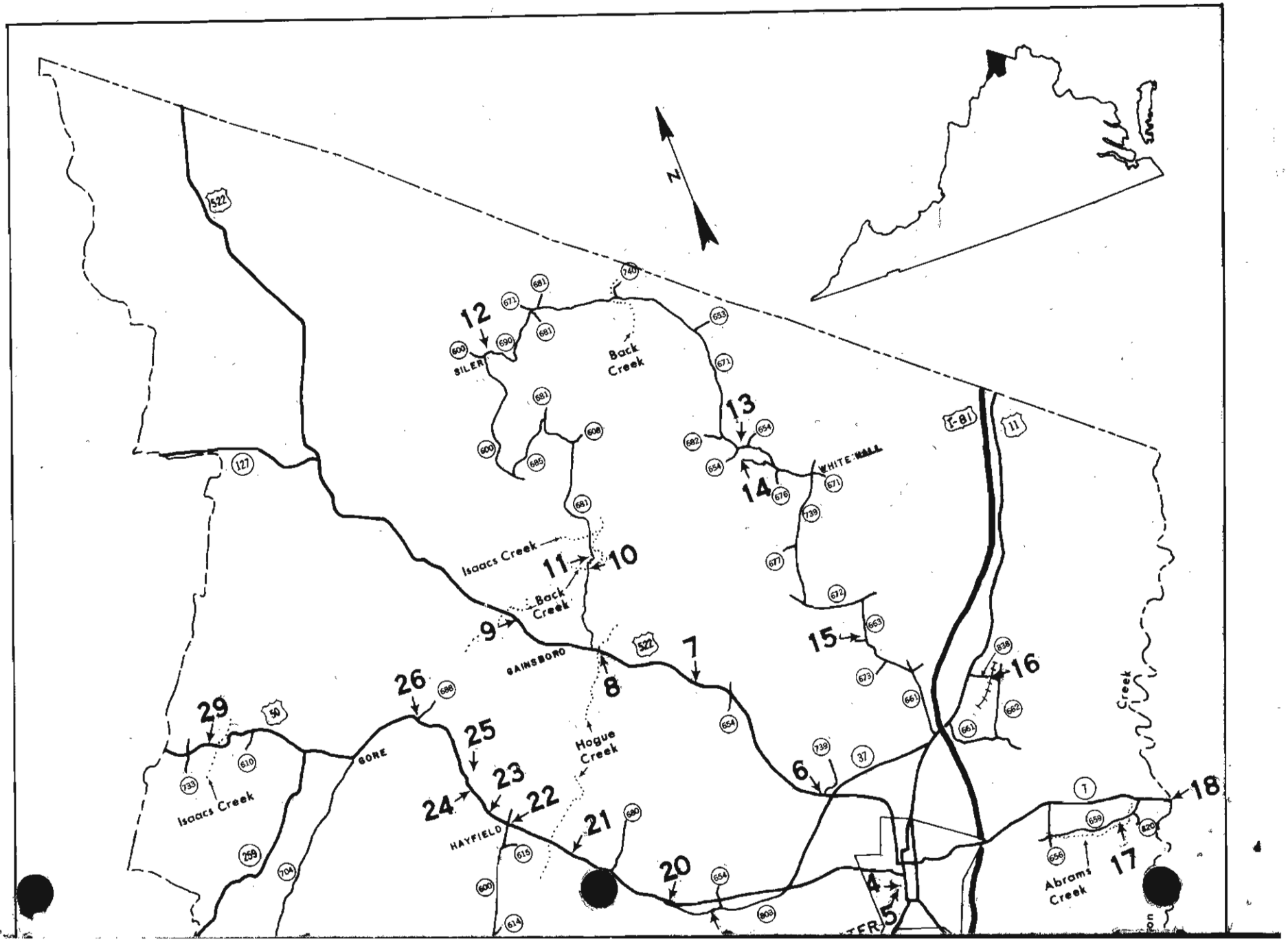
51.1 *2.6* Junction with State Road 654; continue on State Road 671.

51.3 *0.2* *STOP 13.* A bifurcation from the North Mountain fault. The bifurcation fault has a strike along the east side of North Mountain. Its trace can be seen in the easternmost draw on the south end of the mountain where the Martinsburg Formation has been thrust over the formations of Cayugan age. The calcareous facies of the Oriskany is exposed 500 feet west of the fault on the north side of the road. Butts and Edmundson (1966, p. 81-82) describe the stratigraphy of this locality in detail. Continue east on State Road 671.

