Oil and Gas Wells Drilled In Southwestern Virginia Before 1950

By J. W. HUDDLE, ELOISE T. JACOBSEN, *and* A. D. WILLIAMSON

A CONTRIBUTION TO ECONOMIC GEOLOGY

GEOLOGICAL SURVEY BULLETIN 1027-L

Prepared cooperatively by the United States Geological Survey and the Division of Geology, Virginia Department of Conservation and Development

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1956

UNITED STATES DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 25 cents (paper cover)

CONTENTS

ILLUSTRATIONS

TABLES

A CONTRIBUTION TO ECONOMIC GEOLOGY

OIL AND GAS WELLS DRILLED IN SOUTHWESTERN VIRGINIA BEFORE 1950

By J. W. HUDDLE, ELOISE T. JACOBSEN, and A. D. WILLIAMSON

ABSTRACT

A total of about 140 oil and gas test wells have been drilled in southwestern Virginia. About half of these are in Lee County; the remainder are in Scott, Washington, Smyth, Wythe, Pulaski, Montgomery, Wise, Dickenson, Buchanan, Tazewell, and Giles Counties.

The first exploratory well for oil or gas in southwestern Virginia was drilled in Wise County in the early 1890's, but commercial gas production was not established until the discovery well of the Early Grove gas field was drilled in 1931. In Lee County, about 11 wells were drilled between 1910 and 1942; a small amount of oil was produced from one of the wells in 1924. The first commercial oil in Virginia was discovered by the B. C. Fugate No. 1 well in Lee County, which opened the Rose Hill field in 1942. Production increased slowly until 1947 and then declined. Gas was discovered in central Buchanan County in 1948 by the United Producing Co., in the W. M. Ritter No. 1–V–1461 well, and it was found in Dickenson County near Nora in the Clinchfield Coal Corp. No. 101 well. Gas is present in commercial quantities in sandstones and limestones of Mississippian age, and in black shales of Devonian age. Gas accumulation is controlled primarily by porosity and secondarily by structure. In January 1950, the 15 gas wells in Buchanan and Dickenson Counties were shut in, and 15 other wells were being drilled in the hope of proving enough reserves to justify a pipe line.

Nearly all the wells in southwestern Virginia are shallow cable-tool holes ranging in depth from 303 to 6,000 feet. The deepest well, the Kipps Anthracite Coal Co. No. 1, was drilled with rotary tools by the California Co. about 1 mile south of Blacksburg, Montgomery County. The well is located in the Price Mountain fenster near the crest of an anticline. It started in the Mississippian Price sandstone and was abandoned as a dry hole in the Ordovician Moccasin limestone at a depth of 9,340 feet.

Well samples studied for this report were examined dry under a low-power microscope as routine procedure, but occasionally samples were moistened so that such features as oolites and small fossils could be seen. Grain-size charts and color charts were used to standardize the descriptions of samples by different observers. Simple tests, such as hardness and reaction to hydrochloric acid, were used for determination of minerals.

The rocks encountered by the drill range in age from the Cambrian (Rome formation) to the Pennsylvanian (Pottsville group). Possible producing zones include the following formations, arranged in descending stratigraphic order:

the Lee formation, Princeton sandstone, Stony Gap and other sandstone members of the Hinton formation, Greenbrier limestone, Little Valley limestone, Price sandstone, Mississippian and Devonian black shales, Huntersville chert of Price (1929), sandstone of probable Oriskany age, Clinton formation, Clinch sandstone, Trenton limestone, Eggleston limestone, and Moccasin limestone.

The correlations given in the well summaries in this report and in the descriptions of samples that are open-filed are conjectural. The identification of a particular unit is probably consistent within a field, but the correlation with the outlying wells and the surface sections is less certain.

Many stratigraphic and structural problems in the area remain unsolved. Additional subsurface studies will be helpful in providing control for stratigraphic and structural interpretation. Many of the sediments were deposited in or near deltas, and a more complete picture of the conditions of deposition is needed before the correlations in this area can be regarded as reasonably certain.

INTRODUCTION

PURPOSE AND LOCATION OF INVESTIGATION

Test wells for oil and gas were drilled in southwestern Virigina in increasing numbers during the period 1942 to 1950, following the discovery of the Rose Hill oil field. This increasing interest in the oil and gas possibilities of that area has made it desirable to gather together the available information on exploratory wells. About 70 wells have been drilled in Lee County, and about the same number have been drilled in Scott, Washington, Smyth, Wythe, Pulaski, Montgomery, Wise, Dickenson, Russell, Buchanan, and Giles Counties combined. The locations of fields and isolated wells are shown on figure 70 and are further identified in the table on page 504. More-detailed maps of parts of Buchanan and Dickenson Counties, figures 71 and 72, show the location of wells in these counties, including the location of individual wells within fields.

This report was prepared by the United States Geological Survey in cooperation with the Division of Geology, Virginia Department of Conservation and Development. It is an outgrowth of the cooperative work on oil and gas possibilities of southwestern Virginia that resulted in reports by Butts (1927a), Averitt (1941), Miller and Fuller (1944, 1947, and 1954), Wilpolt and Marden (1949), and Miller and Brosgé (1950 and 1954). This report is the direct continuation of the work of Wilpolt and Marden on the upper Mississippian stratigraphy of southwestern Virginia.

The report consists of the history and status of gas and oil fields, method of sample examination, evaluation of sample correlations, a section giving well summaries of 34 wells, and an annotated bibliography of oil and gas exploration and possibilities in southwestern Virginia.

Wells known to have been drilled in southwestern Virginia before 1950 are listed in table 1 of this report. The table gives some information about each well and gives a reference to additional information or source of information. Detailed descriptions of samples from 27 wells in southwestern Virginia have been open-filed in offices of the U. S. Geological Survey in Washington, D. C., the Kentucky Geological Survey at Lexington, Ky., and the Virginia Geological Survey at Charlottesville, Va., all of which are available for inspection by the public. These descriptions include most of the wells for which we have been able to obtain samples.

A few of the field wells have been omitted from the present report because the samples were incomplete or because they were not pertinent. Special effort was made to obtain samples from all the isolated exploratory wells, but the samples from some of these wells had been lost or were not available.

ACKNOWLEDGMENTS

This report was made possible by the cooperation of the companies and indivuduals who permitted the authors to study the samples from their wells and to publish the results of the study. Samples were released for study by the following companies and individuals: The California Co., New Orleans, La.; Clinchfield Coal Co., Dante, Va.; Philip Jenkins, Paintsville, Ky.; Pipe Line Construction & Drilling Co., Pikeville, Ky.; Dr. Adam Stacy, Pineville, Ky.; United Fuel Gas Co., Charleston, W. Va.; United Producing Co., Charleston, W. Va.; and Virginia Coal & Iron Corp, Big Stone Gap, Va. We are indebted to the following individuals for help in locating samples and for providing us with stratigraphic data concerning the wells: Robert Effinger, E. D. Dobrick, Ralph Wilpolt, Byron Finch, Byron Maxwell, Robert Wolfe, Cramon Stanton, D. W. Marden, W. Rogers Moore, W. T. Harnsberger, and E. B. Wood. The Kentucky Geological Survey helped considerably by cutting many of the samples for us. B. N. Cooper, R. L. Miller, and R. H. Wilpolt served as guides on field conferences in southwestern Virginia. Helen Duncan and Jean Berdan determined fossils from several wells. Samples were examined by W. A. Heck, D. W. Marden, M. B. McFarlan, O. A. Sams, Jean Sherman, P. T. Stafford, R. H. Wilpolt, and the authors.

EARLY HISTORY OF EXPLORATORY DRILLING IN SOUTHWESTERN VIRGINIA

The history of exploration in southwest Virginia was summarized by Stanton (1949) and Cooper (1949). The present account draws heavily from their articles. The wells are listed in table 1 by county.

Well no. on fig. 70	Name of well	Operator
1	Grant Smith No. 1	H. and R. Oil Co.
2	O. Cavins No. 1	
3	Mill Davis No. 1	
4	Candy Cawood No. 1	
5	E. C. H. Rosenbaum No. 1	K. R. Wilson Co.
6	Anthony Ely No. 1	
7	C. Phipps No. 1	
8	D. C. McClure No. 1	
9	M. H. Snodgrass No. 1	
10	Osborne No. 1	Oliver Jenkins and others.
11	George Gish No. 1	
12	Hagan No. 1	Southwestern Oil & Gas Co.
13	Hagan No. 2	Do.
14	Hagan No. 3	Do.
15	Isaac Kaufman No. 1	Benedum-Trees Oil Co.
16	Truman No. 1 (272)	Penn-Ohio Gas Co.
17	Arch Rose No. 105	Clinchfield Coal Corp.
18	Clinchfield Coal No. 102	Do.
19	Yukon-Pocahontas Coal Co. No. 2–1466	United Producing Co.
20	Hugh McRae No. 6431	United Fuel Gas Co.
21	Ben Ratliff No. 1	Pipe Line Construction & Drilling Co.
22	W. H. Matney No. 1	United Producing Co.
23	A. L. Powers No. 1	Pipe Line Construction & Drilling Co.
24	F. H. Curtis No. 1–A	Do.
25	F. H. Curtis No. 2–A	Do.
26	R. A. Looney No. 1–1659	United Producing Co.
27	National Shawmut Bank of Boston No. 5810	United Fuel Gas Co.
28	National Shawmut Bank of Boston No. 1–851	Thomas D. Cabot.
29	National Shawmut Bank of Boston No. 1–6416	United Fuel Gas Co.
30	Mathieson Alkali	Mathieson Alkali Corp.
31	J. M. Hoge No. 1	United Producing Co.
32	Newberry No. 1	I. Groskins and others.
33	Cloyd Mountain, Pulaski County well	
34	Kipps Anthracite Coal Co. No. 1	California Co.
35	F. B. Strader No. 1	Do.
36	A. W. Hicks No. 6478	United Fuel Gas Co.
37	New River Pocahontas Coal Co. No. 6219	Do.

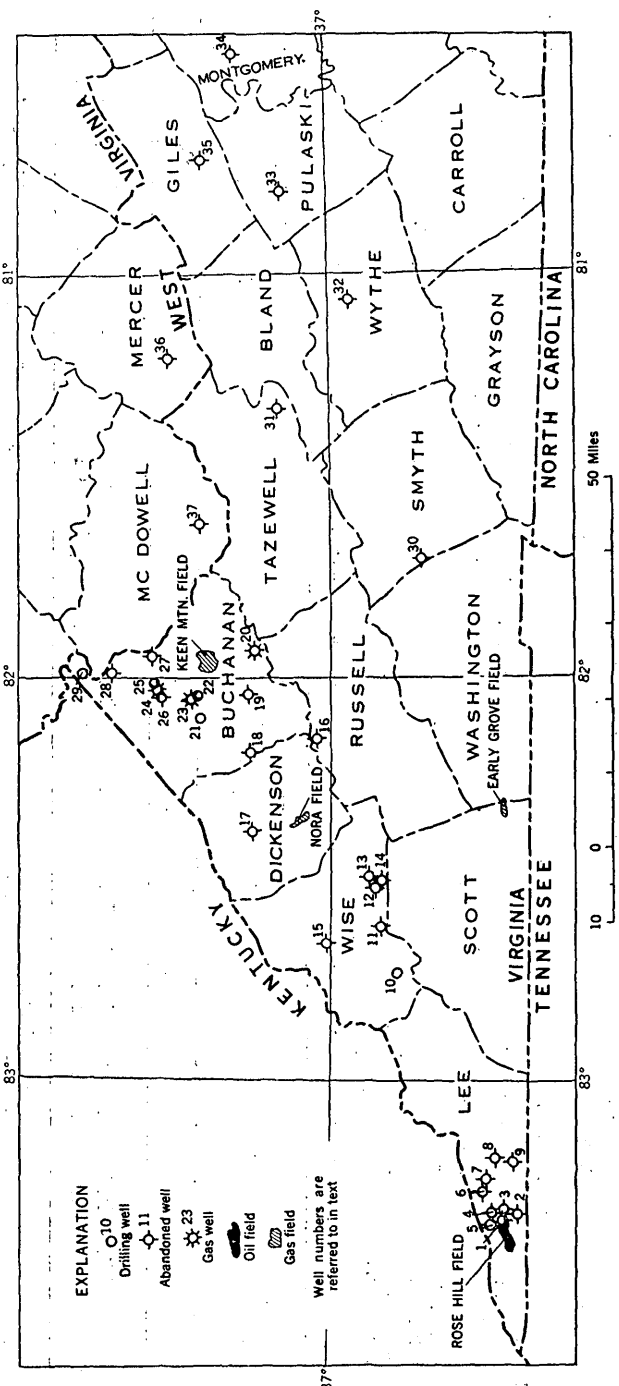

FIGURE 70.—Map showing locations of oil and gas fields and test wells in southwestern Virginia and of two wells in West Virginia.

358667—56——2

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*

Reference:

1. Averitt, Paul, 1941, The Early Grove gas field, Scott and Washington Counties, Va: Virginia Geol. Survey Bull. 56, p. 23–25, 40.
2. Cooper, B. N., Dec. 1949, The search for oil and gas in Virginia: The Commonwealth, p. 28–30, 73–76.
3. Eby, J. B., 1923a (with chapters by Campbell, M. R., and Stose, G. W.), The geology and mineral resources of Wise County and the coal-bearing portion of Scott County, Va: Virginia Geol. Survey Bull. 24, p. 578–583.
4. McGill, W. M., 1936, Prospecting for natural gas and petroleum in Virginia: Virginia Geol. Survey Bull. 46, p. 11–22.
5. Martens, J. H. C., Nov. 1943, Deep well in Russell County, Va: Am. Assoc. Petroleum Geologists Bull., v. 27, no. 11, p. 1543–1548.
6. Miller, R. L. (personal communication).
7. Miller, R. L., and Fuller, J. O., 1947, Geologic and structure contour maps of the Rose Hill Oil field, Lee County, Va: U. S. Geol. Survey Oil and Gas Inv., Preliminary Map 76.
8. Miller, R. L., and Brosgé, W. P., 1950, Geology of the Jonesville district, Lee County, Va: U. S. Geol. Survey Oil and Gas Inv., Prelim. Map 104.
9. Stanton, Cramon, 1949, Oil and gas developments in western and southwestern Virginia: Apalachian Geol. Soc. Bull., v. 1, p. 429–431.
10. Tucker, R. C., 1936, Deep-well records: West Virginia Geol. Survey, p. 276.
11. Tucker, R. C., 1943, Summarized records of deep wells: West Virginia Geol. Survey, v. 16, p. 855–856.
12. Wilpolt, R. H., and Marden, D. W., 1949, Upper Mississippian rocks of southwestern Virginia, southern West Virginia and eastern Kentucky: U. S. Geol. Survey Oil and Gas Inv., Prelim. Chart 38.
13. See footnote, p. 532.

[Gas flow is measured in million cubic feet per day (mcf/d); oil flow is measured in barrels per day (bbls per day)]

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Buchanan County					
Bucu	Clinchfield Coal Corp. No. 102, Clinchfield Coal Corp.	1,373.20	5,847	25.56 mcf/d	Devonian shale	Abandoned	12 13	No. 18, fig. 70
Bucu, Keen Mountain	Yukon-Pocahontas Coal Co. No. 1–1454, United Producing Co.	1,206 Ground	6,271			Abandoned	12	No. 6, fig. 71

Bucu	Yukon-Pocahontas Coal Co. No. 2–1466, United Producing Co.	1,751 Ground	5,100, filled back to 4,216	30 mcf/d		Abandoned	12 13	No. 19, fig. 70; No. 21, fig. 71
Hurley	F. H. Curtis No. 1–A, Pipe Line Construction & Drilling Co.	1,987.44 Ground	3,461	7,234 mcf/d	Bluefield formation	Shut in	12	No. 24, fig. 70; No. 2, fig. 71
Hurley	F. H. Curtis No. 2–A, Pipe Line Construction & Drilling Co.	2,009.8 Ground	3,481			Drilling		No. 25, fig. 70; No. 1, fig. 71
Hurley	R. A. Looney No. 1–1659, United Producing Co.	2,076	4,175			Abandoned	13	No. 26, fig. 70; No. 3, fig. 71
Hurley	W. H. Matney No. 1, United Producing Co.	1,769.86 Ground	2,870			Drilling		No. 22, fig. 70; No. 5, fig. 71
Hurley	A. L. Powers No. 1, Pipe Line Construction & Drilling Co.	1,509.25 Ground	3,725	3,452 mcf/d	Greenbrier limestone	Shut in	12 13	No. 23, fig. 70; No. 4, fig. 71

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Buchanan County—Continued					
Hurley	Ben Ratliff No. 1-F. H. Curtis No. 1–B, Pipe Line Construction & Drilling Co.	1,208.5				Drilling		No. 21, fig. 70
Iaeger, Keen Mountain	R. J. Carlson No. 1, Pipe Line Construction & Drilling Co.	2,122.62 Ground	4,731	400 mcf/d	Greenbrier limestone	Shut in	12 13	No. 10, fig. 71
Iaeger	National Shawmut Bank of Boston No. 1–851, Thomas D. Cabot	1,100±	4,998			Abandoned	10	No. 28, fig. 70
Iaeger	National Shawmut Bank of Boston No. 5810, United Fuel Gas Co.	1,263.12 Ground	5,302			Abandoned	13	No. 27, fig. 70
Iaeger	National Shawmut Bank of Boston No. 1–6416, United Fuel Gas Co.	1,157.43 Ground	5,250			Drilling		No. 29, fig. 70
Iaeger, Keen Mountain	Slocum Land Corp. No. 1-1525, United Producing Co.	1,621.2 Ground	2,365, filled back to 2,345	127 mcf/d	Princeton sandstone	Shut in	12	No. 8, fig. 71

