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DEEP TEST IN ACCOMACK COUNTY, VIRGINIA

Emil Onuschak, Jr.

The J & J Enterprises E. G. Taylor No. 1-G was completed in May, 1971 as a stratigraphic test to "basement" on the Eastern Shore of Virginia near Temperanceville, about eight miles south of the Virginia-Maryland boundary (Figure 1). The test was drilled 4850 feet west of longitude 75°30′W. and 3350 feet north of latitude 37°52′30″N. The well, which was drilled to a total depth of 6272 feet, penetrated the entire section of Coastal Plain sediments. All depths herein discussed, unless specifically stated otherwise, are sample depths uncorrected for lag. They are followed in parentheses by subsea depths calculated from the kelly bushing elevation of 52 feet.

A complete set of samples, taken every ten feet, is on file (W-3180) in the repository of the Virginia Division of Mineral Resources and has been described in detail with a binocular microscope by the writer. Mineralogical and textural characteristics are similar to those in other Middle Atlantic Coastal Plain tests and outcrops. Table 1 is a summary of the formations present.

The descriptive lithologic criteria herein used are explicitly stated and some comparisons are included with units that are defined by other criteria. The "basement" rock of Paleozoic or Precambrian age is a dark-gray porphyroblastic argillite. In a core sample from the test, it was in part conspicuously laminated and crowded with dark spots (Figure 2). The laminations are consistently asymmetrical, very sharp on one side and gradational with the intervening silt-size quartz on the other side. They appear to be graded beds that are primary sedimentary features. The dark spots are biotite porphyroblasts, which are randomly superimposed upon the laminations by subsequent metamorphism. In thin section, the biotite shows a sieve or poikiloblastic texture that is evidence of growth in place during metamorphism. Horizontal and vertical thin sections show a granoblastic texture for the quartz and random orientation for the biotite. The induction-laterolog of the test (Figure 3) indicates the "basement" occurs at depths from 6186 (-6134) feet to 6272 (-6220) feet.

"Red beds" of Triassic age, 116 feet thick, overlie the "basement" and range in depth from 6070 (-6018) feet to 6186 (-6134) feet. These "red beds" are hard red shale that is very micaceous and shows slightly crinkled foliation, which is taken as evidence of indurated shale. Laminations of quartz sand, shale clasts, and quartzite fragments are also present; some individual fragments consisting of associated country rock and calcite probably indicate the presence of calcite-filled fractures.

The Patuxent Formation of Cretaceous age, 4280 feet thick, overlies the "red beds" from depths of 1790 (-1738) to 6070 (-6018) feet. The formation is characterized by very coarse, subangular, feldspathic quartz sand that is variously brown and gray, which marks its contact with the overlying "transitional beds". Sorting varies, but averages only fair; grain size distribution spans three or more grain size classes. Lignite occurs from trace amounts in individual

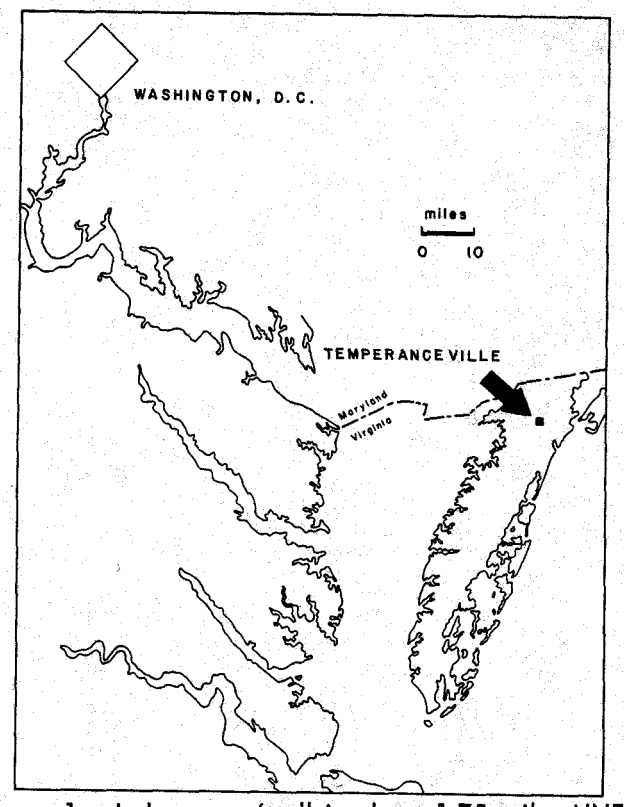

Figure 1. Index map (well is about 1.75 miles NNE of Temperanceville).