Cumulative Mileage	*Distance*	*Explanation*
52.0	*0.7*	Junction with a private road to Old Stone Church; turn right and proceed to the church. En-route note the exposures of the Conococheague Formation in the fields to the south. The North Mountain fault is located just west of a barn and farm house where the Conococheague Formation is thrust over the Martinsburg Formation. The Martinsburg Formation occupies the area between the barn and the church property. Near the church, highly fractured sandstone float from the Tuscarora Formation can be found.
52.6	*0.6*	*STOP 14.* A bifurcating fault from the North Mountain fault. At Old Stone Church the east side of the hill has been mapped (Butts and Edmundson, 1966, Plate 1) as underlain by a fault slice of Tuscarora Formation. Return to State Road 671.
53.2	*0.6*	Junction with State Road 671; turn right on State Road 671.
53.9	*0.7*	Intersection with State Road 739 at White Hall community, turn right on State Road 739. For some distance the road is located on the crest of Apple Pie Ridge, which is underlain by the Elbrook Formation.
56.4	*2.5*	Intersection with State Road 672; turn left on State Road 672.
57.6	*1.2*	Junction with State Road 663; turn right on State Road 663.
58.4	*0.8*	*STOP 15.* Stonehenge (Chepultepec of Butts and Edmundson, 1966) and Conococheague formations. Stop is at junction with a private road to a farm. Starting in the field west of State Road 663, limestones in the upper part of the Stonehenge Formation are exposed. On the hillside to the west the Conococheague-Stonehenge contact can be located. West of this contact, sandstones in the Conococheague support the crest of the ridge and occur as float along its western slope. Continue south on State Road 663.
59.6	*1.2*	Intersection with State Road 661; turn right on State Road 661.
60.8	*1.2*	Intersection with U. S. Highway 11; turn left on U. S. Highway 11.
61.0	*0.2*	Interstate Highway 81 overpass; continue north on U. S. Highway 11.
62.05	*1.05*	Junction with State Road 838; turn right on State Road 838.
62.45	*0.4*	*STOP 16.* Pinesburg Station Dolomite (in part upper Beekmantown of Butts and Edmundson, 1966), New Market Limestone, Lincolnshire Formation, Edinburg Formation, Oranda Formation, and Martinsburg Formation. Pass under the railroad trestle and stop. The Pinesburg Station Dolomite, New Market Limestone, Lincolnshire Formation, and lower part of the Edinburg Formation are exposed between the railroad trestle and State Road 662 in the fields north and south of State Road 838. The Pinesburg Station is medium- to fine-grained, light-gray to medium-gray dolomite. It weathers to various shades of pale yellow, buff, and gray. The New Market consists of very fine-grained, light-gray limestone with abundant clear calcite eyeshaped inclusions generally less than one mm long. The Lincolnshire Formation is a medium- to coarse-grained, dark-gray limestone. Cephalopods, brachiopods, gastropods, and many other fossils in the limestone can be seen in exposures in an intermittent stream bed 1200 feet southwest of the junction of State Roads 838 and 662. The Edinburg Formation consists of a variety of lithologies in exposures both east and west of State Road 662. Bluish- to very dark-gray, fine-grained limestones are the most common rocks, but bentonite, shale, and fine-grained sandstone beds are common east of State Road 662. The Oranda siltstones, shales, bentonites, and argillaceous limestones are poorly exposed in the hill southeast of the road junction. The Martinsburg Formation underlies the topography east of this hill. Contrast the deeply incised drainage pattern that has developed over the Martinsburg to the east with the rolling terrain over the carbonate rocks to the west. Turn around and return to U. S. Highway 11.
62.85	*0.4*	Junction with U. S. Highway 11; turn left on U. S. Highway 11.
63.95	*1.1*	Intersection with Interstate Highway 81-S; turn left on Interstate Highway 81-S.
65.95	*2.0*	Junction with exit ramp for State Highway 7; turn right on exit ramp.
66.25	*0.3*	Junction with State Highway 7; turn left on State Highway 7.

The next two stops are in terrain underlain by shale and sandstone of the Martinsburg Formation which occupies the trough of the Massanutten synclinorium in Frederick County. Note the characteristic deeply incised rectangular stream pattern; this has been interpreted to be a joint-controlled pattern (Hack and Young, 1959).