Iaeger, Keen Mountain	Slocum Land Corp. No. 2–1539, United Producing Co.	1,933.7 Ground	4,611			Abandoned		No. 9, fig. 71
Richlands	Hugh McRae No. 6431, United Fuel Gas Co.	1,799.14 Ground	4,800, plugged to 2,530	133 mcf/d	Lee formation	Shut in	12 13	No. 20, fig. 70; No. 22, fig. 71
Richlands, Keen Mountain	C. L. Ritter No. 1–1527, United Producing Co.	2,252	8,012			Abandoned	13	No. 12, fig. 71
Richlands, Keen Mountain	W. M. Ritter No. 1–V–1461, United Producing Co.	1,619.16 Ground	2,301	17,196 mcf/d	Princeton sandstone	Shut in	12 13	No. 11, fig. 71
Richlands, Keen Mountain	W. M. Ritter No. 2–V–1481, United Producing Co.	1,726.3 Ground	4,275, filled back to 2,480	51 mcf/d	Princeton sandstone	Shut in	13	No. 7, fig. 71
Richlands Keen Mountain	W. M. Ritter No. 3–V–1526, United Producing Co.	2,278.86 Ground	2,986	4,213 mcf/d	Princeton sandstone	Shut in	12	No. 13, fig. 71
Richlands, Keen Mountain	W. M. Ritter No. 4–V–1557, United Producing Co.	2,258.64 Derrick	4,928, hole plugged to 4,688	19.6 mcf/d		Abandoned	13	No. 14, fig. 71

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Buchanan County—Continued					
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 3–1563, United Producing Co.	1,673.5 Ground	4,399, filled back to 4,140	6,152 mcf/d	Greenbrier limestone	Shut in	12	No. 15, fig. 71
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 4–1646, United Producing Co.	1,752.6 Ground	2,404	20,134 mcf/d	Princeton sandstone	Shut in		No. 17, fig. 71
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 5–1647, United Producing Co.	1,826.4 Ground	4,358	926 mcf/d	Greenbriar limestone	Shut in	13	No. 19, fig. 71
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 6–1671, United Producing Co.	1,780.8 Ground	4,536			Abandoned		No. 16, fig. 71
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 7–1672, United Producing Co.	2,228.21 Ground	5,360			Drilling		No. 18, fig. 71
Richlands, Keen Mountain	Yukon-Pocahontas Coal Co. No. 8–1673, United Producing Co.	1,645.1 Ground	4,793			Drilling		No. 20, fig. 71

Dickenson County

Clintwood, Nora field	Clinchfield Coal Corp. No. 101, Clinchfield Coal Corp.	1,520.5 Ground	4,551	464 mcf/d (initial); 1,632 mcf/d (total, after acid)	Greenbrier limestone	Shut in	12 13	No. 4, fig. 72
Clintwood, Nora field	J. C. Rasnick No. 103, Clinchfield Coal Corp.	1,504.3 Ground	3,910	143 mcf/d (initial); 666 mcf/d (settled)	Greenbrier limestone	Shut in	13	No. 3, fig. 72
Clintwood, Nora field	E. C. Smith No. 104, Clinchfield Coal Corp.	1,524.14 Ground	4,033	1,555 mcf/d	Greenbrier limestone	Shut in	13	No. 5, fig. 72
Clintwood	Arch Rose No. 105, Clinchfield Coal Corp.	1,431.3 Ground	5,364	18.26 mcf/d (initial); 442 mcf/d (settled)	Big Stone Gap shale	Shut in	13	No. 17, fig. 70; No. 1, fig. 72
Clintwood	G. W. C. Smith No. 106, Clinchfield Coal Corp.	1,525.3 Ground	5,754	10.53 mcf/d (initial); 539 mcf/d (settled)	Price (?) sandstone	Drilling	13	No. 7, fig. 72
Clintwood	David Colley No. 107, Clinchfield Coal Corp.	1,517.4 Ground	5,804			Drilling		No. 6, fig. 72

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Dickenson County—Continued					
Clintwood, Nora field	Clinchfield Coal Corp. No. 108, Clinchfield Coal Corp.	1,746.4 Ground	5,997			Drilling		No. 2, fig. 72
			Lee County					
Black Valley	O. Cavins No. 1	1,500	2,000			Abandoned	6 8	No. 2, fig. 70
Colman Gap, Rose Hill field	L. E. Bales No. 1	1,530	1,104	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	L. E. Bales No. 2		2,252			Abandoned	6	
Colman Gap, Rose Hill	E. M. Brooks No. 1	1,443	4,079	225 mcf/d	Basal sandstone of the Cayuga, dolomite	Shut in		
Colman Gap, Rose Hill	Clarence Dean No. 1	1,515	2,085	Oil well (went dry)		Abandoned	6	

Colman Gap, Rose Hill	Cleve Dean No. 1, Rouge Oil Co.			800 bbls per day after acid			2	
Colman Gap, Rose Hill	Cleve Dean No. 2, Rouge Oil Co.			Oil well				
Colman Gap, Rose Hill	G. C. Dean Rouge Oil Co.	1,500	1,742	150 bbls per day	Trenton limestone		6 7	
Colman Gap, Rose Hill	Joe Dean, Rouge Oil Co.	1,585	1,574; deepened to 1,666	Oil well	Trenton limestone		6 7	
Colman Gap, Rose Hill field	Joshua A. Dean No. 1, Rouge Oil Co.	1,515	1,800	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	Andy Ely No. 1, Rouge Oil Co.	1,539	2,166	130 bbls per day for 3 months	Trenton limestone		6	
Colman Gap, Rose Hill	Patton Ely	1,545				Abandoned	7	
Colman Gap, Rose Hill	B. C. Fugate No. 1, R. Y. Walker	1,447	1,793	60 bbls per day initial; 8 bbls per day settled	Trenton limestone		7	

358617—56——3

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Lee County—Continued					
Colman Gap, Rose Hill	B. C. Fugate No. 2, R. Y. Walker	1,512	2,003			Abandoned	7	
Colman Gap, Rose Hill	B. C. Fugate No. 2B, Rouge Oil Co.	1,468	1,908			Abandoned	7	
Colman Gap, Rose Hill	B. C. Fugate No. 3, Virginia Lee Oils Co., Inc.	1,451	1,773	3½ bbls per day	Trenton limestone		7	
Colman Gap, Rose Hill	H. and R. Oil Co. No. 1 B. C. Fugate, H. and R. Oil Co.	1,420	1,494	Oil well	Trenton limestone		6	
Colman Gap, Rose Hill	Fugate Estate No. 1, Rouge Oil Co.	1,534	1,610	15 bbls per day	Top of Moccasin limestone		7	
Colman Gap, Rose Hill	Fugate Estate No. 2, Rouge Oil Co.	1,469	1,235	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	Fugate Estate No. 3, Rouge Oil Co.	1,494	1,320	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	Fugate Estate No. 4, Rouge Oil Co.	1,499	1,957	Oil well	Trenton limestone		7	

Colman Gap, Rose Hill	Fugate Estate No. B2, Rouge Oil Co.	1,529	1,769	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	Fugate Estate No. B3, Rouge Oil Co.	1,555	2,037	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	W. T. Jenkins No. 1, Rouge Oil Co.	1,725	210±			Abandoned	6	
Colman Gap, Rose Hill	Bob Lemons No. 1	1,438 Ground	3,261	3/4 bbls per day pumped	Moccasion limestone	Abandoned	7	
Colman Gap, Rose Hill	Bob Lemons No. 2	1,466	1,222	7 bbls per day	Trenton limestone (lower part)		7	
Colman Gap, Rose Hill	Bob Lemons No. 3	1,531	1,590			Abandoned	7	
Colman Gap, Rose Hill	Stacey Nelson Rouge Oil Co.	1,538	1,540	Oil well	Trenton limestone		7	
Colman Gap, Rose Hill	Henly Sutton	1,502	2,707			Abandoned	7	
Colman Gap, Rose Hill	C. Yeary-G. W. Fugate Estate No. 1, H. and R. Oil Co.						6	
Ewing, Rose Hill	Myrtle Campbell No. 1, Rouge Oil Co.		1,320?	5 bbls per day			6	

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Lee County—Continued					
Ewing, Rose Hill	J. W. Campbell, Rouge Oil Co.		1,165?	Oil well (no gas)	Trenton limestone		6	
Ewing, Rose Hill	J. N. Chadwell No. 1, Rouge Oil Co.		2,015			Abandoned	6	
Ewing, Rose Hill	C. Marcum No. 1, A. & R. Oil Co.		1,838	10 bbls per day	Trenton limestone (base)		6	
Ewing, Rose Hill	Logan Snodgrass, Rouge Oil Co.		1,832			Abandoned	6	
Ewing, Rose Hill	George S. Yeary	1,691	3,034			Abandoned	6	
Ewing Rose Hill	Glen Yeary No. 1, Dunnigan and Malloy	1,614	2,023	Oil well	Trenton and Eggleston (?) limestone		6	
Hubbard Springs	D. C. McClure No. 1	1,350	3,300?			Abandoned	7 8	No. 8, fig. 70

Hubbard Springs	C. Phipps No. 1	1,585	1,902½			Abandoned	7 8	No. 7, fig. 70
Hubbard Springs	M. H. Snodgrass No. 1	1,280	1,706			Abandoned	8	No. 9, fig. 70
Rose Hill, Rose Hill	Abney Heirs No. 1, Stacy and Cardwell						6	
Rose Hill, Rose Hill	Sarah Abney			Oil well			6	
Rose Hill, Rose Hill	Jack Asher	1,410	900			Abandoned	7	
Rose Hill, Rose Hill	R. L. Bales Rouge Oil Co.	1,348	1,867	Oil well	Trenton limestone		6	
Rose Hill, Rose Hill	Lucy Beatty					Abandoned	6	
Rose Hill quadrangle	Candy Cawood No. 1	1,710±	150±			Abandoned	6 8	No. 4, fig. 70
Rose Hill quadrangle	Mill Davis No. 1	1,620	4,406			Abandoned	6 8	No. 3, fig. 70
Rose Hill quadrangle	Anthony Ely No. 1	1,330	2,532			Abandoned	8	No. 6 fig. 70
Rose Hill, Rose Hill	C. H. Frye No. 1, Stacy and Cardwell	1,520 Ground	1,694	60 bbls per day	Trenton limestone		13	

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Lee County—Continued					
Rose Hill, Rose Hill	W. B. Fulton	1,415	1,498			Abandoned	7	
Rose Hill, Rose Hill	C. B. Hobbs No. 1, Rouge Oil Co.					Abandoned	6	
Rose Hill, Rose Hill	C. E. Hobbs No. 1, Rouge Oil Co.	1,347	1,620	27 bbls per day			6	
Rose Hill, Rose Hill	C. E. Hobbs No. 2, Rouge Oil Co.					Abandoned	6	
Rose Hill, Rose Hill	Bob Ingram	1,570	1,870			Abandoned	7	
Rose Hill, Rose Hill	Dewey Lee, Rouge Oil Co.		2,156	Oil well (pumped dry)	Trenton limestone	Abandoned	6	
Rose Hill, Rose Hill	Gilbert Lee No. 1	1,420	303			Abandoned	7	
Rose Hill, Rose Hill	Gilbert Lee No. 2	1,420	1,410	Oil well (small, near bottom)		Abandoned	7	

Rose Hill, Rose Hill	Gilbert Lee No. 3	1,420	1,869			Abandoned	7	
Rose Hill, Rose Hill	Gilbert Lee No. 4, American Trading & Producing Co.		2,108			Abandoned	6	
Rose Hill, Rose Hill	Lee Marcum No. 1			Oil well	Trenton limestone		6	
Rose Hill, Rose Hill	M. E. McCurry No. 1, Rouge Oil Co.	2,318		50 bbls per day			6	
Rose Hill, Rose Hill	Lon Montgomery	1,455	2,400?			Abandoned	7	
Rose Hill, Rose Hill	H. B. Nolan, Rouge Oil Co.	1,370	2,373			Abandoned	6 7	
Rose Hill, Rose Hill	J. R. Osborn, Rouge Oil Co.			75 bbls per day after acid			2 6	
Rose Hill, Rose Hill	Owens No. 1, Fred Shaner, and others		2,325				6	
Rose Hill, Rose Hill	Prichard, Mountain Empire Co.	1,460	467?			Abandoned	7	
Rose Hill, Rose Hill	Jim Ray No. 1, Rouge Oil Co.			35 bbls. per day			6	

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Lee County—Continued					
Rose Hill, Rose Hill	Jim Ray No. 2, Rouge Oil Co.			Oil well			6	
Rose Hill, Rose Hill	W. S. Riley No. 1, Rouge Oil Co.		355±			Abandoned	6	
Rose Hill, Rose Hill	W. S. Riley No. 2	1,524	1,840	35 bbls. per day	Trenton limestone		6	
Rose Hill quadrangle	E. C. H. Rosenbaum No. 1, K. R. Wilson Co.					Abandoned	6	No. 5, fig. 70
Rose Hill, Rose Hill	Sensabaugh Heirs well, K. R. Wilson Co.		2,002			Abandoned	6	
Rose Hill, Rose Hill	Alfred Shackleford No. 1, Stacy and Cardwell	1,550	2,876?			Abandoned	6 13	
Rose Hill quadrangle	Grant Smith No. 1 H. and R. Oil Co.					Abandoned	6	No. 1, fig. 70

358667—56——4

Scott and Washington Counties

Brumley, Early Grove	John M. Arnold, Victor Behm		3,500–4,000			Abandoned	1	
Mendota, Early Grove	Bailey Barker, Holston Oil & Gas Co.		2,500±			Abandoned	1	
Mendota Early Grove	G. W. Fleenor, Bristol Natural Gas Co.	1,510.9	3,854	75 mcf/d	Little Valley limestone	Producing	1	
Mendota, Early Grove	C. B. and J. H. Hunsucker, Bristol Natural Gas Co.	1,506.5	3,721	200 mcf/d	Little Valley limestone	Abandoned	1	
Mendota, Early Grove	H. A. Miller No. 8, Bristol Natural Gas Co.		5,862	30 mcf/d	Devonian shale	Producing	9	
Mendota, Early Grove	Earl S. Ridgeway No. 1, Bristol Natural Gas Co.	1,461.35	3,613	1,750 mcf/d	Little Valley limestone	Producing	1	
Mendota, Early Grove	E. D. Smith, Bristol Natural Gas Co.	1,459.1	3,435	1,500 mcf/d	Little Valley limestone	Shut in	1	
Mendota, Early Grove	J. R. Smith Heirs No. 1, Bristol Natural Gas Co.	1,561.3	5,650			Abandoned	1	
Mendota, Early Grove	Margaret Sproles, Bristol Natural Gas Co.	1,578.9	4,103	1,000 mcf/d		Producing	1	
Wallace, Early Grove	W. E. Leonard, Holston Oil & Gas Co.		2,600±			Abandoned	1	

TABLE 1.—*Data concerning wells drilled in Virginia prior to Jan. 1, 1950*—Continued

Quadrangle and field	Name of well and owner	Elevation (feet)	Total depth (feet)	Initial open flow	Producing horizon	Status, Jan. 1, 1950	Reference No.	No. on figs. 70–72
			Wise County					
Coeburn	Hagan No. 1, Southwestern Oil & Gas Co.	2,500±	3,751			Abandoned	9 12 13	No. 12, fig. 70
Coeburn	Hagan No. 2, Southwestern Oil & Gas Co.	2,575	1,407			Abandoned	9 13	No. 13, fig. 70
Coeburn	Hagan No. 3, Southwestern Oil & Gas Co.	2,600±	5,348			Abandoned	9 13	No. 14, fig. 70
Pound	Isaac Kaufman No. 1, Benedum-Trees Oil Co.	2,230	3,670			Abandoned	4 9 13	No. 15, fig. 70
Wise	George Gish No. 1		2,153			Abandoned	3	No. 11, fig. 70
Wise	Osborne No. 1, Oliver Jenkins and others					Drilling	13	No. 10, fig. 70

Other counties

Giles County, Pearisburg quad.	F. B. Strader No. 1, The California Co.		1,450			Abandoned	9	No. 35, fig. 70
Montgomery County, Blacksburg	Kipps Anthracite Coal Co. No. 1, The California Co.	2,483.10 Ground	9,340			Abandoned	13	No. 34, fig. 70
Pulaski County	Well at foot of Cloyd Mountain					Abandoned	2	No. 33, fig. 70
Rockingham County, Woodstock quad.	C. L. Souder No. 1, Eastern States Gas Co.	1,460 Ground (barometer)	2,992	100 mcf/d		Abandoned	9 11	
Russell County, Bucu	Truman No. 1 (272), Penn-Ohio Gas Co.	2,050 Ground	6,006			Abandoned	5 11 12	No. 16, fig. 70
Smyth County	Mathieson Alkali, Mathieson Alkali Corp.					Abandoned	2	No. 30, fig. 70
Tazewell County, Burkes Garden	J. M. Hoge No. 1, United Producing Co.	3,052.4 Ground	5,632			Abandoned		No. 31, fig. 70
Wythe County, Max. Meadows	Newberry No. 1, I. Groskins and others	2,000±	1,295±			Abandoned	9	No. 32, fig. 70

The earliest "wildcat" well in southwestern Virginia was drilled in the early 1890's on the G. W. Gish, Nettle Patch farm on Clear Creek, about 2 miles south of Ramsey in Wise County. The total depth was about 2,150 feet; a slight show of gas was obtained at 626 feet, probably in the Bluestone formation. Gas seeping from this well can be ignited, and the well is locally known as The Burning Well (Eby, 1923a, p. 581–582; Stanton, 1949, p. 430). According to Cooper (1949, p. 29), a well was drilled in 1910 in Possum Hollow near the Rose Hill field; however, this well was not listed by Miller and Fuller (1947). About 1910, a well was drilled near the base of Cloyd Mountain a few miles north of Pulaski, and an artesian flow of sulfur water was obtained (Cooper, 1949, p. 29). A water well drilled about 1911 in Wassum Valley near Marion in Smyth County showed traces of oil and gas at a shallow depth (Cooper, 1949, p. 29). The earliest exploratory well in the Rose Hill and Jonesville areas, recorded by Miller and Brosgé (1950) is the D. C. McClure well, located about 4 miles west of Jonesville, which was completed in 1915.