67.75	*1.5*	Junction with State Road 656; turn right on State Road 656.
68.35	*0.6*	Junction with State Road 659; turn left on State Road 659.
69.75	*1.4*	*STOP 17.* Alluvial deposits; fossils. Stratified pebble and fossil zones containing several genera of mollusks are exposed in meander scars along Abrams Creek to the south of the road. Relic meanders and terraces can also be seen. Continue east on State Road 659.
70.45	*0.7*	Junction with State Highway 7; turn right on State Highway 7.
70.95	*0.5*	*STOP 18.* Geomorphic relationships of the Edinburg and Martinsburg formations. Opequon Creek flows approximately along the strike of the contact between the relatively resistant limestone of the Edinburg Formation to the east and the more easily erodable shales and siltstones of the Martinsburg Formation to the west. Two terrace levels can be seen where a wide flood plain has developed over the Martinsburg adjacent to Opequon Creek. Turn around and travel west on State Highway 7.
75.05	*4.1*	Cross over Interstate Highway 81; continue on State Highway 7 into Winchester.
76.65	*1.6*	Intersection with U. S. Highway 50 (Braddock Street); turn left on U. S. Highway 50 and follow it west out of the city.
79.15	*2.5*	Junction with State Road 803; continue west on State Road 803.
80.55	*1.4*	Junction with State Road 654; continue west on State Road 803.
80.75	*0.2*	*STOP 19.* North Mountain fault. The Elbrook shaly limestones and dolomites are exposed in the roadcuts; note characteristic shaly weathering. The Martinsburg Formation is exposed about 0.2 mile to the west along the road to a church. The North Mountain fault is traced through the draw between these formations. Continue west on State Road 803.
81.45	*0.7*	*STOP 20.* Hamilton Formation and a bifurcation of a fault from the North Mountain fault. At the junction with U. S. Highway 50, turn left on U. S. Highway 50 and stop. Extensively fractured Hamilton dark-gray,


N
522
127
50
11
I-81
SILER
Back Creek
WHITE
Isaacs Creek
Back Creek
GAINSBORO
Hogue Creek
GORE
Isaacs Creek
HAYFIELD
Abrams Creek
Creek
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
20
21
22
23
24
25
26
29