EARLY GROVE GAS FIELD

The Early Grove gas field in Washington and Scott Counties just north of the Tennessee line yielded the first commercial production of gas in the Commonwealth of Virginia. This field was described by Averitt (1941). The discovery well was drilled in 1931 by Davis Elkins and Associates to a total depth of 3,613 feet. Initial production of 1,750,000 cu ft per day was obtained from a sand lens in the Mississippian Little Valley limestone. Eleven wells were drilled on, or near, the Early Grove anticline; seven wells produced gas and four were dry. Three of the dry wells were drilled off structure, and the fourth was on structure but encountered tightly cemented sandstone in the producing zones. Wells 1 to 4, drilled by Davis Elkins and Associates, were sold to the Bristol Natural Gas Co., Bristol, Va. (succeeded by Old Dominion Natural Gas Corp., Morgantown, W. Va.), and this corporation drilled the later wells. Initial production ranged from 30,000 to 1,750,000 cu ft per day. The H. A. Miller No. 8 was drilled to a depth of 3,670 feet and was completed on January 18, 1942 with an open flow of 127,000 cu ft per day. In 1947, this well was deepened to the black shale to the total depth of 5,862 feet, and initial flow of 30,000 cu ft was obtained (Stanton, 1949, p. 430). Gas was turned into the 4-inch pipe line from Early Grove to Bristol in March 1938, and the field has continued to produce through 1953. The producing sands in the Little Valley limestone have low porosity and low permeability. Consequently, gas pressure declines rapidly in producing wells, and the pressure recovers slowly after the well is shut in.

ROSE HILL OIL FIELD

The discovery of the Early Grove gas field led to the drilling of numerous other test wells in southwestern Virginia. The first significant discovery was the Rose Hill oil field in 1942. Nine, or more, wells were drilled in Lee County in the vicinity of the Rose Hill field before commercial production was obtained. Five of these wells were dry, three had shows of oil and gas, and one, the Gilbert Lee No. 2, produced a small amount of oil from the Trenton limestone.

The only oil produced in Virginia, and, indeed, the only oil produced in the whole Appalachian Valley, comes from the Rose Hill field. The field is located in the Cumberland overthrust block near the crest of the Powell Valley anticline, where erosion has locally cut through the overthrust sheet and exposed the underlying block in windows or fensters. Production comes from the Trenton limestone in the stationary block beneath the overthrust. The oil is produced from fracture zones; the unfractured Trenton limestone is too impervious to give up the oil it contains at a commercial rate. Much of the production has come from the wells drilled inside the fensters, but some production has come from wells outside the fensters.

The first commercial well in the Rose Hill field was the B. C. Fugate No. 1, drilled in 1942. Initial production was about 60 bbls per day from the Ordovician Trenton limestone at 1,115 feet, and settled production was 8 bbls per day. As a result of this discovery, other wells were drilled in the period 1942–1945, but without much success. In 1946 and 1947 several productive wells were drilled, and in January 1947 the field probably produced more than 400 bbls per day (Stanton, 1949, p. 430). Actual production data are not available. Production increased during 1947 but has declined since then. Several dry wells drilled in 1948–1949 dampened interest in the field until the Stacy and Cardwell, C. H. Frye No. 1 was completed in October 1949 with initial production of about 60 bbls per day. This well renewed interest in the field, and several offset wells were being drilled as of January 1, 1950.

One of the difficulties in the development of the Rose Hill field has been predicting the location of fracture zones at depth. Production from fracture zones is always difficult to predict. If regular fractures occur at intervals of 2 feet, it is possible to miss these fractures with a 4-inch hole. Perhaps the answer is directional drilling, which would make possible the testing of a large horizontal area from the same location. The increase in production after acidizing some wells can be explained as the result of acid opening channels from the well into the fracture system. Another problem in the Rose Hill field has been the rapid accumulation of paraffin in the producing string of tubing. The paraffin is probably in solution in the oil, and the reduction in

pressure accompanying production may cause it to be precipitated. Paraffin may accumulate in the rock fractures as well as in the tubing. This is a problem for the petroleum engineers, but until it is solved the Rose Hill field will not be an attractive area for additional drilling.

The type of structure present in the Rose Hill field continues northeastward into the adjacent Jonesville area. Miller and Brosgé (1950) suggest three locations worthy of test wells in the Jonesville area. Seven wells, all abandoned, have been drilled in the Jonesville area, but only one tested the Trenton Limestone in the stationary block; therefore, the area is essentially untested. Four of these wells reported shows of oil or gas. If commercial accumulation of oil is present in the Jonesville area, it should be similar to that in the Rose Hill field.

WISE COUNTY WELLS

Five of the six wells drilled in Wise County have had shows of gas. The Burning Well south of Ramsey has already been mentioned. The Isaac Kaufman No. 1 near Lipps, Va., drilled in 1933 by the Benedum-Trees Oil Co., had two shows of gas, each reported to have an initial flow of 50,000 cu ft per day; the upper show was at 1,550 feet in the basal sandstone of Pennsylvanian age and the lower was at 3,600 feet in the Greenbrier limestone. The well was abandoned in the Greenbrier limestone at a total depth of 3,670 feet after a long fishing job failed to recover the tools. Three wells, Hagan Nos. 1, 2, and 3, were drilled by the Southwest Oil & Gas Co. in the southern part of Wise County near the Scott County line. The Hagan No. 1 encountered gas in the Princeton sandstone and at two horizons in the Greenbrier limestone. An initial open flow of 200,000 cu ft was measured at a depth of 1,363 feet in the top of the Princeton sandstone. In the Greenbrier limestone, gas was encountered, with 100,000 cu ft of initial flow at a depth of 2,575 and between 40,000 and 50,000 cu ft of initial open flow at 3,332 feet. The well was abandoned at a total depth of 3,751 feet (Stanton, 1949, p. 430), probably in Devonian rocks. Small shows of gas were encountered in the Hagan No. 2, which reached a total depth of 1,407 feet, and in the Hagan No. 3, which was originally drilled to 1,583 feet into the top of the Greenbrier. The Hagan No. 3 was later deepened by the United Carbon Co. to a depth of 5,348 feet and probably stopped in Silurian rocks. Although several small shows of gas were found, the well was abandoned. Samples from the lower part of this well taken by the United Carbon Co. were not available for study.

BUCHANAN COUNTY WELLS

The discovery well in the Keen Mountain field, and the first gas well in Buchanan County, was the United Producing Co., W. M. Ritter No. 1–V–1461. It was completed in February 1948 in the top

of the Princeton sandstone, which was reached at a depth of 2,295 feet. The well had an initial production of 17,196,000 cu ft per day. Five wells in the Keen Mountain field can produce from the Princeton sandstone. Other wells drilled in the field and elsewhere in the county found gas in commercial quantities in the sandstones in the Pottsville group and in upper Mississippian rocks and in the porous zones in the Greenbrier limestone. Shows of gas have been reported from the Mississippian Price sandstone. The location of the field and of other exploratory wells drilled in Buchanan County are shown in figures 70 and 71. The following table serves to further identify wells in figure 71.

Well no. on fig. 71	Name of well	Operator
1	F. H. Curtis No. 2–A	Pipe Line Construction & Drilling Co.
2	F. H. Curtis No. 1–A	Do.
3	R. A. Looney No. 1–1659	United Producing Co.
4	A. L. Powers No. 1	Pipe Line Construction & Drilling Co.
5	W. H. Matney No. 1	United Producing Co.
6	Yukon-Pocahontas Coal Co No. 1–1454	Do.
7	W. M. Ritter No. 2–V–1481	Do.
8	Slocum Land Corp. No. 1–1525	Do.
9	Slocum Land Corp. No. 2–1539	Do.
10	R. J. Carlson No. 1	Pipe Line Construction & Drilling Co.
11	W. M. Ritter No. 1–V–1461	United Producing Co.
12	C. L. Ritter No. 1–1527	Do.
13	W. M. Ritter No. 3–V–1526	Do.
14	W. M. Ritter No. 4–V–1557	Do.
15	Yukon-Pocahontas Coal Co No. 3–1563	Do.
16	Yukon-Pocahontas Coal Co No. 6–1671	Do.
17	Yukon-Pocahontas Coal Co No. 4–1646	Do.
18	Yukon-Pocahontas Coal Co No. 7–1672	Do.
19	Yukon-Pocahontas Coal Co No. 5–1647	Do.
20	Yukon-Pocahontas Coal Co No. 8–1673	Do.
21	Yukon-Pocahontas Coal Co No. 2–1466	Do.
22	Hugh McRae No. 6431	United Fuel Gas Co.

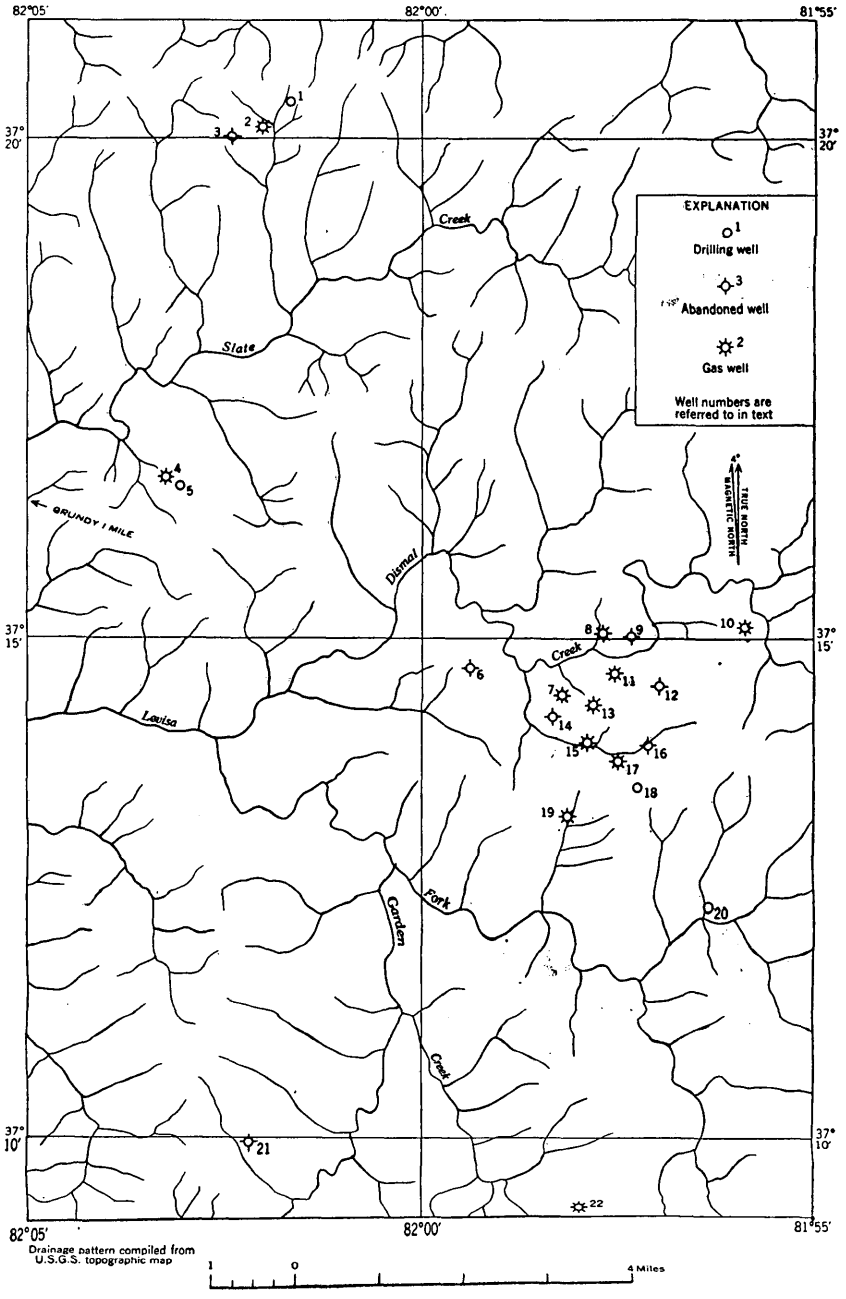

FIGURE 71.—Map of part of Buchanan County, Va., showing the locations of test wells in the Keen Mountain field and adjacent area. The limits of the field have not yet been determined by drilling.

The wells were shut in on January 1, 1950 to await additional potential production and the building of a pipe line. A total of 14 wells have been drilled in the Keen Mountain field, 9 of the 14 are potential producing wells, 4 were dry, and 1 was being drilled on January 1, 1950. Initial open flow ranges from 51,000 to 20,134,000 cu ft per day. Most of the wells have been drilled by the United Producing Co. and the Pipe Line Construction & Drilling Co.

Outside of the Keen Mountain field, 13 other wells have been drilled for gas. On January 1, 1950, 3 of these were shut in, 3 were dry, and 7 were being drilled. The F. H. Curtis No. 1–A had an initial open flow of 7,234,000 cu ft per day in the Bluefield formation, and the A. L. Powers No. 1 well had an initial open flow of 3,452,000 cu ft per day in the Greenbrier limestone. The Hugh McRae No. 6431 well, drilled by the United Fuel Gas Co., had an initial open flow of 103,000 cu ft from the Lee formation.

DICKENSON COUNTY WELLS

In Dickenson County, the Nora field (see fig. 70) has been developed by the Clinchfield Coal Corp. Well Nos. 101, 103, and 104, drilled in the vicinity of Nora (see fig. 72), had initial open flows after acidization of 1,632,000, 666,000, and 1,555,000 cu. ft. per day respectively, from the Greenbrier limestone ("Big Lime" of drillers). The Clinchfield Coal Corp. has also drilled wells elsewhere in Dickenson County and has obtained gas in the black shales from two wells. In January 1950 the wells were shut in, but the drilling program has continued in the expectation of proving enough territory to justify a pipe line. The black shale can produce gas in many places where the shale has been shattered in the plane of the Pine Mountain overthrust. Shale will probably produce small amounts of gas over long periods of time. Shows of gas in the Princeton sandstone and in the Stony Gap sandstone member of the Hinton formation have been reported, but no commercial reserve of gas has been found in these units. These formations are productive in Buchanan County, and they might be productive in Dickenson County.

In Buchanan, Dickenson, and Wise Counties the structural control of gas accumulation is not obvious. Production appears to depend primarily on porosity. This is true for both the Mississippian sandstones and the Greenbrier limestone. Most of the sandstones in the section are quite silty. Silty sandstones tend to have high porosity and low permeability. If they are tightly cemented, the original or potential porosity is destroyed. The silty sandstones may produce small volumes of gas for long periods of time, and the principal hope of these fields lies in the longevity of the wells. Limestone production comes mainly from zones of oolitic and dolomitic limestones.

358667—56——5

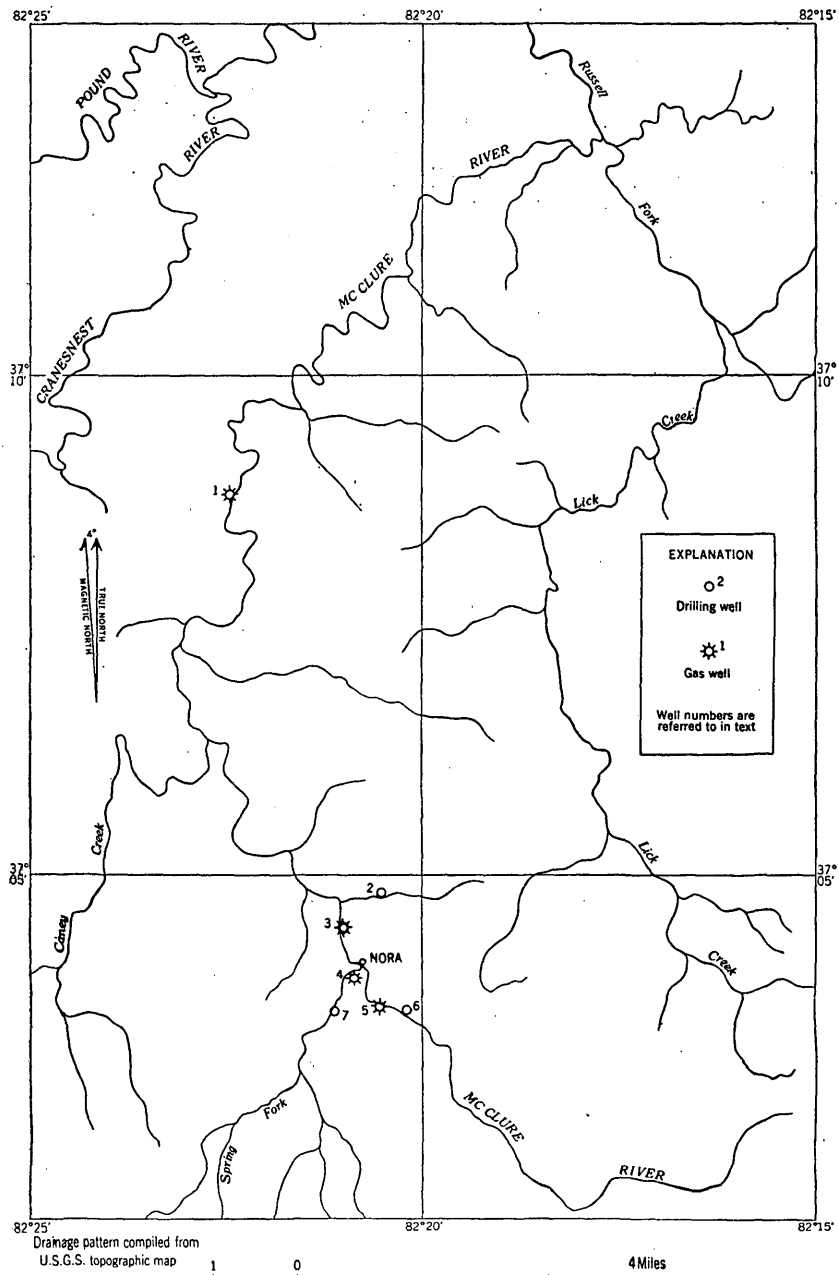

FIGURE 72.—Map of part of Dickenson County, Va., showing locations of test wells in the Nora field and adjacent area. All wells were drilled by the Clinchfield Coal Corp. Names of wells are: No. 1, Arch Rose 105; No. 2, C. C. C. 108; No. 3, Rasnick 103; No. 4, C. C. C. 101; No. 5, E. C. Smith 104; No. 6, David Colley 107; No. 7, G. W. C. Smith 106.

OTHER COUNTIES TESTED

Other counties in southwestern Virginia have been tested, but only by one or two wells. In Russell County, the only well is located near the common corner of Russell, Dickenson, and Buchanan Counties. This well, the Penn-Ohio Gas Co., Truman No. 1 or Clinchfield Coal Corp. No. 1 (272), was drilled in 1932 to a depth of 6,006 feet and was abandoned as a dry hole in Devonian black shales.