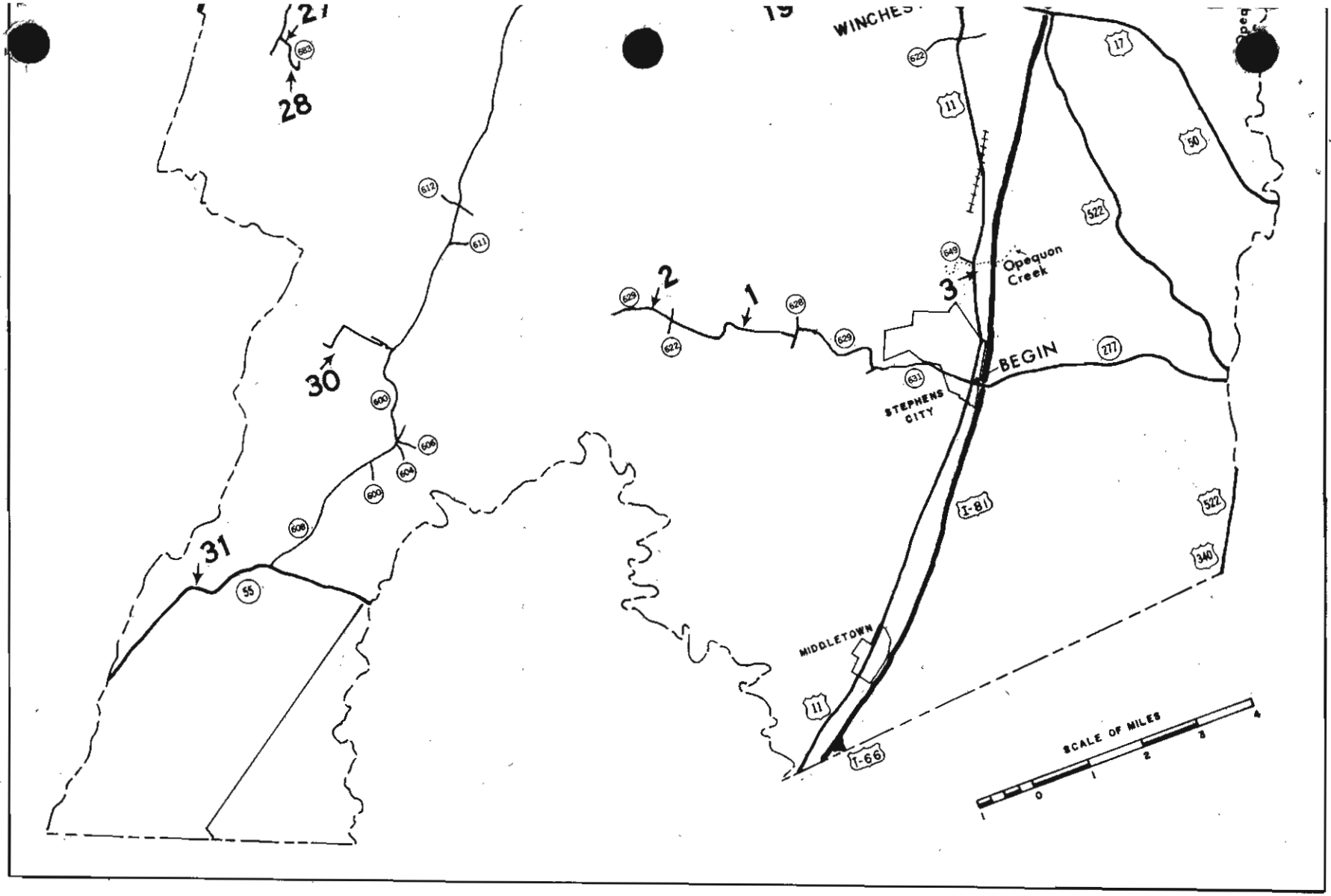


Figure 1. Map of Frederick County showing U. S. and State Highways, State Roads, and location of stops along road-log route. (Base modified from 1969 Virginia Department of Highways map of Frederick County.)

Cumulative Mileage	*Distance*	*Explanation*

fine-grained sandstones and shales are exposed in the roadcut on the north side of the highway. About 0.4 mile to the east along the highway are outcrops of the Martinsburg Formation where it has been thrust over rocks of Cayugan age along a bifurcation from the North Mountain fault (Butts and Edmundson, 1966, p. 84). Note the offset in the strike between the ridges northeast and southwest of the gap. The Hamilton, Brallier, Chemung, and Hampshire formations are exposed in the roadcuts west of this stop. Continue on U. S. Highway 50.

81.85 *0.4* Junction with State Road 680; continue west on U. S. Highway 50.

82.85 *1.0* *STOP 21.* Brallier-Hamilton contact. In roadcuts just before crossing Hogue Creek the contact between the gray to olive siltstones of the Brallier Formation and the dark-gray, fine-grained, fossiliferous sandstones of the Hamilton Formation is well exposed. Continue west on U. S. Highway 50.

83.15 *0.3* Cross over Hogue Creek.

84.0 *0.85* *STOP 22.* Needmore Formation (Onondaga of Butts and Edmundson, 1966), Tioga Bentonite, and Marcellus Shale. Intersection with State Road 600 at Hayfield community. The gray to olive, hackly weathering shales of the Needmore are exposed at the northeast corner of the intersection; trilobites, ostracodes, and corals are abundant in several beds. The yellow to buff Tioga Bentonite overlies the Needmore shales to the east. Diligent searching will be required to identify the Tioga because it weathers easily and is only a few feet thick. East of and overlying the Tioga is the black fissile shale of the Marcellus, which contains a few small brachiopods. Continue west on U. S. Highway 50.

84.5 *0.5* *STOP 23.* Oriskany and New Scotland formations. Where U. S. Highway 50 makes about a 30-degree bend to the north are good exposures in roadcuts. The Oriskany at this locality is predominantly a sandstone in contrast to its being a limestone at Stop 9 in Gainesville, 3.5 miles to the northeast. The New Scotland is deeply weathered, but the abundant black chert in the unit defines the bedding. Continue west on U. S. Highway 50.

85.0 *0.5* *STOP 24.* Wills Creek and Tonoloway formations. In roadcuts the Wills Creek and Tonoloway formations are partially exposed. The Wills Creek consists of calcareous shales, laminated shaly limestone (Figure 5), siltstone, and medium-grained sandstone. Mud cracks (Figure 6), ripple marks, and ostracodes abound in the calcareous shales. The Tavenner Sandstone Member is also exposed at this locality. The Tonoloway is predominantly a laminated, fine-grained limestone which when weathered resembles the "marbled edges of the pages of a book" (Butts and Edmundson, 1966, p. 48). Continue west on U. S. Highway 50.

85.3 *0.3* Exposures of the Tonoloway Formation can be seen in the roadcuts at this locality. To the west is Great North Mountain, the top of which is supported by sandstone of the Silurian Tuscarora Formation. The axis of the Great North Mountain anticline has a strike along the crest of the mountain.

85.4 *0.1* *STOP 25.* Keyser and Tonoloway formations. Traverse to the east along a gravel road to an abandoned quarry in which are good exposures of the Tonoloway containing several fossil zones. Though the bulk of the quarry is in the Tonoloway, basal Keyser beds (Butts and Edmundson, 1966, p. 49-51) of gray, coarse-grained limestone are exposed in the top few feet. Pelmatozoan stems, tabulate corals, stromatoporoids, brachiopods, and stromatolites are common. Continue west on U. S. Highway 50.

86.9 *1.5* *STOP 26.* McKenzie, Bloomsburg, and Wills Creek formations. A few hundred feet west of the junction with State Road 688 the apex of the Besor Ridge anticline is located. The barn northwest of the junction rests on red sandstone and shale in the Bloomsburg Formation just to the east of the apex (Figure 7). In the roadcut on the south side of the road, gray claystone and calcareous shale in the upper part of the McKenzie Formation is exposed in the anticline (Note: not mapped, but measured at this locality by Butts and Edmundson, 1966, Plate 1, p. 51). The Bloomsburg and the Wills Creek limestones, shales, and sandstones are continuously exposed on the western limb of the structure. Continue west on U. S. Highway 50.

88.4 *1.5* Gore community; junction with State Road 704; turn left on State Road 704.

92.9 *4.5* Junction with State Road 683; turn left on State Road 683.

92.95 *0.05* *STOP 27.* Hamilton Formation. Stop at Mt. Salem Church. The road crosses a belt of Hamilton for about 0.3 mile. Gastropods, cephalopods, brachiopods, and several other fossil types can be collected near the church. To the east toward the contact with the Marcellus Shale, fossil zones become fewer in number. Continue on State Road 683.

Figure 5. Laminated shaly limestone in the Wills Creek Formation; view is to the northeast.

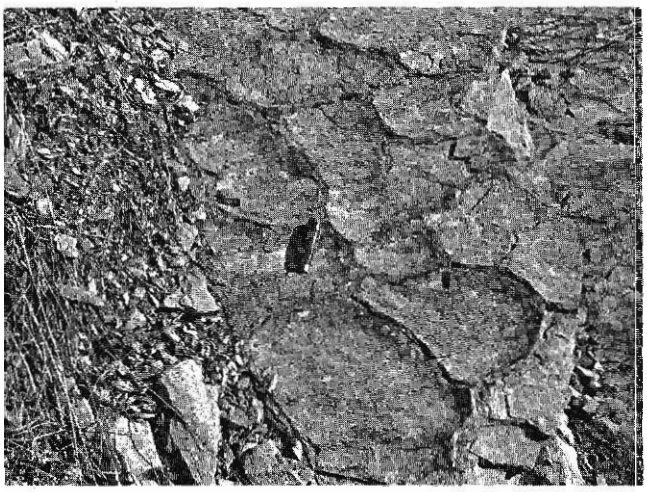


Figure 6. Mud cracks in shale of the Wills Creek Formation; view is to the northeast.

Cumulative Mileage	*Distance*	*Explanation*
93.6	*0.65*	*STOP 28.* Oriskany Formation. At the gap between Cove Ridge and Bear Ridge near Rock Enon Springs, the tops of these ridges are supported by the Oriskany. Vertical exposures of the fossiliferous sandstone occur on both sides of the gap (Figure 8). Shale chips derived from the Needmore Formation can be found on the western slopes of these ridges and chert float from the New Scotland occurs on the eastern slopes. Return to State Road 704.
94.3	*0.7*	Junction with State Road 704; turn right on 704.
98.8	*4.5*	Junction with U. S. Highway 50 at Gore community; turn left on U. S. Highway 50.
99.7	*0.9*	Junction with State Highway 259. In the roadcuts of this vicinity conglomeratic beds in the Chemung Formation can be seen. Continue on U. S. Highway 50.
101.6	*1.9*	Cross over Isaacs Creek.

Figure 7. Bloomsburg red beds in the Besor Ridge anticline; view is to the northeast.

Figure 8. Vertical beds of Oriskany sandstone; view is to the northeast.

101.8	*0.2*	*STOP 29.* Hampshire-Chemung contact. In the roadcut west of the creek, plant fragments occur in the Hampshire red beds very close to the underlying Chemung beds of coarse-grained, light-gray sandstones containing robust brachiopods. Turn around and return to Hayfield via U. S. Highway 50.
109.0	*7.2*	Intersection with State Road 600 at Hayfield community; turn right on State Road 600.
110.1	*1.1*	Junction with State Road 614; turn right and continue on State Road 600.
116.8	*6.7*	Junction with private road to Wilde Acres (Mountain Falls Boulevard) at Mountain Falls Community Church; turn right. Obtain permission from the Wilde Acres office to visit Mountain Falls.
117.0	*0.2*	Junction with Falcon Drive; turn left on Falcon Drive.
117.1	*0.1*	Junction with Winchester Drive; turn right on Winchester Drive.
117.8	*0.7*	Junction with Mountain Lodge Drive; turn left on Mountain Lodge Drive.