The only well in Tazewell County, the United Producing Co. Hoge No. 1 well located on top of the Burkes Garden anticline, was shut down on January 1, 1950. The well started in the Lower Ordovician. No cuttings were available from this well at the time that this report was being prepared. In Smyth County, near Chilhowie, the Mathieson Alkali Corp. drilled a well; but no information is available concerning their findings. In Wythe County, the I. Groskins and others, Newberry No. 1 well was drilled on a bluff north of the Norfolk & Western Railway and about ¼ mile east of the U. S. Highway 11 railroad crossing to the east of Wytheville. It probably started in the Rome formation and may have drilled through the Pulaski fault. In Pulaski County, the only well was drilled near the base of Cloyd Mountain and encountered artesian sulfur water (Cooper, 1949, P. 29). No well is known to have been drilled in Bland County. The California Co. Strader No. 1 well was drilled near the crest of Bane dome, about 4 miles south of Pearisburg in Giles County. The well started near the top of the Cambrian Rome formation and was abandoned at 1,450 feet in the Rome formation. Nearly all of the rock penetrated was limestone or dolomite.

South of Blacksburg in Montgomery County, the California Co. drilled the Kipps Anthracite Coal Co. No. 1 well with rotary tools to a depth of 9,340 feet. This well is located near the top of Price Mountain in a fenster exposure of lower Mississippian rocks in the stationary block beneath the Pulaski overthrust sheet. Mississippian rocks in the stationary block have been folded to form Price Mountain anticline, and the well was located near the crest of this anticline. Drilling started in the Price sandstone, which is equivalent to the Pocono formation. The drill encountered an abnormally thick section of Devonian rocks and was abandoned in the Ordovician Moccasin limestone. The thick section of Devonian rocks is probably due to folding, flowage, and structure rather than to stratigraphic thickening.

The only other test wells in the western part of Virginia are the four wells drilled near Bergton in Rockingham County by the Eastern States Gas Co. These wells are not shown on the index map, because Rockingham County is considerably to the northeast of the area covered by this report.

METHOD OF SAMPLE EXAMINATION

Cable-tool cuttings are the most common samples in the Appalachian region, and all samples examined for this report are cable-tool samples, except those from the Kipps Anthracite Coal Co. No. 1 well at Price Mountain, which are rotary samples. In the examination of cable-tool samples, the fine cuttings were assumed to represent the interval drilled, and the larger chunks were assumed to be cavings from the intervals above. During the early stage of sample examination, percentage logs were made. After the examiners became familiar with the geologic section, and after strip logs for adjacent wells were available, interpretive logs were made.

The samples were examined under low-power binocular microscopes, with magnification ranging from 6 to 30 power. Routine examination was made on dry samples, but supplementary examination was made on wet samples to recognize diagnostic features, such as oolites, grain shapes, and particular minerals, which are obscure in dry samples, but which can be seen clearly in wet samples. Only simple tests were made on the samples. Hardness was determined by the use of a needle, and only the simple chemical tests, such as solution in water and reaction in dilute or concentrated hydrochloric acid, were used. Grain size was determined by comparison with prepared charts or slides containing standard screened particles classified on the Wentworth grade scale. The use of these charts helped greatly in standardizing the observations of the various sample examiners.

The color chart distributed by the National Research Council was used to standardize colors and color names for the sample descriptions available as open-file reports [1] and on microfilm. The use of this color chart gave reasonable consistency for each individual observer and for the group. In the descriptions of the samples, the color name (as identified on the chart) is given, followed by the color formula placed in parentheses. Using this formula, it is possible to distinguish between colors with the same name, such as grayish reds (5R 4/2 and 10R 4/2). These fine distinctions are not always significant, but the information has been made available in the event that it may be required by future investigators.

Descriptions of samples from the open-file report [2] appear in the following order: (1) rock name (the principal type followed by less-abundant type in order of abundance when more than one type is present); (2) adjective describing the composition of the rock if it is

[1] Huddle, J. W., Jacobsen, E. T., Williamson, A. D., and others, 1955. Detailed logs of 28 wildcat wells in Lee, Wise, Buchanan, Montgomery, and Dickenson Counties, Va. Open-file report. Original copy on file in the Geological Survey library, Washington, D.C. Microfilm on file and available for purchase through the Kentucky Geological Survey, Lexington, Ky., and the Virginia Division of Geology, University Station, Charlottesville, Va.

[2] Huddle, Jacobsen, Williamson, and others, op. cit.

outstanding (such adjectives as argillaceous, silty, micaceous, calcareous, sandy, and conglomeratic are commonly used); (3) color name (followed by the color formula in parentheses according to the rock color chart distributed by the National Research Council); (4) structure (using such descriptive words as fissile, massive, and crossbedded); (5) texture (described by an adjective or an adverb; if the rock is a sandstone, Wentworth's grade terms are used and the sorting, shape, and surface of the sand grains are described; if the rock is a limestone, it is described as fine, medium, or coarsely crystalline, dense, oolitic, or by similar words or phrases); (6) mineral composition; (7) cement; (8) apparent porosity or permeability; (9) any other features observed (such as fossils or concretions). This arrangement of the descriptions facilitates plotting log strips, which is a very common and convenient way of using well records to study subsurface stratigraphy.

The samples used for this study were obtained primarily from the companies that drilled the wells; the Kentucky Geological Survey made the sample splits for most of the wells. The Kentucky Geological Survey sample library retained one of the cuts, and the remainder of the sample was sent to the Virginia Geological Survey sample library. Some of the samples are also available from the sample library of the West Virginia Geological Survey. If the samples are available for study, a reference to the sample library containing the well sample is given in the heading of each well description in this report.

DEFINITIONS OF LITHOLOGIC TERMS USED IN THIS REPORT

In the sample descriptions that were transmitted to the State Geologist and placed on open file,[3] rocks are described under the commonly used rock names, such as "sandstone," "shale," and "limestone." Recent work on sedimentary rocks has resulted in some changes in nomenclature that have not clarified definitions; in fact, some of these changes have even added to the confusion by resurrecting and redefining obsolete terms. Because of this confusion, the rock names used in this text are defined below.

The term "sandstone," as used in this report, refers to a consolidated rock composed mainly of detrital grains of rock and minerals other than calcite or dolomite. At least 50 percent of a sandstone must consist of sand-size grains—grains between $\frac{1}{16}$ and 2 millimeters in diameter. Most sandstone contains many more quartz grains than grains of other minerals or rocks, and deviations from this normal composition are recorded in the sample descriptions. The recently

[3] Huddle, Jacobsen, Williamson, and others, op. cit.

defined names of varieties of sandstone, such as "graywacke," "subgraywacke," and "orthoquartzite" are not used, but the sample descriptions provide the information that might be given by more precise terminology.

Rock composed mainly of particles 1/16 to 1/256 millimeters in diameter is called siltstone in this report. Siltstones are composed of rock and mineral fragments of quartz, chlorite, mica, and clay minerals with calcareous, carbonaceous, siliceous, or ferruginous impurities or cement. Quartz is generally the most abundant mineral in siltstone and may be present as sand grains or silt grains, or both. Many argillaceous and micaceous siltstones are laminated and break easily along the planes of lamination, whereas others are massive. Although the grains in a siltstone are so small that the shape and composition of the individual grains rarely can be determined by low-power microscopic examination, any sand grains present can be so determined. Siltstone is gradational between fine-grained sandstone and shale. The use of the term "siltstone" makes it possible to distinguish rocks with a gas-reservoir potentiality greater than that of shale but less than that of fine-grained sandstones.

"Shale" is used as a general term. It includes the very fine grained clastic rocks that are indurated, argillaceous, and consist mainly of particles smaller than silt. Shale generally contains one or more clay minerals, abundant quartz, and some mica and chlorite. Minerals other than clay may predominate, and calcium carbonate, silica, and detrital and colloidal organic material occur as cementing material or impurities. Under a low-power microscope, shale is seen to have a smooth appearance unless silt or sand grains are present in appreciable quantities. Fissility or lamination is not implied by the term "shale" in this report; such structure, if present, is noted in the description.

Limestone is a rock composed mainly of dense (aphanitic) to coarsely crystalline calcite or dolomite that contains some clay, silt, and sand impurities. Varieties of limestone are recognized on the basis of differences in mineral composition and texture. Dolomitic limestone, as used in the sample descriptions, is rock that contains enough magnesium carbonate to slow the reaction of the limestone with dilute hydrochloric acid. Much of the limestone, here described, is clastic, expecially the coarsely crystalline and oolitic limestone with fossil fragments.

Effective porosity and permeability are indicated in the sample descriptions by descriptive terms. Satisfactory methods of estimating porosity or permeability by microscopic observation have not yet been devised. If a geologist is able to compare his estimates with laboratory determinations of particular rocks, he is frequently able to make reasonably accurate estimates of porosity and permeability

for a field. This experience, however, cannot be directly transferred from one field to another field or from one part of the geologic column to another. Because of the fact that our estimates of porosity and permeability are completely unchecked by laboratory determinations, use of these estimates should rest upon the assumptions that they are based primarily on observable pore spaces and on previous experience on the part of the observers. A sandstone described as silty may also be described as a low-porosity sandstone. Actually, porosity may be high and the permeability low; or, if the sand is tightly cemented, there may be truly no porosity and no permeability. The degree of cementation, and the amount of silt or clay indicated in the rock description, are probably the best indices to permeability given in the sample descriptions. Most of the sands examined appear to be tight (only slightly porous); this is one of the discouraging results of this study. Good reservoir rocks should have considerable porosity and permeability; and, if such rocks were present, they would indicate greater promise for gas and oil production in southwestern Virginia than the rocks actually found by sample examination. However, fine-grained sandstone and siltstone produce over long periods of time in some fields, and the ultimate recovery may equal or exceed that from the coarser-grained sandstone reservoirs, even though the annual yield is smaller. The only satisfactory check on the true porosity and permeability of possible producing formations in southwestern Virginia would be laboratory tests on large chips, such as those that were reported by Averitt (1941, p. 26–29).

CRITERIA FOR CORRELATION

The validity of correlation in any geologic report depends on the information available and the experience and opinions of the author. It is, therefore, desirable to state the criteria used for correlation and the amount and type of work on which the correlations are based. The following notes give this information.

Correlation and identification of formations indicated in the descriptions of well samples and in this report are suggested. Considerable dependence has been placed on previous work, especially the report of Wilpolt and Marden (1949) for the upper Mississippian rocks of Buchanan, Dickenson, and Wise Counties; and the reports of Miller and Fuller (1944 and 1947) and Miller and Brosgé (1950) for Lee County. This report is based on a laboratory examination of samples rather than on field work. Williamson and Huddle made four short field trips to southwestern Virginia in order to see a few of the surface sections. R. L. Miller, B. N. Cooper, and R. H. Wilpolt showed the authors some of the outcrops and assisted them greatly in a review of the stratigraphy of the area. Jacobsen and Williamson made notes of

probable formation contacts when they were examining samples, but Huddle is responsible for the stratigraphic classification and for the correlations shown in the well summaries and in the sample descriptions in the open files of the Virginia Geological Survey. The identifications within the individual fields are reasonably consistent, but the names applied by correlation may be wrong. Correlation of the outlying wells with the field wells and the surface sections are more doubtful. The authors wish to emphasize that interpretations other than those given are possible and, in some cases, equally probable from present information.

REVIEW OF STRATIGRAPHY

The rocks tested for oil and gas in southwestern Virginia range in age from the Cambrian Rome formation to the Pennsylvanian Wise formation. The formation names are given in table 2.

Table 2.—*Stratigraphic names used in this report*

Pennsylvanian system:
- Pottsville group:
  - Wise formation
  - Gladeville sandstone
  - Norton formation
  - Lee formation

Mississippian system:
- Bluestone formation
- Princeton sandstone
- Hinton formation, equivalent to the Pennington shale—several members including the Avis limestone of Reger (1926), and at the base the Stony Gap sandstone member
- Bluefield formation
- Greenbrier limestone
- Maccrady shale, equivalent to the Little Valley limestone (present in the Early Grove Gas field)
- Price sandstone, equivalent to the Pocono formation

Mississippian and Devonian systems:
- Big Stone Gap shale

Devonian system:
- Hampshire formation equivalents
- Chemung formation
- Brallier shale
- Millboro shale of Butts (1940)
- Huntersville chert of Price (1929)
- Ridgeley sandstone
- Rocky Gap sandstone of Swartz (1929)
- New Scotland limestone, equivalent to the Helderberg limestone

Silurian system:
- Cayuga dolomite—approximately equivalent in part to the Hancock limestone and Tonoloway limestone
- Clinton formation:
  - Keefer sandstone member
  - Cacapon sandstone member
- Clinch sandstone

Ordovician system:
- Juniata formation (Sequatchie formation in Lee and Wise Counties)
- Reedsville shale, Trenton limestone } Martinsburg shale
- Eggleston limestone
- Moccasin limestone and Stones River group:

In Lee County
Hardy Creek limestone
Ben Hur limestone
Woodway limestone
Hurricane Bridge limestone
Martin Creek limestone
Rob Camp limestone
Poteet limestone
Dot limestone

- Beekmantown dolomite
- Chepultepec dolomite

Cambrian system:
- Copper Ridge dolomite
- Maynardville limestone
- Nolichucky shale
- Honaker dolomite
- Rome formation
- Shady dolomite
- Erwin quartzite

The principal formations for actual or potential production of oil or gas, arranged in order of increasing age, include the Lee formation, Princeton sandstone, Stony Gap and other sandstone members of the Hinton formation, Greenbrier limestone, Little Valley limestone, Price sandstone or the equivalent Pocono formation, Mississippian and Devonian black shales, Huntersville chert of Price (1929), sandstones of probable Oriskany age, Clinton formation, Clinch sandstone, Trenton limestone, Eggleston limestone, and Moccasin limestone. There is little chance for production from the older Cambrian and Ordovician dolomites, commonly known as the Knox dolomite, but production might come from a number of formations not mentioned in the list above.

Drillers' names used locally include the "Salt sand" for any of the Pennsylvanian sandstones, "Ravencliff sand" for the Princeton sandstone, and "Upper, Middle, and Lower, Maxton sands" for various sandstones in the Princeton sandstone and Bluefield formations. The "Little Lime" is the lowest well-developed limestone in the Bluefield formation overlying a caving shale, which the drillers have named "Pencil Cave." This shale overlies the "Big Lime" or Greenbrier limestone. The drillers recognize several units below the "Big Lime," including the "Big Injun," "Red Injun," which is equal to the Maccrady shale; the "Squaw," the "Weir," and the Berea sand. Not all of these sands below the "Big Lime" are well developed in southwestern Virginia, but the Weir and the Berea sand may be represented in the Price sandstone, or in its equivalent, the Pocono formation. (See C. W. Merrels, 2nd., 1946; and J. F. Pepper and others, 1946.)

PENNSYLVANIAN FORMATIONS

The youngest rocks encountered by drilling activities in southwestern Virginia are part of the Wise formation of the Pottsville group of the Pennsylvanian system. The subdivisions of the Pennsylvanian system were recognized by a comparison of the sample logs with the diamond-drill logs published in the Virginia Geological Survey coal reports, especially those by Hinds (1918), and by Harnsberger (1919). The Wise and Norton formations contain sandstone, siltstone, shale, and coal. According to the Virginia Geological Survey, these formations are distinguished by the recognition of the intervening Gladeville

sandstone. If the Gladeville sandstone cannot be identified, the underlying and overlying formations cannot be distinguished. The Lee formation at the base of the Pennsylvanian system is characterized by the presence of conglomerate and clean quartz sandstone.

The identification of individual coal seams was attempted, but only a few of the more probable correlations are included in the sample descriptions. Coal can be recognized by an experienced driller if he is watching for it, but it is easily missed. Drilling-time logs are very useful in recognizing coal, but it is not possible to get accurate coal thicknesses from time logs because the associated shales and underclays cut at about the same rate as the coals. Drillers experience the same difficulty in distinguishing coal from roof shales and underclays by rate of drilling or by feel of the drill. Coal caves easily, especially the thicker seams, and cavings from thick coal beds are found in many samples below the coal seam. Each appearance of coal fragments in a sample, therefore, requires the examiner to determine whether these pieces represent a thin coal bed or whether they represent a caving from a thick coal bed above. Often it is not possible to make this determination with assurance. Hence, correlation of coal beds in well samples is doubtful except for the thicker coal beds, where one or more samples consist entirely of coal or where supplementary information is available, such as time logs or electric logs. The authors did not have time logs or electric logs for any of the wells in southwestern Virginia.

The base of the Pennsylvanian system in this report has been drawn at the base of the first massive sandstone above the red shales. This may not be a consistent stratigraphic horizon. The Mississippian and Pennsylvanian contact is difficult to recognize in southwestern Virginia because of the lack of satisfactory criteria. No obvious unconformity is present, and the sandstone and conglomerate in the Pennsylvanian Lee formation are very similar to those in the older sandstones of the Bluestone formation and the Princeton sandstone. Lithologically, they cannot be distinguished from each other. Geologists mapping this contact in southern West Virginia and Virginia have usually considered the base of the massive conglomeratic sandstone above the red shales to be the base of the Pennsylvanian. Conglomerate is not everywhere present at the base of the Lee formation, however; and where present, it is not always recognizable in samples. Pebbles may be absent; and even if present, they may be pulverized by the drill and be unrecognizable in the samples. In some wells and sections, Wilpolt and Marden (1949) placed the contact between the Mississippian and Pennsylvanian systems within the massive sandstone series. This correlation was based partly on the absence of red beds near the base of the massive sandstones at several

outcrops and partly on the presence of thin beds of coal in the upper part of the Bluestone formation. They correlated the coal found in the upper part of the Bluestone at Pennington Gap and several localities to the northeast with thin coal beds in the subsurface. They presented no new evidence to justify changing the older basis for recognizing the Mississippian and Pennsylvanian boundary in southwestern Virginia. In the present report, the older basis is used rather than that of Wilpolt and Marden, because it seems easier to follow in the subsurface and because there is no fossil evidence that would justify a change.

MISSISSIPPIAN FORMATIONS

The Mississippian rocks of southwestern Virginia are difficult to subdivide because they represent the deposits of several interfingering contemporaneous environments. In West Virginia, Reger (1926, p. 291–532) divided the Mississippian into a number of formations and groups belonging to his Pocono and Mauch Chunk series. Butts (1940, p. 336–407), Cooper (1944, p. 143–187), and Wilpolt and Marden (1949) regarded Reger's formations as members, and reduced the Bluestone, Princeton, Hinton, and Bluefield groups of Reger to formational rank. This usage is followed here. The classification depends upon the recognition of two key sandstones—the Princeton sandstone between the Hinton and Bluestone formations and the Stony Gap sandstone member at the base of the Hinton formation.

The Bluestone formation is characterized by variegated shales, siltstones, sandstones, and mudstones. The presence of red colors and limy beds distinguish the formation from the overlying Lee formation. Fossils found in the Bluestone formation were submitted to Helen Duncan and Jean Berdan, of the U. S. Geological Survey. The determination of these fossils indicates that the Bluestone formation in parts of McDowell County, West Virginia, and Buchanan and Dickenson Counties, Virginia, contains fresh-water deposits. The fossils give no clear evidence as to the age of the beds, and Miss Berdan reports them to be either Mississippian or Pennsylvanian. Marine fossils have been found in the Bluestone formation in Mercer County by Reger (1926, p. 847), who reported pelecypods, and by Butts (1940, p. 405), who reported small pelecypods and ostracods. The Bluestone formation probably represents the subaerial position of the Mauch Chunk delta in part of Virginia and West Virginia, interfingering with marine beds in Mercer County, W. Va. The base of the Bluestone formation is determined by the recognition of the underlying Princeton sandstone.

In surface and subsurface studies, the Princeton sandstone is considered a key bed. At the surface it is typically a hard quartzitic

sandstone more or less conglomeratic and cross-bedded, but in places it is weak and shaly. In wells, the Princeton sandstone is identified on the basis of stratigraphic position and lithology. The first hard, clean, quartz sandstone that is found at about the proper distance below the first red beds is considered to be Princeton—naturally, this is not a wholly satisfactory basis for identification. In southwestern Virginia and southern West Virginia, the Princeton sandstone is absent in some wells. In other wells, the interval to recognizable horizons above and below the sandstone identified as Princeton is variable. These variations are so abrupt and so much at random that identification of the Princton sandstone in these wells is doubtful.

The Princeton sandstone generally has been regarded as a continuous sheet of sandstone, but some of the evidence given above suggests that it may be a series of sand lenses at different stratigraphic horizons. Geologic maps of Virginia and West Virginia show the Princeton sandstone as a continuous mappable unit. It is possible that the geologist, tracing what he considers to be a blanket sand in an area of poor outcrop, might jump from sand lens to sand lens and mistakenly map as a blanket sand what is really a zone of sand lenses in a shale and siltstone sequence. Evidence indicating that this may have happened is given in the discussion of the Stony Gap sandstone member of the Hinton formation.

The Princeton sandstone is reported to change rapidly in thickness. A part of the difference in thickness of the Princeton sandstone observed along the outcrop and in well logs is attributable to observational error. In surface work, the resistant massive beds are called Princeton sandstone, and the gradational nonresistant shaly beds above and below are excluded. In sample studies, these weak and more or less sandy beds are often included in the Princeton sandstone. This results in an apparent subsurface thickening, whereas actually the thickening is due to the inclusion of the other beds. In the F. H. Curtis No. 1–A well, drilled by the Pipe Line Construction & Drilling Co., the driller reported the hard sandstone from 2,590 to 2,650 feet as the Princeton sandstone. He also recorded sand (and sand is present in the samples) below this hard sandstone down to the limy beds, here called the Avis limestone of Reger. This indicates one type of thickness-determination and correlation problem present in the well studies. What should be included in the Princeton sandstone? Should it include only the hard sandstone, or should it include all the sandstone from the top of the hard sandstone to the top of Reger's Avis limestone? Above the hard sandstone are other sandstones that might also be included in the Princeton. Until we know how the Princeton sandstone was deposited—in other words, whether it was laid down as a blanket sand bed, in lenses, or in a linear deposit such

as offshore bars or channels—there is no satisfactory answer to this question.

The Hinton formation, like the Bluestone formation, includes variegated shale, siltstone, and sandstone. The limestone and calcareous shale contain marine fossils at many places. In Mercer County, W. Va., Reger recognized and named the individual sandstone, shale, and limestone members. Cooper (1944, p. 172–187), and Wilpolt and Marden (1949) recognized some of these named units of Reger as members of the Hinton formation, and this is the usage followed here. Two of the members, the Avis limestone of Reger, and the Stony Gap sandstone member, are recognized in subsurface studies. The name "Avis" is used to designate a sandstone of Pennsylvanian age in Texas and is, therefore, not available for the limestone member of Mississippian age in Virginia. Wilpolt and Marden (1949) used the term "limestone member" as a substitute. There are other limestone, limy shale, and fossiliferous zones present in the surface and subsurface that can easily be confused with the Avis limestone of Reger. Also, there are sandstones that can be confused with the Stony Gap sandstone member. Consequently, the subsurface identification of these members is uncertain.

The Avis limestone of Reger, as recognized in well samples, is a dark argillaceous limestone grading into calcareous shale and containing many fossils. Chips of the Avis limestone of Reger typically break up rapidly in dilute hydrochloric acid, but some pieces still retain their shape in the insoluble residues. In central Buchanan County, the Avis limestone of Reger is recognized in the subsurface by its stratigraphic position—it is overlain by a sandstone and underlain by a prominent red shale. Well logs matched on this sequence correspond at other horizons about as exactly as can be expected. The sandstone at the top is called the Princeton sandstone, and the limestone is called Avis limestone of Reger. This may, or may not, be a correct identification of the surface formations, but the identification within a field is quite satisfactory. The Avis limestone of Reger thins northwest of the Keen Mountain field and is thin or absent in the Pipe Line Construction & Drilling Co., F. H. Curtis No. 1–A well; it is about 13 feet thick in the United Producing Co. Looney No. 1 well. Toward the southwest, the sequence of the Princeton sandstone, Avis limestone of Reger, and red shale changes by the introduction of sandstone in the red shale unit of the sequence. This sandstone is present within the red shale in the Clinchfield Coal Co. No. 102 well and becomes more prominent in central Dickenson County, lying between the Avis limestone of Reger (above) and the red shale (below).

The Stony Gap sandstone member forms the base of the Hinton formation in surface sections. In most places it is a fine-grained quartz sandstone or siltstone. In subsurface studies, a thick sandstone that is approximately in the proper stratigraphic position is identified as the Stony Gap sandstone member. In some wells, this is the first sandstone above the Greenbrier limestone, and in other wells there are several sandstones between the one identified as the Stony Gap sandstone member and the Greenbrier limestone. In the United Fuel Gas Co., A. W. Hicks No. 6478 well, Wilpolt and Marden (1949) show three sandstones below the Stony Gap sandstone member. This identification of the Stony Gap is based on a comparison with the surface section at the type locality. In the United Fuel Gas Co., New River Pocahontas Coal Co., No. 6219 well, Wilpolt and Marden called the lowest sand in the sequence the Stony Gap sandstone member. The sandstones in the Hinton formation and in the Bluefield formation are probably lenticular, and their correlation is uncertain.

Another uncertainty in identification results from the fact that it is possible to include one or more sandstones in the Stony Gap sandstone member of the Hinton formation. Thicknesses of the member, therefore, vary according to the interpretation of the geologist examining the sample log. There is no clear evidence that the Stony Gap member is continuous at the same stratigraphic horizon. In geologic mapping it is probable that the name, as used in reports, refers to a zone in which two or more sandstone tongues or lenses occur. This may be true of the surface sections measured by Wilpolt and Marden (1949) and by Cooper (1944, p. 172–187) in Mercer County, West Virginia, and in Tazewell County, Virginia. Comparison of plotted log strips of these surface sections with the Stony Gap section measured in Mercer County by Reger (1926, p. 195–200) suggests that the previous identifications of the Princeton sandstone, Stony Gap sandstone member of the Hinton formation, Falls Mills sandstone of Reger (1926), and the marine fossiliferous limestone members (including the Avis limestone of Reger) have not been consistent. If the log strips of the above-mentioned sections are matched on the basis of named sandstones correlated by surface mapping, the sequence of beds does not match satisfactorily. A better match is obtained by placing the emphasis on the marine fossil zones. If this is done, the red units match very well, and sandstones are present at consistent horizons; however, the correlation of the main sandstones—the Princeton, Stony Gap, the Fall Mills, Droop and Graham of Reger (1926), and others—is at variance with the correlation by surface mapping. It is fully realized that matching log strips, particularly on the basis of interval, may lead to serious miscorrelations; nevertheless, the comparison of logs suggests strongly that additional surface and sub-

surface data are needed to resolve the problems of correlation of the Mississippian formations in southwestern Virginia.

The Bluefield formation, as recognized in wells, consists of shale and limestone with minor amounts of sandstone. Although the beds are not distinctive in themselves, they are correlated on the basis of position between the Stony Gap sandstone member of the Hinton formation and the Greenbrier limestone. Marine fossils are fairly common. The formation appears to be gradational from the Greenbrier limestone (below) into the red beds of the Hinton (above), as is suggested by Cooper (1948).

The top of the Greenbrier limestone is placed at the top of the massive limestone. This is difficult to determine, even when a complete set of samples is available, because the contact between the Bluefield formation and the Greenbrier limestone has an interfingering facies relationship. Furthermore, recognition of the top of the Greenbrier depends in part on the quality of the samples, the sample interval, and on the sample logging. If the examiner logs a rock as a limestone, it is likely to be included in the Greenbrier; but if he logs the same rock as argillaceous limestone, it is likely to be placed in the Bluefield formation. Variation in the distinction of argillaceous limestone and relatively pure calcareous limestone is inevitable with different observers, and it is probable that variations occur with the same observer. It follows that the top of the Greenbrier limestone has not been consistently drawn, and that it represents neither the same horizon nor lithologic change in the various wells. Thickness maps of the Greenbrier vary considerably because of difficulty in determining the top of the formation. Nevertheless, the Greenbrier definitely is thickest in the Greendale syncline in Virginia, and considerable variation in thickness exists, even though the exact amount of change is difficult to determine.

About half of the oil and gas production from the Greenbrier limestone in West Virginia comes from the clastic oolitic limestone beds, and the other half comes from the dolomitic limestone in the basal 30 feet, according to Rittenhouse (1949, p. 1728). Porous and permeable zones in the Greenbrier apparently are confined to these zones.

In southwestern Virginia, crossbedded oolitic limestone occurs at intervals throughout the Greenbrier limestone. The oolites range from ¼ mm to 2 mm in diameter, and some pisolites, larger than 2 mm in diameter, are present. The matrix encasing the oolites is dense gray to brown argillaceous limestone, which is similar to the very sparsely oolitic limestone that makes up most of the Greenbrier limestone. Rounded and frosted quartz grains are present in the oolitic limestone, but they seldom exceed 1 to 2 percent of the rock; fine angular quartz grains are also present. It may be possible to corre-

late the oolitic limestone from well to well in a field. However, oolitic limestone may be present in one well and may be absent in another well a mile away. Rittenhouse (1949 p. 1711–1714) described similar clastic oolitic limestone in the Greenbrier limestone in West Virginia; however, in West Virginia the percentage of oolites is higher and the beds are thicker and more numerous than in Virginia. According to Rittenhouse, the clastic oolitic limestone beds are beach or near-shore deposits. If this is correct, when the oolitic beds are traced parallel to the ancient shore lines they should be nearly continuous and should reoccur at the same horizon, but when they are traced from the shore oceanward they may be discontinuous and may occur at different horizons. However, bars and organic reefs might occur in the off-shore direction at the same horizon as the beach or near-shore deposits of oolitic limestone.

Cherty and, in places, dolomitic limestone occurs persistently near the base of the Greenbrier limestone. In surface sections the chert occurs as nodules within the limestone, and the nodules become more abundant as they are traced from Bluefield, W. Va., toward the southwest. In some well samples, chert comprised more than one-fourth of the sample. The dolomitic limestone may be secondary, or it may be primary and related to the evaporites of southwestern Virginia. If it is part of the evaporite series, perhaps it should be included with the Maccrady shale or Little Valley limestone rather than with the Greenbrier limestone. In the correlations given in the well-sample descriptions, only the dolomite clearly associated with red beds is correlated with the Maccrady shale. Additional study of the origin and distribution of dolomitic limestone in the basal Greenbrier limestone is needed to aid the exploration for oil and gas in Virginia and West Virginia.

Red limestone and shale occur in the lower part of the Greenbrier limestone. They have been called the Taggard limestone by Reger (1926, p. 476–480). Wilpolt and Marden (1949) recognized the Taggard limestone of Reger in their surface sections, but they were unable to trace it in the subsurface. In a few wells, red limestone and shale occur at about the horizon of Reger's Taggard limestone. At present, there is not enough evidence to determine whether the Taggard limestone of Reger is widespread at the surface and generally absent in the subsurface, or whether these thin red beds are not represented in samples. It is possible that several tongues of red shale and limestone extend into the Greenbrier limestone facies, as suggested by Cooper (1948, p. 260). The Taggard limestone of Reger probably represents a finger, or fingers, of the red shale facies of the Maccrady shale and may indicate the partial equivalence of the Greenbrier limestone and the Maccrady shale.

The Little Valley limestone is the producing formation in the Early Grove gas field. According to Averitt (1941, p. 17–21), the formation consists mainly of argillaceous limestone with one or more beds of fine-grained sandstone, and is equivalent to the Maccrady shale. Cooper (1944, p. 154–157) recognized the Little Valley limestone below the Greenbrier limestone in Tazewell County, Virginia. This limestone is thickest in the type region in the Greendale syncline. It was not recognized in the subsurface in Buchanan and Dickenson Counties, but it may be represented in the basal part of the Greenbrier limestone.

The contact between the Greenbrier limestone and Little Valley limestone or Maccrady shale is sharp and easily determined because of the change in color and lithology. According to present definition, the Maccrady shale is identified by the presence of red beds. Where the Maccrady shale is absent, the Maccrady time interval is probably represented by a facies of the underlying, or overlying, formation. Apparently, it is absent in the Pipe Line Construction & Drilling Co., A. L. Powers No. 1 well, although it may be present in the United Producing Co., Yukon-Pocahontas No. 2 well. It is thin, or absent, in most of the Keen Mountain field wells and in the wells near Grundy, but it is present in most of the other wells in southwestern Virginia. In the United Fuel Gas Co., A. W. Hicks No. 6478 well, dolomite and anhydrite are included in the Maccrady shale because the red shale appears to be intimately related to the evaporites.

The contact between the Maccrady shale and the Price sandstone of southwestern Virginia or the equivalent Pocono formation in West Virginia is drawn at the base of the red beds.

The Price sandstone consists mainly of sandstone and siltstone, with thin beds of coal near the middle and with conglomerate in the lower part of the formation. In the wells in Buchanan, Dickenson, and Wise Counties, the Price sandstone grades into, or interfingers with, dark-colored shales and siltstones. In Tazewell County and in the counties to the northeast, red and gray sands and shales of the Chemung formation grade upward into the Price sandstone. The basal contact of the Price sandstone is inconspicuous everywhere, and fossils are used to distinguish the formation from the underlying Devonian rocks. The base of the Mississippian is unrecognizable in many wells, because diagnostic fossils are not present in the sample. Consequently, the base of the Price sandstone is not necessarily at the same stratigraphic position in the various well-sample descriptions in the open-file report.[4] Conglomerate is present at the base of the Price sand-

[4] Huddle, J. W., Jacobsen, E. T., Williamson, A. D., and others, 1955. Detailed logs of 28 wildcat wells in Lee, Wise, Buchanan, Montgomery, and Dickenson Counties, Va. Open-file report. Original copy on file in the Geological Survey library, Washington, D. C. Microfilm on file and available for purchase through the Kentucky Geological Survey, Lexington, Ky., and the Virginia Division of Geology, University Station, Charlottesville, Va.

stone at some localities, but it is absent in many surface sections and wells. According to Cooper (1944, p. 149), the Price contains a conglomerate 200 to 300 feet above the base at Bluefield, Va. This is the reason that the conglomerate in the nearby United Fuel Gas Co., well Nos. 6478 and 6219 was not taken as the base of the Price sandstone. The United Producing Co., Yukon-Pocahontas Coal Co. No.2 well shows much siltstone in the Price sandstone, and the formation is a siltstone in most of the wells to the northeast in Buchanan County. In the California Co., Kipps Anthracite Coal Co. No. 1 well, the base of the Price is drawn arbitrarily at a change from siltstone to shale. Coal is present in the sample at a depth of 1,090 feet, and the contact between the Price sandstone and the Upper Devonian was selected at the first change in lithology below the coal. Coal is unusual in the lower part of the Price sandstone, which is normally marine in this area, but coal is even more unlikely in the Upper Devonian. Several samples in the lower part of the Price are calcareous. Calcareous beds are uncommon in the surface sections of Price sandstone, but fossiliferous beds are known, and such beds could be calcareous in the subsurface, where they have not been weathered.

MISSISSIPPIAN AND UPPER DEVONIAN FORMATIONS

The name "Big Stone Gap shale" is used in the original broad sense of Stose (chapter in Eby, 1923a, p. 46–53). It consists of a thick series of dark-gray and black shale with smaller amounts of gray shale and siltstone. At Bluefield, Va., about 10 feet of black shale lies between the overlying Price sandstone and the underlying Chemung formation. Cooper (1944, p. 143–144) traced this black shale from Bluefield to Scott County, Va., and is confident that the 10 feet of black shale at Bluefield is the Big Stone Gap shale. In the wells in Buchanan, Dickenson, and Wise Counties there are no satisfactory criteria to distinguish the Price sandstone, Big Stone Gap shale, Chemung formation, and the Brallier shale, but these wells show an increasing thickness of black shale toward the southwest. This agrees with surface evidence showing that the black shale increases in thickness toward Scott and Lee Counties. Martens (1945, p. 11), in a West Virginia deep-well report, does not divide this interval and calls it the "Devonian shales."