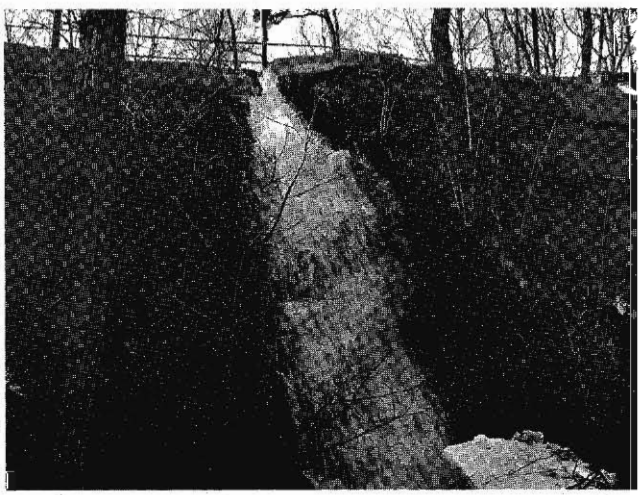


Figure 9. Cascades of Falls Run over Keefer Sandstone Member; view is to the northwest.

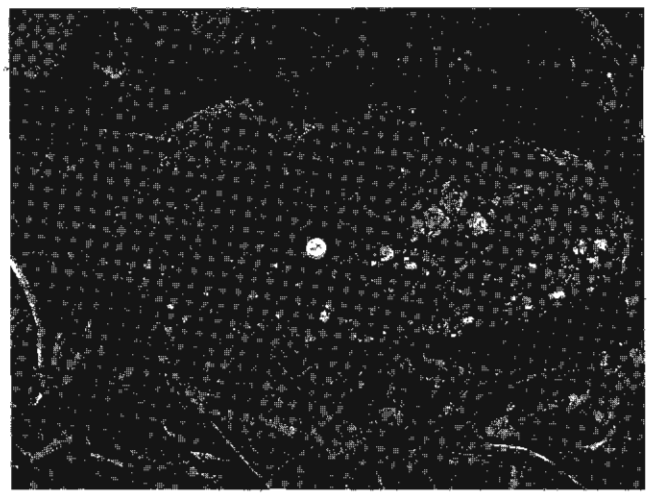


Figure 10. Oswego conglomeratic sandstone; detached block.

Cumulative Mileage	*Distance*	*Explanation*
118.3	*0.5*	*STOP 30.* Clinton Formation, Keefer Sandstone Member. The member, the upper unit of the Clinton, is primarily a quartzose sandstone with some shaly partings. It is resistant to weathering and serves as a good marker bed by which the structure of the area can be traced. The lake just to the west is underlain by lower units of the Clinton Formation; fossils can be found in the bluff on the eastern shore. Return to State Road 600. At Mountain Falls, Fall Run cascades over steeply dipping beds of Keefer (Figure 9).
119.8	*1.5*	Junction with State Road 600; turn right on State Road 600.
121.5	*1.7*	Junction with State Road 608 at Mountain Falls Community; turn right on joint State Roads 600 and 608.
122.2	*0.7*	Junction with State Road 608; turn right on State Road 608.
124.1	*1.9*	Exposures of Oriskany Sandstone on the right side of road.
124.7	*0.6*	Exposures of the Keefer Sandstone Member of the Clinton Formation.
124.8	*0.1*	Junction with State Highway 55; turn right on State Highway 55.
126.0	*1.2*	*STOP 31.* Tuscarora, Juniata, and Oswego formations. Exposures are in roadcuts at the south end of Short Mountain. The resistant, quartzose Tuscarora sandstones supports the top of Short Mountain. It is well exposed on its southeast slope and on the northeast slope of Paddy Mountain south of the road. The Juniata, a series of red beds displaying cross bedding and other primary sedimentary features, and the underlying Oswego, primarily a sequence of conglomeratic green to light-gray sandstones (Figure 10), are partially exposed here and to the west of the Tuscarora.

END OF ROAD LOG

REFERENCES

Butts, Charles, and Edmundson, R. S., 1966, Geology and Mineral Resources of Frederick County: Virginia Division of Mineral Resources Bull. 80, 142 p.

Hack, J. T., and Young, R. S., 1959, Intrenched meanders of the North Fork of the Shenandoah River, Virginia: U. S. Geol. Survey Prof. Paper 354-A, 10 p.

⚒ ⚒ ⚒ ⚒ ⚒

OIL AND GAS DEVELOPMENT IN VIRGINIA DURING 1970

David M. Young[1]

A total of 2,869,102 Mcf (thousand cubic feet) of natural gas was produced in Virginia during 1970, which was slightly more than the 2,845,846 Mcf produced during 1969. Production was reported from four counties: Buchanan County, 791,966 Mcf; Dickenson County, 432,245 Mcf; Tazewell County, 1,636,724 Mcf; and Wise County, 8167 Mcf.