DEVONIAN FORMATIONS

The Chemung and Brallier formations consist of sandstone, siltstone, and shale with some calcareous beds. At the surface, the Chemung is distinguished from the Brallier on the basis of stratigraphic position, fossils, and lithology. The Chemung formation

contains thicker sandstones and more sandy beds than the underlying Brallier shale, and the Brallier becomes thinner-bedded and has fewer sandstones toward the base. Undoubtedly, the contact between the two formations is gradational, and, without fossil evidence, it is very difficult to distinguish these formations. The contact between the formations in the well records here reported is determined primarily by the amount of siltstone present.

Red sandstones of the Catskill type in northern Virginia have been called the Hampshire formation by Butts (1940, p. 333–335). Cooper (1944, p. 145–151) reported red sandstone in the lower part of the Price sandstone near Bluefield, W. Va. Red sandstone also occurs in the samples between 1,490 and 1,830 feet in the California Co., Kipps Anthracite Coal Co. No. 1 well. These may be equivalent of the Hampshire formation of West Virginia, or they may belong in the lower part of the Price sandstone. This type of red bed was not seen in the samples of any other well.

A black fissile shale above the Huntersville chert of Price (1929) is called Millboro shale (Butts, 1941, p. 308–312) in this report on the basis of lithology and stratigraphic position. The upper contact of the formation is gradational into the overlying formation, whether it is the Brallier, Chemung, or Big Stone Gap. The subdivision of the rocks between the Millboro of Butts (1940) and the Price sandstone is unsatisfactory, and additional surface and subsurface mapping and stratigraphic study are needed to determine the Devonian stratigraphy of this area. Only some of the more obvious phases of the facies problems are understood at present.

The Cumberland Mountain thrust block rides on the black shale series in Wise and Dickenson Counties. The Clinchfield Coal Corp., well Nos. 102, 105, and 106 show evidence of the Pine Mountain overthrust fault. In the wells that penetrated the fault zones the black shale has been altered to a coal-like graphitic shale in the gouge zones. Apparently, the stratigraphic displacement is not great, and the movement must have been mainly horizontal in the black shale, because all the wells penetrate a normal succession of strata and penetrate the Huntersville chert of Price (1929) immediately below the black shales.

Price's Huntersville chert includes gray, white, and black chert; siliceous limestone; and siltstone. It is quite unlike any of the younger rocks and is easily recognized in the normal section; however, it could be confused with some of the older rocks in the area. In Tazewell County, there are two zones of glauconite in the Huntersville chert (Cooper, 1944, p. 132–133). In the United Fuel Gas Co., New River Pocahontas Coal Co. No. 6219 well in McDowell County, West Virginia, glauconite is present in the samples here correlated with the

Huntersville chert, but glauconite also occurs in the "Oriskany" sands of the West Virginia subsurface (Martens, 1945, p. 11, 12). The following wells in southwest Virginia have penetrated the Huntersville chert of Price (1929): the California Co., Kipps Anthracite Coal Co. No. 1 well, Montgomery County; the United Producing Co., C. L. Ritter No. 1–1527 well, Buchanan County; and the Clinchfield Coal Corp., Arch Rose No. 105 well, Dickenson County. The Clinchfield Coal Corp., G. W. C. Smith No. 106 well probably reached Price's Huntersville, but the samples have not been studied for the deeper portion of this well. The Southwestern Oil & Gas Co., Hagan No. 3 well in Wise County also penetrated the Huntersville chert of Price (1929), but no samples are available. The Jenkins and others, Osborne No. 1 well in Wise County started below Price's Huntersville chert, and the first cuttings preserved were between 225 and 230 feet in the Clinton formation.

Part of the Huntersville chert of Price (1929) may have been cut off by the Pine Mountain overthrust in the Clinchfield Coal Corp., Arch Rose No. 105 well. In the California Co., Kipps Anthracite No. 1 well in Montgomery County, Price's Huntersville chert primarily is hard siliceous limestone and quartzitic sandstone with very low porosity. Lithologically, it is quite different from Price's Huntersville chert as found in the wells in West Virginia and in Buchanan and Dickenson Counties.

It is not possible in any of the wells to distinguish between the Rocky Gap sandstone of Swartz (1929) and the Ridgeley sandstone, because fossils necessary to distinguish these sandstones are not available in the well samples. The formations are equivalent to the beds called the Oriskany sandstone in West Virginia wells (Martens, 1939, p. 30–36). The type Oriskany sandstone of New York is not directly traceable into the area under discussion, but the Rocky Gap sandstone of Swartz (1929) and Ridgeley sandstone are mapped in southwestern Virginia; these names are preferred because the correlation with the Oriskany sandstone of New York is doubtful. The underlying fossiliferous limy shales are called Helderberg limestone in West Virginia, but they have been identified as New Scotland limestone in the United Fuel Gas Co., New River Pocahontas Coal Co. No. 6219 well and in the United Producing Co., C. L. Ritter No. 1–1527 well, in accordance with the terminology used by the Virginia Geological Survey. Some of the rocks included in this interval may be of Silurian age.

SILURIAN FORMATIONS

The Upper Silurian formations cropping out in southwestern Virginia are called Hancock limestone in Lee County and are called

Tonoloway limestone in Tazewell County and other counties toward the northeast. The Hancock limestone is penetrated by a number of the wells in Lee County. Limestone of Late Silurian age is not reached by the wells in Dickenson and Buchanan Counties, except by the United Producing Co., C. L. Ritter No. 1–1527 well. The United Fuel Gas Co. No. 6219 well, McDowell County, W. Va., encountered 336 feet of dolomite and anhydrite in the Upper Silurian rocks. The name "Cayuga dolomite" is used for Silurian rocks in these wells because this term indicates less-precise correlation than Hancock limestone or Tonoloway limestone, and the evidence does not justify an exact correlation. The beds called Cayuga dolomite in United Fuel Gas. Co. No. 6219 well are probably equivalent to those called the Salina formation in central and northern West Virginia by Martens (1945, p. 12–13).

The sandstones of the Clinton and Clinch formations are very hard and quartzitic in the northern counties of the area under consideration, but they become argillaceous and thin bedded toward the southwest in Lee County. Usually, the sandstones of the Clinton and Clinch formations can be recognized in well samples by the presence of hard quartzitic sandstone and by the red iron ores that occur in the sandstones of the Clinton formation. The iron ores are most abundant in the lower part of the Clinton. The Silurian sandstone section was penetrated by the wells in the Rose Hill and Jonesville areas, by the Jenkins and others Osborne No. 1 well in Wise County, and by the California Co., Kipps Anthracite Coal Co., No. 1 well in Montgomery County.

CORRELATION OF FORMATIONS IN THE ROSE HILL FIELD, EARLY GROVE FIELD, AND OUTLYING WELLS

Only two wells from the Rose Hill field were studied for this report. They were correlated with the aid of information supplied by R. L. Miller, who checked the correlations. Miller and Fuller (1954) in their Rose Hill report have a table giving the diagnostic characters of the older rocks as seen in samples (this material is not repeated here). Averitt (1941, p. 23–25) discussed the correlation of the Early Grove gas field wells (this discussion is not repeated here). The outlying wells, such as the California Co., Kipps Anthracite Coal Co. No. 1 well, and the Jenkins and others, Osborne No. 1 well, have been correlated by comparison with nearby surface sections. The Jenkins and others, Osborne No. 1 well, was compared with the Hagan section measured by Miller and Brosgé (1950), the Powell Valley sections measured by Bates (1939), the Wise County sections

measured by Eby (1923a), and the Tazewell County section measured by Cooper (1944).

SUMMARY

In recent years, geologists have become increasingly aware of the complexity of Appalachian geosynclinal stratigraphy. The recognition of deltaic and related depositional environments has led to a better understanding of the relationships of many of the formations and to the elimination of some of the unconformities and formations. Special problems of the relationship of the Mississippian formations were suggested in a paper by Cooper (1948). The problems of the Devonian rocks of this character have not yet received study, and the problems of the Silurian and Ordovician rocks have not yet been completely solved. Much stratigraphic work remains to be done in the Valley of Virginia and adjacent areas before the complex picture is completed. In southwest Virginia, deposition appears to have been essentially continuous from the beginning of Millboro time of Butts (1940) until the end of Pottsville time. Sharp contacts and easily traced key beds are unusual. The rocks were deposited in the subaerial and seaward portions of deltas and in the adjacent bays, lagoons, and open sea. At times the climate was moist, and coal-forming swamps were present in the deltas. At other times the climate was dry, and evaporites were deposited in local areas. The complicated facies that resulted from these conditions will be better understood as additional wells are drilled and as better stratigraphic control is available. Additional drilling in the Cumberland overthrust block will provide more control on the nature and character of the Pine Mountain overthrust if the wells are drilled through the overthrust block. Many other stratigraphic and structural problems remain in southwestern Virginia. Additional subsurface studies will be extremely helpful in solving some of these problems.

WELL LOGS

[Complete sample descriptions are available in open-file reports of the U. S. Geological Survey]

VIRGINIA

BUCHANAN COUNTY

Clinchfield Coal Corp. No. 102 well

Clinchfield Coal Corp., owner
Located 5,000 ft west of 82°10′; 4,500 ft south of 37°10′.
Elevation, 1,373.2 ft. Total depth, 5,847 ft.
Drilling commenced Nov. 16, 1948; deepened, Feb. 1, 1950 to Apr. 7, 1950.
Production: None.
Coal at 268–275, 350–354, 375–392, 553–555, 898–905, 1,052–1,060, 1,080–1,090, 1,103–1,114, 1,440–1,450, 1,470–1,500, 1,529–1,543, 1,592–1,610, 2,769–2,771 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	512+	535
Lee formation	1,103	1,638
Bluestone formation	580	2,218
Princeton sandstone	67	2,285
Hinton formation:		
Avis limestone of Reger	57	2,342
Hinton formation undivided	243	2,585
Stony Gap sandstone member	263	2,848
Bluefield formation	502	3,350
Greenbrier limestone	386	3,736
Maccrady shale	57	3,793
Price sandstone	347	4,140
Big Stone Gap shale	368+	4,508

Yukon-Pocahontas Coal Co. No. 2-1466 well

United Producing Co.
Located 200 ft south of 37°10′; 13,800 ft east of 82°05′.
Elevation, ground, 1,751 ft. Total depth, 5,100 ft; filled back to 4,216 ft.
Drilling commenced Nov. 13, 1947; completed July 7, 1948.
Production: 30 million cubic feet (initial).
Shows: gas at 1,585, 3,062–3,076, 4,058, 4,375 ft; oil at 1,086 ft.
Coal at 390–400, 424–435, 484–493, 581–592, 750–756, 769–775, 852–863, 957–963, 971–978, 1,119–1,125, 1,147–1,155, 1,214–1,220, 1,258–1,269, 1,280–1,287, 1,373–1,383, 1,475–1,484, 1,563–1,572, 1,647–1,652, 1,692–1,700, 1,700–1,706, 1,883–1,887, 1,887–1893, 2,275–2,287 ft.
Sample-library reference: Virginia Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	502+	581
Lee formation	1,369	1,950
Bluestone formation	482	2,432
Princeton sandstone	148	2,580
Hinton formation:		
Avis limestone of Reger	65	2,645
Hinton formation undivided	385	3,030
Stony Gap sandstone member	185	3,215

Formations	Thickness (feet)	Depth to base of formation (feet)
Bluefield formation	505	3,720
Greenbrier limestone	603	4,323
Maccrady(?) shale	17	4,340
Price sandstone	285	4,625
Big Stone Gap shale	323	4,948
Chemung formation	152+	5,100

F. H. Curtis No. 1-A well

Pipe Line Construction & Drilling Co.
Located 9,800 ft west of 82°00′; 29,400 ft south of 37°25′.
Elevation, 1,987.44 ft. Total depth, 3,461 ft.
Drilling commenced Oct. 3, 1948; completed June 1, 1949.
Production: 6,005.3 million cubic feet (initial) at 3,397–3,431 ft.
Shows: gas at 1,485, 2,750, 2,760, 3,386 ft; oil at 1,022, 2,250 ft.
Coal at 456–460, 2,127–2,132, 2,132–2,137, 2,137–2,142, 2,146–2,150, 3,029–3,033 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	659+	1,010
Lee formation	1,219	2,229
Bluestone formation	371	2,600
Princeton sandstone	200	2,800
Hinton formation:		
Avis limestone of Reger	50	2,850
Hinton formation undivided	367	3,217
Stony Gap sandstone member	58	3,275
Bluefield formation	186+	3,461

R. A. Looney No. 1-1659 well

United Producing Co.
Located 30,100 ft south of 37°25′; 11,600 ft west of 82°00′.
Elevation, ground, 2,076 ft. Total depth, 4,175 ft.
Drilling commenced Sept. 8, 1949; completed Jan. 19, 1950.
Production: None.
Shows: gas at 1,555 and 2,247 ft; oil at 1,205 ft.
Coal at 28–30, 57–60, 115–117 ft according to drillers' log; 362–367, 391–399, 407–413, 413–419, 1,464–1,473, 1,552–1,559, 1,601–1,612, 1,976–1,980, 2,162–2,170, 2,178–2,183, 2,195–2,198, 2,198–2,206, 2,206–2,212, 2,215–2,218 ft.
Sample-library reference: Virginia Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	789+	1,125
Lee formation	1,210	2,335
Bluestone formation	465	2,800
Princeton sandstone	124	2,924
Hinton formation:		
Avis limestone of Reger	54	2,978
Hinton formation undivided	252+	3,230

Formations	Thickness (feet)	Depth to base of formation (feet)
(No sample)	502	3, 732
Bluefield formation	36+	3, 768(?)
Greenbrier limestone	339(?)	4, 107
Maccrady shale	68+	4, 175

W. H. Matney No. 1 well

United Producing Co.
Located 20,900 ft south of 37°20′; 14,900 ft west of 82°00′.
Elevation, ground, 1,769.86 ft. Total depth, 2,870 ft.
Drilling commenced June 10, 1949.
Coal at 202–205, 507–512, 600–604, 691–698, 895–902, 1,043–1,050, 1,167–1,175, 1,310–1,322, 1,603–1,605, 1,605–1,613, 1,659–1,667, 1,763–1,769 ft.
Sample-library reference: Virginia Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	694+	718
Lee formation	1, 132	1, 850
Bluestone formation	381+	2, 231

A. L. Powers No. 1 well

Pipe Line Construction & Drilling Co.
Located 16,300 ft west of 82°00′; 20,400 ft south of 37°20′.
Elevation, 1,509.25 ft. Total depth, 3,725 ft.
Drilling commenced Sept. 5, 1948; completed Apr. 10, 1949.
Production: 3,452 million cubic feet at 3,332–3,334, 3,472–3,474, 3,500–3,508 ft.
Shows: gas at 315, 843, 2,609–2,619 ft.
Coal at 485–489, 1,375–1,380 ft.
Sample-library reference: Virginia Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	407+	528
Lee formation	1, 062	1, 590
Bluestone formation	360	1, 950
Princeton sandstone	168	2, 118
Hinton formation:		
Avis limestone of Reger	67	2, 185
Hinton formation undivided	227	2, 412
Stony Gap sandstone member	209	2, 621
Bluefield formation	519	3, 140
Greenbrier limestone	370	3, 510
Maccrady shale	118	3, 628
Price sandstone	97+	3, 725

R. J. Carlson No. 1 well

Keen Mountain field

Pipe Line Construction & Drilling Co.
Located 3,500 ft west of 81°55′; 29,400 ft south of 37°20′.
Elevation, 2,122.62 ft. Total depth, 4,731 ft.

Drilling commenced June 10, 1948; completed Feb. 23, 1949.
Production: 400 million cubic feet at 4,040–4,044 ft.
Shows: gas at 1,228–1,233, 1,900–1,905, 3,176, 3,833–3,835 ft.
Coal at 1,065–1,074, 1,176–1,196, 1,202–1,212, 1,735–1,750, 1,911–1,920, 2,323–2,330 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	170+	808
Lee formation	1,364	2,172
Bluestone formation	501	2,673
Princeton sandstone	86	2,759
Hinton formation:		
Avis limestone of Reger	81	2,840
Hinton formation undivided	551	3,391
Stony Gap sandstone member	139	3,530
Bluefield formation	385	3,915
Greenbrier limestone	569	4,484
Maccrady shale	101	4,585
Price sandstone	127+	4,712

National Shawmut Bank of Boston No. 5810 well

United Fuel Gas Co.
Located 15,000 ft north of 37°20′; 9,800 ft west of 81°55′.
Elevation, ground, 1,263.12 ft. Total depth, 5,302 ft.
Drilling commenced Feb. 2, 1949; completed Aug. 12, 1949.
Production: None.
Shows: gas at 222, 494, 917, 1,209, 1,350, 2,274–2,279, 2,308–2,312, 2,805, 2,812, 3,151–3,200 ft.
Coal at 285–291, 310,315, 335–345, 440–450, 828–836, 836–841, 915–926, 964–973 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	426+	486
Lee formation	932	1,418
Bluestone formation	374	1,792
Princeton sandstone	108	1,900
Hinton formation:		
Avis limestone of Reger	37	1,937
Hinton formation undivided	249	2,186
Stony Gap sandstone member	88	2,274
Bluefield formation	619	2,893
Greenbrier limestone	338	3,231
Maccrady shale	147	3,378
Price sandstone	231	3,609
Big Stone Gap shale	288	3,897
Chemung and Brallier formations	888	4,785
Millboro shale of Butts (1940)	520+	5,305

Slocum Land Corp. No. 1-1525 well

Keen Mountain field
United Producing Co.
Located 29,950 ft south of 37°20′; 13,000 ft west of 81°55′.
Elevation, ground, 1621.2 ft. Total depth, 2,365 ft (filled back to 2,345 ft.)
Drilling commenced Mar. 29, 1947; completed Aug. 28, 1948.
Production: 348 million cubic feet at 1,005, 2,306 ft.
Coal at 2,164–2,175, 2,193–2,202, 2,210–2,220, and 2,230–2,239 ft.
Sample-library reference: Virginia Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Bluestone formation	421+	2,286
Princeton sandstone	79+	2,365

Slocum Land Corp. No. 2-1539 well

Keen Mountain field
United Producing Co.
Located 11,200 ft west of 81°55′; on 37°15′.
Elevation, ground, 1933.7 ft. Total depth, 4,611 ft.
Drilling commenced Dec. 1, 1948; completed Sept. 22, 1949.
Shows: gas at 1,253, 4,119, 4,412 ft.
Coal at 421–433, 574–579, 623–645, 1,018–1,032, 1,245–1,256, 1,407–1,417, 1,437–1,449, 1,505–1,521, 1,675–1,692, 1,698–1,702, 1,718–1,725, 1,725–1,728, 1,803–1,827, 1,835–1,842 ft.
Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 1,865–2,713 ft.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	314+	735
Lee formation	1,130+	1,865

Hugh McRae No. 6431 well

United Fuel Gas Co.
Located 4,350 ft south of 37°10′; 9,800 ft east of 82°00′.
Elevation, ground, 1799.14 ft. Total depth, 4,800 ft (plugged to 2,530 ft).
Drilling commenced Oct. 16, 1948; completed July 28, 1949.
Production: 133 million cubic feet at 935–938 ft.
Shows: gas at 810, 1,348–1,352 ft; oil at 2,678–3,036 ft.
Coal at 482–488, 500–508, 531–537, 609–618, 676–684, 775–780, 792–798, 868–878, 933–941, 956–962, 1,239–1,249, 1,340–1,354, 1,408–1,418 ft.
Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 275–998 ft.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	145+	420
Lee formation	1,332	1,752
Bluestone formation	443	2,195
Princeton sandstone	171	2,366

Formations	Thickness (feet)	Depth to base of formation (feet)
Hinton formation:		
Avis limestone of Reger	71	2, 437
Hinton formation undivided	410	2, 847
Stony Gap sandstone member	310	3, 157
Bluefield formation	534	3, 691
Greenbrier limestone	524	4, 215
Maccrady shale	54	4, 269
Price sandstone	232	4, 501
Big Stone Gap shale	299+	4, 800

C. L. Ritter No. 1-1527 well

Keen Mountain field
United Producing Co.
Located 3,000 ft south of 37°15′; 9,500 ft west of 81°55′.
Elevation, derrick, 2,252 ft. Total depth, 8,012 ft.
Drilling commenced May 11, 1948.
Coal at 2,189–2,197, 2,821–2,831, 3,190–3,200 ft.
Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 7,177–7,448 ft.

Formations	Thickness (feet)	Depth to base of formation (feet)
Lee formation	287+	2, 400
Bluestone formation	461	2, 861
Princeton sandstone	133	2, 994
Hinton formation:		
Avis limestone of Reger	52	3, 046
Hinton formation undivided	502	3, 548
Stony Gap sandstone member	174	3, 722
Bluefield formation	411	4, 133
Greenbrier limestone	517	4, 650
Maccrady shale	104	4, 754
Price sandstone	246	5, 000
Big Stone Gap shale	274	5, 274
Chemung and Brallier formations	1, 215	6, 489
Millboro shale of Butts (1940)	646	7, 135
Huntersville chert of Price (1929)	55	7, 190
(No sample)	48	7, 238
New Scotland limestone	120	7, 358
Cayuga dolomite	228	7, 586
Clinton formation	56+	7, 642

W. M. Ritter No. 1-V-1461 well

Keen Mountain field
United Producing Co.
Located 2,100 ft south of 37°15′; 12,250 ft west of 81°55′.
Elevation, ground, 1619.16 ft. Total depth, 2,301 ft.
Drilling commenced Aug. 20, 1947; completed Feb. 1, 1948.
Production: 17,196 million cubic feet at 2,295–2,301 ft.
Shows: gas at 714–724, 1,086, 1,405, 1,550 ft.
Coal at 264–283, 614–625, 696–698, 701–711, 726, 722–756, 1,409–1, 419, 1,437–1,447, 1,547–1,560 ft.

Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 650–2,300 ft.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	404+	426
Lee formation	1,329	1,755
Bluestone formation	378	2,133
Princeton sandstone	168±	2,301

W. M. Ritter No. 2-V-1481 well

Keen Mountain field
United Producing Co.
Located 2,500 ft south of 37°15′; 15,500 ft west of 81°55′.
Elevation, ground, 1726.3 ft. Total depth, 4,275 ft (filled back to 2,480 ft).
Drilling commenced Apr. 9, 1948; completed Feb. 16, 1949.
Production: 51 million cubic feet T. P. at 458, 2,460 ft.
Shows: oil at 3,871, 3,880 ft.
Coal at 2,336–2,343, 2,381–2,398 ft.
Sample-library reference: Virginia Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Bluestone formation	163+	2,401
Princeton sandstone	134	2,535
Hinton formation:		
Avis limestone of Reger	52	2,587
Hinton formation undivided	513	3,100
Stony Gap sandstone member	162	3,262
Bluefield formation	411	3,673
Greenbrier limestone	502	4,175
Maccrady(?) shale	87±	4,262

W. M. Ritter No. 4-V-1557 well

Keen Mountain field
United Producing Co.
Located 4,700 ft south of 37°15′; 15,600 ft west of 81°55′.
Elevation, derrick, 2258.64 ft. Total depth, 4,928 ft (hole plugged to 4,688 ft).
Drilling commenced Sept. 16, 1948; completed May 22, 1949.
Production: None.
Shows: gas at 1,988–1,991, 2,475–2,782 ft; oil at 2,475–2,482 ft.
Coal at 808–811, 824–830, 908–917, 922–933, 933–942, 1,431–1,436, 1,588–1,594, 2,171–2,181, 2,191–2,200, 2,914–2,918 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey, 3,464–4,675 ft.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	579+	959
Lee formation	1,515	2,474
Bluestone formation	440	2,914
Princeton sandstone	142	3,056

Formations	Thickness (feet)	Depth to base of formation (feet)
Hinton formation:		
Avis limestone of Reger	65	3, 121
Hinton formation undivided	515	3, 636
Stony Gap sandstone member	143	3, 779
Buefield formation	410	4, 189
Greenbrier limestone	486+	4, 675

Yukon-Pocahontas Coal Company No. 3-1563 well

Keen Mountain field
United Producing Co.
Located 6,500 ft south of 37°15′; 14,000 ft west of 81°55′.
Elevation, ground, 1,673.5 ft. Total depth, 4,399 ft (plugged to 4,140 ft).
Drilling commenced Nov. 13, 1948; completed May 7, 1949.
Production: 6,152 million cubic feet.
Shows: gas at 1,577, 1,590, 3,885–3,905 ft.
Coal at 170–175, 298–305, 742–748, 778–784, 1,058–1,071, 1,446–1,465, 1,577–1,593 ft.
Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 1,790–2,188, 2,215–4,283 ft.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	420+	500
Lee formation	1, 378	1, 878
Bluestone formation	450	2, 328
Princeton sandstone	124	2, 452
Hinton formation:		
Avis limestone of Reger	78	2, 530
Hinton formation undivided	562	3, 092
Stony Gap sandstone member	110	3, 202
Bluefield formation	476	3, 678
Greenbrier limestone	460	4, 138
Maccrady shale	68	4, 206
Price sandstone	77+	4, 283

Yukon-Pocahontas Coal Company No. 4-1646 well

Keen Mountain field
United Producing Co.
Located 7,400 ft south of 37°15′; 12,000 ft west of 81°55′.
Elevation, ground, 1752.6 ft. Total depth, 2,404 ft.
Production: 20,134 million cubic feet (initial) at 2,391, 2,392, 2,400, 2,404 ft. (main production).
Shows: gas at 1,030, 1,461–1,465, 1,595–1,601 ft.
Coal at 148–152, 182–186, 194–198, 285–288, 310–315, 350–355, 381–387, 675–682, 788–796, 1,026–1,036, 1,102–1,111, 1,246–1,256, 1,461–1,464, 1,592–1,559, 1,599–1,608 ft.
Sample-library reference: Virginia Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	583+	723
Lee formation	1, 175	1, 898
Bluestone formation	485	2, 383
Princeton sandstone	8+	2, 391

Yukon-Pocahontas Coal Co. No. 5-1647 well

Keen Mountain field
United Producing Co.
Located 10,600 ft south of 37°15′; 15,200 ft west of 81°55′.
Elevation, ground, 1826.4 ft. Total depth, 4,358 ft.
Drilling commenced Aug. 30, 1949; completed Jan. 1, 1950.
Production: 926 million cubic feet (initial) at 4,014, 4,095, 4,262–4,266½ (main production), 4,358 ft.
Shows: gas at 1,767, 3,940 ft.
Coal at 82–90, 99–101, 184–190, 243–248, 507–510, 1,028–1,030, 1,202–1,208, 1,281–1,291, 1,609–1,611, 1,767–1,773, 1,864–1,873 ft.
Sample-library reference: Virginia Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	669+	669
Lee formation	1,413	2,082
Bluestone formation	410	2,492
Princeton sandstone	157	2,649
Hinton formation:		
Avis limestone of Reger	64	2,713
Hinton formation undivided	501	3,214
Stony Gap sandstone member	170	3,384
Bluefield formation	505	3,889
Greenbrier limestone	459	4,348
Maccrady shale	6+	4,354

DICKENSON COUNTY

Clinchfield Coal Corp. No. 101 well

Nora field
Clinchfield Coal Corp.
Located 4,500 ft± west of 82°20′; 6,200 ft± south of 37°05′.
Elevation, ground, 1,520.5 ft. Total depth, 4,551 ft.
Production: 1,632 million cubic feet (after acid).
Shows: gas at 1,028–1,032 ft.
Coal at 24–32, 145–152, 167–175, 208–213, 321–327, 511–518, 544–550, 663–671, 865–870, 1,097–1,102, 1,182–1,191, 1,261–1,270, 1,316–1,324, 1,470–1,475, 1,649–1,658 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Norton formation	574+	574
Lee formation	1,109	1,683
Bluestone formation	591	2,274
Princeton sandstone	72	2,346
Hinton formation:		
Avis limestone of Reger	71	2,417
Hinton formation undivided	267	2,684
Stony Gap sandstone member	238	2,922
Bluefield formation	441	3,363
Greenbrier limestone	534	3,897

Formations	Thickness (feet)	Depth to base of formation (feet)
Maccrady shale	55	3, 952
Price sandstone	248	4, 200
Big Stone Gap shale	291	4, 491
Chemung formation	60+	4, 551

J. C. Rasnick No. 103 well

Nora field
Clinchfield Coal Corp.
Located 5,000 ft west of 82°20′; 2,900 ft south of 37°05′.
Elevation, ground, 1504.3 ft. Total depth, 3,910 ft.
Drilling commenced May 1949; completed Oct. 18, 1949.
Production: 666 million cubic feet (settled) at 3,817 ft.
Shows: gas at 555, 1,054, 1,519–1,525 ft; oil at 669–670 ft.
Coal at 169–175, 203–206, 336–343, 594–597, 1,042–1,048, 1,177–1,182, 1,266–1,277, 1,374–1,377, 1,405–1,408, 1,514–1,516, 1,525–1,529, 1,594–1,596, 1,629–1,636 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	603+	603
Lee formation	1, 065	1, 668
Bluestone formation	566	2, 234
Princeton sandstone	78	2, 312
Hinton formation:		
Avis limestone of Reger	66	2, 378
Hinton formation undivided	272	2, 650
Stony Gap sandstone member	253	2, 903
Bluefield formation	452	3, 355
Greenbrier limestone	497	3, 852
Maccrady shale	58+	3, 910

E. C. Smith No. 104 well

Nora field
Clinchfield Coal Corp.
Located 2,700 ft west of 82°20′; 8,000 ft south of 37°05′
Elevation, ground, 1,524.14 ft. Total depth, 4,033 ft.
Drilling commenced May 24, 1949; completed Oct. 20, 1949.
Production: 1,555 million cubic feet at 3,974–3,983 ft.
Shows: gas at 1,083–1,085, 1,700–1,706, 3,781–3,786, 3,940–3,945 ft.
Coal at 167–170, 333–338, 343–347, 1,213–1,222, 1,341–1,344, 1,592–1,596, 1,699–1,706, 1,716–1,721, 1,721–1,725, 1,725–1,730, 1,734–1,744 ft.
Sample-library reference: Virginia Geological Survey; Kentucky Geological Survey, 103–1,711 ft.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	498+	601
Lee formation	1, 133	1, 734
Bluestone formation	598	2, 332
Princeton sandstone	70	2, 402

Formations	Thickness (feet)	Depth to base of formation (feet)
Hinton formation:		
Avis limestone of Reger	96	2, 498
Hinton formation undivided	230	2, 728
Stony Gap sandstone member	268	2, 996
Bluefield formation	470	3, 466
Greenbrier limestone	516	3, 982
Maccrady shale	43+	4, 025

Arch Rose No. 105 well

Clinchfield Coal Corp.
Located 11,900 ft west of 82°20′; 7,100 ft south of 37°10′.
Elevation, ground, 1431.3 ft. Total depth, 5,364 ft.
Drilling commenced June 9, 1949; completed Dec. 17, 1949.
Production: 442 million cubic feet (settled).
Shows: gas at 620, 872, 1,011, 4,150–4,157 (?) ft.
Coal at 35–44, 209–214, 227–232, 425–431, 443–447, 793–800, 1,086–1,091, 1,164–1,174, 1,479–1,484 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	679+	679
Lee formation	1, 027	1, 706
Bluestone formation	451	2, 157
Princeton sandstone	125	2, 282
Hinton formation:		
Avis limestone of Reger	51±	2, 333
Hinton formation undivided	271±	2, 604
(No sample)	30	2, 634
Stony Gap sandstone member	94±	2, 728
Bluefield formation	444	3, 172
Greenbrier limestone	373	3, 545
Maccrady shale	66	3, 611
Price sandstone	286	3, 897
Big Stone Gap shale	420	4, 317
Chemung and Brallier formations	?	?
Fault gouge; Pine Mountain overthrust (?)	5	5, 276
Millboro shale of Butts (1940)	?	5, 361
Huntersville (?) chert of Price (1929)	3+	5, 364

G. W. C. Smith No. 106 well

Clinchfield Coal Corp.
Located 5,500′ west of 82°20′; 8,300 ft south of 37°05′.
Elevation, ground, 1525.3 ft. Total depth, 5,754 ft.
Drilling commenced June 21, 1949; completed Jan. 19, 1950.
Production: 539 million cubic feet (settled).
Shows: gas at 684–753, 2,923 (?), 3,735–3,750, 4,459, 4,596–4,600, 4,635 (?) ft.
Coal at 150–162, 323–329 (driller's log), 329–335, 684–687 (driller's log), 953–965, 1,197–1,200 (driller's log), 1,206–1,215, 1,262–1,280, 1,310–1,321, 1,361–1,373 ft.

Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Norton formation	609+	609
Lee formation	1,105	1,714
Bluestone formation	546	2,260
Princeton sandstone	117	2,377
Hinton formation:		
Avis limestone of Reger	108	2,485
Hinton formation undivided	226	2,711
Stony Gap sandstone member	270	2,981
Bluefield formation	495	3,476
Greenbrier limestone	474	3,950
Maccrady shale	57	4,007
Price sandstone	100+	4,107

C. H. Frye No. 1 well

Rose Hill field
Stacy and Cardwell.
Located 150 ft east of 83°22′30″; 6,825 ft north of 30°37′30″.
Elevation, ground, 1,520± ft. Total depth, 1,694 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Copper Ridge dolomite	298+	350
(Pine Mountain Fault)		
Hancock limestone	29	379
Clinton formation	348	727
Clinch sandstone	163	890
Sequatchie formation	271	1,161
Reedsville shale	327	1,488
Trenton limestone	206+	1,694

Alfred Shackleford No. 1 well

Rose Hill field
Stacy and Cardwell.
Located 525 ft east of 83°22′30″; 8,400 ft north of 36°37′30″.
Elevation, 1,550 ft. Total depth, 2,876 ft (?).
Drilling commenced in November 1949; completed Feb. 20, 1950.
Dry hole.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Copper Ridge dolomite	157+	582
(Pine Mountain fault)		
Hancock limestone	29	611
Clinton formation	332	943
Clinch sandstone	152	1,095
Sequatchie formation	246	1,341

Formations	Thickness (feet)	Depth to base of formation (feet)
Reedsville shale	317	1, 658
Trenton limestone	555	2, 213
Eggleston limestone	130	2, 343
Hardy Creek limestone	117	2, 460
Ben Hur (?) limestone	125	2, 585
Woodway (?) limestone	113+	2, 698

WISE COUNTY

Hagan No. 1 well

Southwestern Oil & Gas Co.
Located 200 ft east of 82°30′; 9,500 ft south of 36°55′.
Elevation, 2,500 ft±. Total depth, 3,751 ft.
Production: None.
Shows: gas 110–250 million cubic feet at 1,365, 1,420–1,422, 1,430–1,445, 2,575, 2,732, 3,550–3,570 ft.
Coal at 70–72, 228–230, 304–308 ft.
Samples retained by Virginia Coal & Iron Co., Big Stone Gap, Va.

Formations	Thickness (feet)	Depth to base of formation (feet)
Lee formation	698+	698
Bluestone formation	537	1, 235
Princeton sandstone	220	1, 455
Hinton formation:		
Avis limestone of Reger	32	1, 487
Hinton formation undivided	382	1, 869
Stony Gap sandstone member	193	2, 062
Bluefield formation	582	2, 644
Greenbrier limestone	491	3, 135
Maccrady shale	33	3, 168
Price sandstone	202	3, 370
Big Stone Gap shale	300	3, 670
Chemung formation	81+	3, 751

Hagan No. 2 well

Southwestern Oil & Gas Co.
Located 600 ft west of 82°30′; 9,700 ft south of 36°55′
Elevation, ground, 2,575 ft. Total depth, 1,407 ft.
Drilling commenced Dec. 12, 1940; abandoned as a dry hole.
Production: None.
Coal at 50, 192, 282, 474 ft.
Samples retained by Virginia Coal & Iron Co., Big Stone Gap, Va.