Oil production from Lee County totaled 917 barrels from two wells in the Ben Hur and Rose Hill fields. About one-half of this was produced from a well in the Rose Hill field that was drilled deeper in 1970.

The outstanding feature of oil and gas development in Virginia during 1970 was a renewal of drilling activity in Buchanan, Dickenson, and Tazewell counties. Total footage that was drilled in these counties amounted to 72,997 feet in 17 holes with a combined gas openflow of about 17,000 Mcf from 14 producing wells. Three dry holes were plugged and abandoned; two of these were drilled about 50 feet apart, after the first of the two resulted in a fishing job.

Four operators in Buchanan County produced 791,966 Mcf of gas: Ashland Oil Company, 569,809 Mcf; Cabot Corporation, 42,784 Mcf; P & S Oil and Gas Corporation, 48,514 Mcf; and United Fuel Gas Company, 130,859 Mcf.

Early in 1970 the United Fuel Gas Company purchased 10 wells and leased about 30,000 acres in Buchanan and Dickenson counties from the Clinchfield Coal Company, a division of The Pittston Company. Drilling started in June, 1970 on this and other acreage and by the end of the year 10 wells had been completed or abandoned in Buchanan County. In early 1970 two additional wells were completed as gas producers and one was abandoned. Footage that was drilled amounted to 54,772 feet and the combined openflow for the 10 gas wells was 12,656 Mcf. Three wells, including one that was drilled about 50 feet from a first hole, were plugged and abandoned.

In Dickenson County the Clinchfield Coal Company sold 425,615 Mcf of gas to the Kentucky-West Virginia Gas Company and used 6630 Mcf

[1] Chief geologist, Clinchfield Coal Company, a division of The Pittston Company. Everett J. Dishman, Jr., Oil and Gas Inspector, Virginia Division of Mines and Quarries, furnished production data.

in field operations for production of 432,245 Mcf. The United Fuel Gas Company completed three shut-in gas wells in the County with an openflow of 3878 Mcf after induced fracturing of the Berea sandstone. Total footage amounted to 12,757 feet.

In Lee County one well in the Rose Hill field, the Dean No. 2, was deepened from 1856 to 2000 feet in the Trenton limestone and produced 438 barrels of oil during the last quarter of 1970. This was the only drilling activity and production that was recorded for the field. The Bledsoe well in the Ben Hur field produced 479 barrels of oil during the second and third quarters of 1970. There was no drilling activity in the area, although six wells are still incomplete and awaiting deepening, stimulation attempts, or plugging.

Gas production from Tazewell County consisted of 1,636,724 Mcf as reported by two operators: United Fuel Gas Company, 551,063 Mcf, and Consol-Ray Brothers, 1,085,661 Mcf. One well that was drilled to a total depth of 5466 feet and completed by the United Fuel Gas Company had an openflow of 242 Mcf after induced fracturing of the Berea sandstone.

The Penn-Virginia Corporation produced 8167 Mcf of gas for local use from two wells in Wise County near Stonega. Eight other wells in the immediate area remain shut in. The Trans State Oil Ltd. Riggs No. 1 near Big Stone Gap, which had been idle during 1969, was perforated from 974 to 978 feet for fracturing of the Clinch sandstone in the zone of a reported oil show. The treatment attempt was not successful and the well will be plugged and abandoned.

Table 1. — Summary of Virginia drilling during 1970.

Operator	Lease	Well No.	Total Depth (feet)	Status
Buchanan County				
United Fuel Gas Co.	Clell Ramey	9516	3940	Gas well
"	Lydia Belcher	9517	4055	Gas well
"	R. C. and D. H. Bell	9518	3947	Gas well
"	J. B. Belcher	9580*	3687	Gas well
"	The Pittston Company	9581	3906	Gas well
"	Bull Creek Coal Co.	9582	5600	Plugged and abandoned
"	The Pittston Company	9583	4241	Gas well
"	The Pittston Company	9584	2935	Plugged and abandoned
"	The Pittston Company	9584A*	4025	Plugged and abandoned
"	The Pittston Company	9586	4511	Gas well
"	The Pittston Company	9587	5860	Gas well
"	Lynn Camp Coal Co.	9590	3815	Gas well
"	G. C. Charles	9591*	4250	Gas well
Dickenson County				
United Fuel Gas Co.	The Pittston Company	9585	4165	Gas well
"	The Pittston Company	9588	4485	Gas well
"	The Pittston Company	9589	4109	Gas well
Lee County				
Trans State Oil Ltd.	Josh Dean	2	2000	Oil well (OWDD from 1856 feet)
Tazewell County				
United Fuel Gas Co.	New River and Pocahontas Consolidated Coal Co.	9578	5466	Gas well

* Wells completed in early 1971.

NEW PUBLICATION

Report of Investigations 24. GEOLOGY OF THE EAGLE ROCK, STROM, ORISKANY, AND SALISBURY QUADRANGLES, VIRGINIA, by Odell S. McGuire; 39 p., 4 maps in color. Price: $4.75 (plus 4 percent State sales tax).

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.

Virginia Division of Mineral Resources
Box 3667
Charlottesville, VA 22903

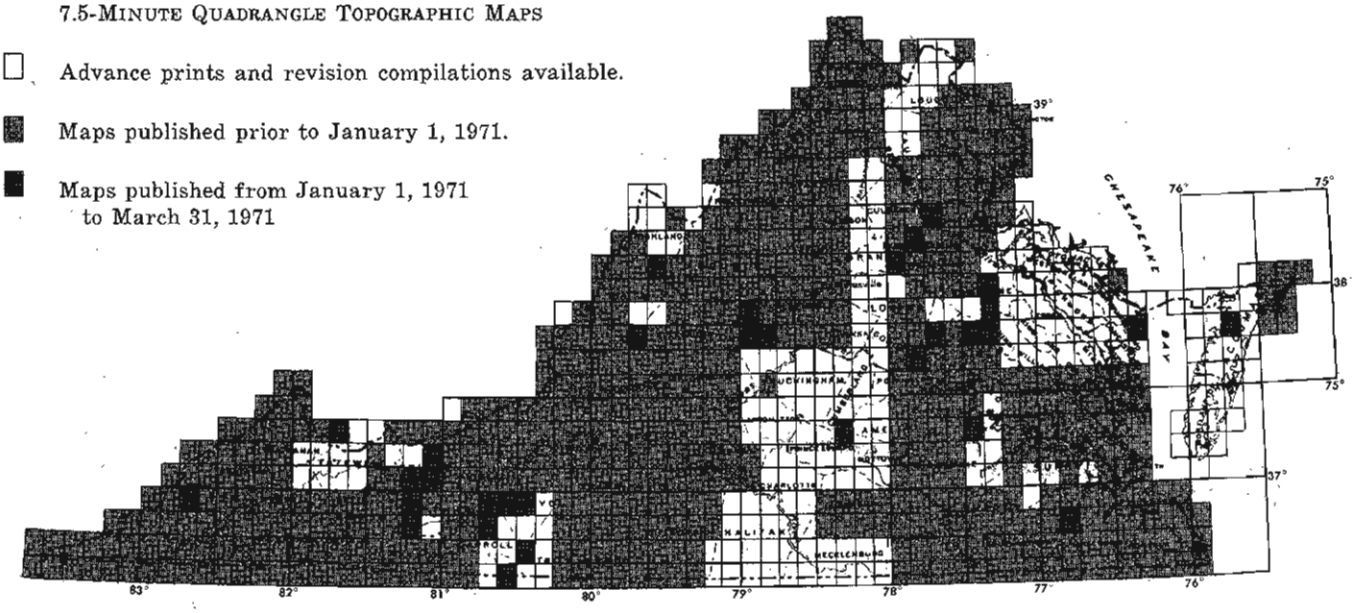
Second-class postage paid at
Charlottesville, Virginia.

Return Postage Guaranteed

TOPOGRAPHIC MAPS

7.5-MINUTE QUADRANGLE TOPOGRAPHIC MAPS

- ☐ Advance prints and revision compilations available.
- ▒ Maps published prior to January 1, 1971.
- ■ Maps published from January 1, 1971 to March 31, 1971



Maps published from January 1, 1971 through March 31, 1971:

Alum Ridge	Hanover	Lovingston	Penola	Speedwell
Ashland	Hillsville	Meadows of Dan	Perkinsville	War
Big Bend	Hiwassee	Mine Run	Reedville	Williamsville
Bland	Horeshoe Mountain	Montpelier	Rice	Zuni
Bowling Green	Indian Valley	Mount Airy	Richardsville	
Chester	Lahore	*Norton	Rocky Gap	
Crockett	Longdale Furnace	Parksley	Sherando	* Updated map

ADVANCE PRINTS AND REVISION COMPILATIONS

Advance prints and copies of revision compilations are available at 50 cents each from the U. S. Geological Survey, Topographic Division, 1109 N. Highland St., Arlington, VA 22210.

PUBLISHED MAPS

State index is available free. Updated maps, on which recent cultural changes are indicated, are now available for certain areas of industrial, residential, or commercial growth. Published maps are available at 50 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903.