Formations	Thickness (feet)	Depth to base of formation (feet)
Gravel	21	21
Lee formation	499+	520
Bluestone formation	595	1, 115
Princeton sandstone	200	1, 315
Hinton formation:		
Avis limestone of Reger	25	1, 340
Hinton formation undivided	67+	1, 407

Hagan No. 3 well

Southwestern Oil & Gas Co.
Located 500 ft east of 82°30′; 7,500 ft south of 36°55′.
Elevation, ground, 2,600 ft±.
Total depth, 5,348 ft; plugged to 5,000 ft; abandoned at 1,583 ft as a dry hole by Southwestern Oil & Gas Co.; resumed by United Producing Co.
Shows: gas at 1,458, 2,012–2,015, 2,677, 5,235–5,294 ft.
Coal at 114–117, 207–210, 278–281, 415–419 ft.
Samples retained by Virginia Coal & Iron Co., Big Stone Gap, Va.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Lee formation	710+	760
Bluestone formation	590	1,350
Princeton sandstone	216	1,566
Hinton formation:		
Avis limestone of Reger	17+	1,583

Isaac Kaufman No. 1 well

Benedum-Trees Oil Co.
Located 6,400 ft east of 82°40′; 400 ft north of 37°00′.
Elevation, 2,230 ft. Total depth, 3,670 ft.
Drilling commenced Apr. 4, 1932; completed May 27, 1933.
Production: None.
Shows: gas at 335, 1,560, 3,250, 3,600 ft; oil at 2,450–2,470 ft.
Coal at 273–276, 405–410, 1,162–1,166, 1,722–1,725 ft.
Samples retained by Virginia Coal & Iron Co., Big Stone Gap, Va.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Wise formation	14+	38
Gladeville sandstone	67	105
Norton formation	1,070	1,175
Lee formation	876	2,051
Bluestone formation	399	2,450
Princeton sandstone	144	2,594
Hinton formation:		
Avis limestone of Reger	30	2,624
Hinton formation undivided	186	2,810
Stony Gap sandstone member	160	2,970
Bluefield formation	240	3,210
Greenbrier limestone	460+	3,670

Osborne No. 1 well

Osborne No. 1 well
Oliver Jenkins and others.
Located 40 ft southwest of junction of Virginia Highway 610 and County Road 662; 3 miles ± ENE. of East Stone Gap.
Elevation, not known. Total depth, 4,861 ft.
Drilling commenced in 1948; completed Feb. 25–30, 1950.
Production: None.

Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	Thickness (feet)	Depth to base of formation (feet)
Clinton formation	245+	470
Clinch sandstone	208	678
Sequatchie formation	252	930
Reedsville shale	425	1,355
Trenton limestone	550	1,905
Eggleston limestone	122	2,027
Pre-Eggleston limestone of Middle Ordovician age	1,557	3,584
Beekmantown dolomite	713	4,297
Chepultepec dolomite	564+	4,861

GILES COUNTY

F. B. Strader No. 1 well

The California Co.
Located 2,800 ft west of 80° 40′; 1,000 ft north of 37° 16′.
Elevation, not known. Total depth 1,450 ? ft.
Production: None.
No coal.

Formations	Thickness (feet)	Depth to base of formation (feet)
Rome formation	1,443+	1,443

MONTGOMERY COUNTY

Kipps Anthracite Coal Co. No. 1 well

The California Co.
Located 1,190 ft north of 37° 11′; 3,209 ft west of 80° 27′.
Elevation, ground, 2,483.1 ft. Total depth, 9,340 ft.
Drilling commenced Mar. 3, 1949; abandoned Dec. 2, 1949.
Production: None.
Shows: gas at 7,350 and 7,520 ft.
Coal: 1,090–1,100 ? ft.
Sample-library reference: samples and cores at the Virginia Geological Survey.

Formations	Thickness* (feet)	Depth to base of formation (feet)
Price sandstone	950+	1,160
Chemung formation	690	1,850
Brallier shale	1,350	3,200
Millboro shale of Butts (1940)	2,400	5,600
Huntersville chert of Price (1929)	130	5,730
Clinton formation:		
Keefer sandstone member	130	5,860
Cacapon sandstone member	190	6,050
Clinch sandstone	160	6,210
Juniata formation	192	6,402
Martinsburg shale	2,738	9,140
Eggleston limestone	160	9,300
Moccasin limestone	40+	9,340

*No correction for dip.

WEST VIRGINIA

MERCER COUNTY

A. W. Hicks No. 6478 well

United Fuel Gas Co.
Located 1,500 ft south of 37° 20′; 7,600 ft east of 81° 15′.
Elevation, ground, 2,834.18 ft. Total depth, 4,014 ft—well drilling 4,914, Feb. 6, 1951.
Production: 47 million cubic feet; test after shot 26 million cubic feet at 3,180–3,187 ft.
Coal at 678–682, 1,100–1,102, 1,106–1,107, 1,116–1,119, 1,294–1,304 ft.
Sample-library reference: Virginia Geological Survey and Kentucky Geological Survey.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Hinton formation:		
Hinton formation undivided	550+	601
Stony Gap sandstone member	77	678
Bluefield formation	1, 124	1, 802
Greenbrier limestone	1, 206	3, 008
Maccrady shale	166	3, 174
Pocono formation	623	3, 797
Big Stone Gap shale	81	3, 878
Chemung and Brallier formations	136+	4, 014

McDOWELL COUNTY

New River Pocahontas Coal Co. No. 6219 well

United Fuel Gas Co.
Located 1,800 ft north of 37° 15′; 8,750 ft west of 81° 35′.
Elevation, ground, 1,627.16 ft. Total depth, 7,276 ft.
Drilling commenced Oct. 11, 1947; completed Jan. 19, 1949.
Coal at 2,017–2,020, 2,020–2,022, 2,022–2,030, 2,030–2,033, 6,018–6,028 ft.

Formations	*Thickness (feet)*	*Depth to base of formation (feet)*
Bluestone formation	635+	692
Princeton sandstone	49	741
Hinton formation:		
Hinton formation undivided	186	927
Avis limestone of Reger	50	977
Hinton formation undivided	573	1, 550
Stony Gap sandstone member	105	1, 655
Bluefield formation	600	2, 255
Greenbrier limestone	960	3, 215
Maccrady shale	55	3, 270
Pocono formation	414	3, 684
Big Stone Gap shale	160	3, 844
Chemung and Brallier formations	1, 171	5, 015
Millboro shale of Butts (1940)	1, 382	6, 397
Huntersville chert of Price (1929)	61	6, 458
Ridgeley sandstone and Rocky Gap sandstone of Swartz (1929)	59	6, 517
New Scotland limestone	64	6, 581
Cayuga dolomite	442	7, 023
Clinton formation	245	7, 268
Clinch sandstone	8+	7, 276

ANNOTATED BIBLIOGRAPHY

Averitt, Paul, 1941, The Early Grove gas field, Scott and Washington Counties, Va.: Va. Geol. Survey Bull. 56, 50 p.

Gives a descriptive log of one well and graphic logs of three other wells. Describes the field and discusses possibilities of extension. Contains 3 pls., 4 figs., and index and geologic maps.

Bates, R. L., 1939, Geology of Powell Valley in northeastern Lee County, Va.; Contributions to Virginia Geology–II: Va. Geol. Survey Bull. 51, p. 31–94.

Oil and gas possibilities discussed on p. 94; drilling not recommended. Contains 7 pls., 8 figs., and index and geologic maps.

Bevan, A. C., 1942, Virginia's war mineral resources: Va. Geol. Survey Reprint ser. 4, 9 p.

Short note on Early Grove gas field and well near Bergton, Rockingham County, Va.

Butts, Charles, 1927a, Oil and gas possibilities at Early Grove, Scott County, Va.: Va. Geol. Survey Bull. 27, 18 p.

Brief description of the geology of the area, with a discussion of the oil and gas possibilities. Contains 2 figs., including map.

——— 1927b, Fensters in the Cumberland overthrust block in southwestern Virginia: Va. Geol. Survey Bull. 28, 12 p.

Brief discussion of drilling activities prior to 1927 in Rose Hill area, with generalized log of one well. Discusses possibilities for production. Contains 2 pls., including map.

——— 1940, Geology of the Appalachian Valley in Virginia: Va. Geol. Survey Bull. 52, pt. I, 568 p.

Description of the geologic formations of the Appalachian Valley. Contains 63 pls., 10 figs., including index, geologic, and sketch maps.

——— 1941, Geology of the Appalachian Valley in Virginia: Va. Geol. Survey Bull. 52, pt. II, 271 p.

Fossil plates and explanations. Contains 72 pls.

Cooper, B. N., 1944, Geology and mineral resources of Burkes Garden quadrangle, Virginia: Va. Geol. Survey Bull. 60, 299 p.

Discussion of the stratigraphy of rocks encountered in wells in Buchanan and Dickenson Counties, Va. Contains 21 pls., 11 figs., including index and geologic maps.

——— 1948, Status of Mississippian stratigraphy in the central and northern Appalachian region: Jour. Geology, v. 56, no. 4, p. 255–263.

Discussion of Mississippian facies problems.

——— 1949, The search for oil and gas in Virginia: The Commonwealth, p. 28–30, 73–76.

History of oil and gas exploration in Virginia.

Eby, J. B., 1923a (with chapters by Campbell, M. R., and Stose, G. W.), The geology and mineral resources of Wise County and the coal-bearing portion of Scott County, Va.: Va. Geol. Survey Bull. 24, 617 p.

Gives information about a well in Wise County, and discusses oil and gas possibilities, p. 578–583. Contains 45 pls., 55 figs., and index and geologic maps.

Eby, J. B. 1923b, The possibilities of oil and gas in southwest Virginia as inferred from isocarbs: Am. Assoc. Petroleum Geologists Bull., v. 7, no. 4, p. 421–426

By use of isocarbs, he infers that no commercial oil remains in the plateau area of southwest Virginia.

Giles, A. W., 1921, The geology and coal resources of Dickenson County, Va.: Va. Geol. Survey Bull. 21, 224 p.

No discussion of oil and gas, but there are graphic logs of diamond-drill holes. These can be used in studying Pottsville well cuttings. Contains 18 pls., 21 figs., and index and geologic maps.

——— 1925, The geology and coal resources of the coal-bearing portion of Lee County, Va.: Va. Geol. Survey Bull. 26, 177 p.

No discussion of oil and gas, but there are graphic logs of diamond-drill holes given on plate VII. Contains 21 pls., 11 figs., and index and geologic maps.

——— 1927a, An oil seep in the folded Appalachians: Am. Assoc. Petroleum Geologists Bull., v. 11, no. 7, p. 757–763

Report of an oil seep about 2 miles east-southeast of Rose Hill in Lee County, Va. Included also is a very generalized driller's log of a dry hole drilled in late 1922 or early 1923 to a depth of 303 feet, and a well drilled in 1927 to a depth of 400 feet with small production. Both wells stopped in Clinton(?) formation.

——— 1927b, Oil and gas possibilities of Virginia: Econ. Geology, v. 22, no. 8, p. 791–825.

Short discussions of the physiographic provinces of Virginia, including the stratigraphy and possibilities for oil and gas in each province. The Rose Hill well (1921?) is discussed briefly, and the driller's log from Butts' 1923 report on Rose Hill is entered. Eby's report on isocarbs is cited.

Harnsberger, T. K., 1919, The geology and coal resources of the coal-bearing portion of Tazewell County, Va.: Va. Geol. Survey Bull. 19, 195 p.

Diamond-drill logs, p. 23–35, mainly in Pottsville. Contains 14 pls., 17 figs., and index and geologic maps.

Hinds, Henry, 1916, The coal resources of the Clintwood and Bucu quadrangles, Va.: Va. Geol. Survey Bull. 12, 206 p.

Logs of diamond-drill holes.

——— 1918, The Geology and coal resources of Buchanan County, Va.: Va. Geol. Survey Bull. 18, 250 p.

Descriptive logs of deep diamond-drill hole on Dismal Creek, p. 13–16. Contains 16 pls., 22 figs., and index and geologic maps.

Holden, R. J., 1938, Oil shale in Virginia (abstract): Geol. Soc. America Bull., v. 49, no. 12, pt. 2, p. 1950–1951.

Reports of oil distilled from folded Devonian shale in Lee and Wise Counties, Va.

McGill, W. M., 1932, Explorations for oil and gas in southwestern Virginia: The Mountain Empire, v. 1, no. 3, p. 10–11, 16.

Reference to Early Grove and Rose Hill fields and other drilling.

McGill, W. M., 1936, Prospecting for natural gas and petroleum in Virginia: Va. Geol. Survey Bull. 46–B, p. 11–22.

Discussion of oil and gas possibilities; mentions several wells, but gives no logs.

Martens, J. H. C., 1939, Petrography and correlation of deep well sections in West Virginia and adjacent states: West Virginia Geol. Survey, v. 11, 255 p.

Gives discussion of criteria for recognition of formations in subsurface applicable to southwestern Virginia, p. 19–42. Contains 22 pls., 8 figs.

——— 1943, Deep well in Russell County, Va.: Am. Assoc. Petroleum Geologists Bull., v. 27, no. 11, p. 1543–1548.

Sample log of the Penn-Ohio Gas Co.-Clinchfield Coal Corp., Truman No. 1 (272) well.

——— 1945, Well-sample records: West Virginia Geol. Survey, v. 17, 889 p.

Gives sample logs of the Penn-Ohio Gas Co., Truman No. 1 (272) well and of wells in West Virginia counties adjacent to Virginia, p. 862–866.

Martens, J. H. C., and Hoskins, H. A., 1948, A dolomitic zone at the base of the Greenbrier limestone (Big Lime): West Virginia Geol. Survey Repts. No. 4.

Merrels, C. W. 2d, 1946, The Berea sand of southern West Virginia: U. S. Geol. Survey Oil and Gas Inves. Prelim. Map 59.

Map of the Berea sand in southern West Virginia, shows thickness of sands and oil pools in the sand. Text by J. F. Pepper and Wallace de Witt, Jr. Shows the distribution of the Berea sand and the outcrop of the Pocono sandstone in counties adjacent to southwestern Virginia.

Miller, R. L., 1948, Rose Hill oil field, Lee County, Va.: Structure of typical American oil fields, v. 3, p. 452–479.

Discusses the occurrence of oil in this area and the possibility of the extension of the field; maps, and sections.

Miller, R. L., and Brosgé, W. P., 1950, Geology of the Jonesville district, Lee County, Va.: U. S. Geol. Survey Oil and Gas Inves. Prelim. Map 104.

Discussion of oil possibilities and data on all wells in area drilled before 1950.

——— 1954, Geology and oil resources of the Jonesville district, Lee County Va.: U. S. Geol. Survey Bull. 990, 240 p.

Discusses oil and gas possibilities of the Jonesville area and gives available information about wells drilled. Contains 36 figs., 8 pls., and index and geologic maps.

Miller, R. L., and Fuller, J. O., 1944, Geology of the Rose Hill oil field, Lee County, Va.: U. S. Geol. Survey Oil and Gas Inves. Prelim. Map 20.

Data given on about 15 wells. Report superceded by Map 76 (see below).

——— 1947, Geologic and structure contour maps of the Rose Hill oil field, Lee County, Va.: U. S. Geol. Survey Oil and Gas Inves. Prelim. Map 76.

List of wells drilled prior to January 20, 1947, and graphic logs interpreted. Structure and stratigraphy of the field described and possibilities discussed.

Miller, R. L., and Fuller, J. O., 1954, Geology and oil resources of the Rose Hill district—the fenster area of the Cumberland overthrust block—Lee County, Va.: Va. Geol. Survey Bull. 71, 383 p.

Discusses oil and gas possibilities of Lee County, Va., and gives the history of drilling and development to March 1950. Contains 17 figs., 50 pls., and geologic maps.

Price, P. H., 1929, Pocahontas County: W. Va. Geol. Survey County Repts., 531. p.

Reference to Huntersville chert, p. 236. Contains 21 figs., 71 pls., 2 maps.

——— 1942, Discovery of gas in Rockingham County, Va.: Am. Assoc. Petroleum Geologists Bull., v. 26, no. 2, p. 275.

Report of the Great Eastern States Gas Co., C. L. Souder No. 1 well near Bergton, Va. No log is given.

Reger, D. B., 1926, Mercer, Monroe, and Summers Counties: West Virginia Geol. Survey County Rpts., 963 p.

Contains 34 pls., 30 figs., and 6 maps.

Rittenhouse, Gordon, 1949, Petrology and paleogeography of Greenbrier formation: Am. Assoc. Petroleum Geologists Bull., v. 33, no. 10, p. 1704–1730.

Describes the petrology and paleogeography of the Greenbrier formation in Ohio and West Virginia, as determined from study of well samples, insoluble residues, heavy minerals, and thin sections.

Roberts, J. K., 1942, Annotated geological bibliography of Virginia.

Stanton, Cramon, 1949, Oil and gas developments in western and southwestern Virginia: Appalachian Geol. Soc. Bull., v. 1, p. 429–431.

History of exploration for oil and gas.

Swartz, F. M., 1929, The Helderberg group from central Pennsylvania to southwestern Virginia: Pennsylvania Acad. Sci. Proc., v. 3, p. 75–88.

Reference to Rocky Gap sandstone, p. 80. Contains 3 figs., and 1 pl.

Tucker, R. C., 1936, Deep-well records: West Virginia Geol. Survey Repts., v. 7, 560 p.

Record of one Virginia well, p. 276. Contains 1 pl., 2 maps.

——— 1943, Summarized records of deep wells: West Virginia Geol. Survey, v. 16, 938 p.

Summarized records of wells in Lee, Rockingham, and Russell Counties, Va., p. 855–856.

Wentworth, C. K., 1922, The geology and coal resources of Russell County, Va.: Va. Geol. Survey Bull. 22, 179 p.

Graphic diamond-drill logs, pl. III. Contains 28 pls., 16 figs., and index and geologic maps.

Wilpolt, R. H., and Marden, D. W., 1949, Upper Mississippian rocks of southwestern Virginia, southern West Virginia, and eastern Kentucky: U. S. Geol. Survey Oil and Gas Inves. Prelim. Chart 38.

Graphic surface sections and well logs of Upper Mississippian rocks. Several maps showing thickness of stratigraphic units.

Woodward, H. P., 1932, Geology and mineral resources of the Roanoke area, Virginia: Va. Geol. Survey Bull. 35, 172 p.

Oil and gas possibilities discussed, p. 120–121. Contains 29 pls., 8 figs., and index and geologic map.

——— 1938, Outline of the geology and mineral resources of Russell County, Va.: Va. Geol. Survey Bull. 49, County series, no. 2, 91 p.

Oil and gas possibilities and one well discussed, p. 61–63. Contains 13 pls., 9 figs., and index and geologic maps.

INDEX