samples to as much as 25 percent. Maroon clay that is similar in color, but softer than the red shale of the Triassic, and green silty, micaceous clay, yellowish-brown clay, and gray, carbonaceous clay are present. Chalky mollusk fragments are scattered throughout the formation. Mica, generally muscovite, is abundant.

Much of the Patuxent is composed of two alternating lithologies:

1. Very coarse quartz sand and gravel that is angular and poorly sorted, which contains varying amounts of silt, traces of chalky fossil fragments, and abundant green, maroon, and gray clay, traces of metamorphic rock fragments, small amounts of feldspar, and varying amounts of lignite.
2. Gray, medium to coarse, quartz sand that is better sorted than (1), which contains no silt, little or no clay, traces of chalky fossil fragments, abundant muscovite, and traces of feldspar.

Lithology (1) is usually the thicker of the two, with the maximum thickness being 130 feet.

Sediments, here referred to as the "transitional beds", overlie the Patuxent Formation and underlie the Nanjemoy Formation from a depth of 1520 (-1468) to 1790 (-1738) feet. These beds, 270 feet thick, are probably Cretaceous and Paleocene in age. The contact of the "transitional beds" with the overlying Nanjemoy is based on a prominent electrical log "break" (Figure 3) and diagnostic lithologic changes. Coarse, gray, subangular, well-sorted quartz sands comprise the interval. Chalky fossil fragments occur throughout it and are abundant enough in some samples to be interpreted as shell beds. The "beds" are the youngest sediments in which there is abundant lignite. The top of the interval is marked by the youngest occurrence of feldspar in the hole. Toward the base the sediments become very clayey and altered brown glauconite occurs.

Table 1. Geologic summary of the J & J Enterprises, Inc. E. G. Taylor No. 1-G (VDMR repository number W-3180).

Depth below kelly bushing in feet	*Rock unit*	*Age*
0-160	Columbia Group	Pleistocene
160-790	Yorktown Formation	Miocene
790-1270	Calvert Formation	Miocene
1270-1520	Nanjemoy Formation	Eocene
1520-1790	"transitional beds"	Paleocene-Cretaceous
1790-6070	Patuxent Formation	Cretaceous
6070-6186	"red beds"	Triassic
6186-6272 T.D.	"basement"	Paleozoic-Precambrian

The Nanjemoy Formation, 250 feet thick and of Eocene age, overlies the "transitional beds" and underlies the Calvert Formation from a depth of 1270 (-1218) feet to 1520 (-1468) feet. The Nanjemoy-Calvert contact is marked by an electrical log "break" and the youngest abundant glauconite (in the Nanjemoy). The sediments are dark gray, medium to coarse, quartz sands containing as much as 25 percent glauconite. A foraminifer, *Marginulina anconoides* Hussey, of Eocene age (Hussey, 1949, p. 122) has been tentatively identified from samples, including those from the top and bottom of the formation interval. In the samples glauconite does not occur deeper than 1530 feet nor does persistent feldspar at more shallow depths. This change, coincident with a prominent electrical log "break", is considered as the base of the Nanjemoy and the top

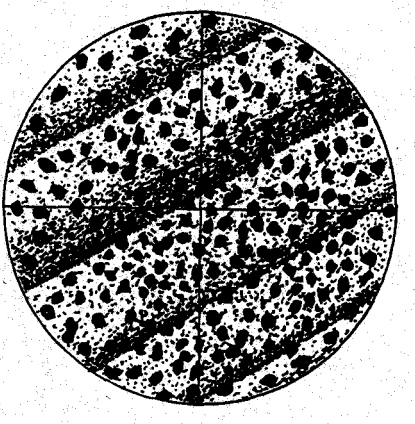

Figure 2. "Basement" hand specimen, 10X.

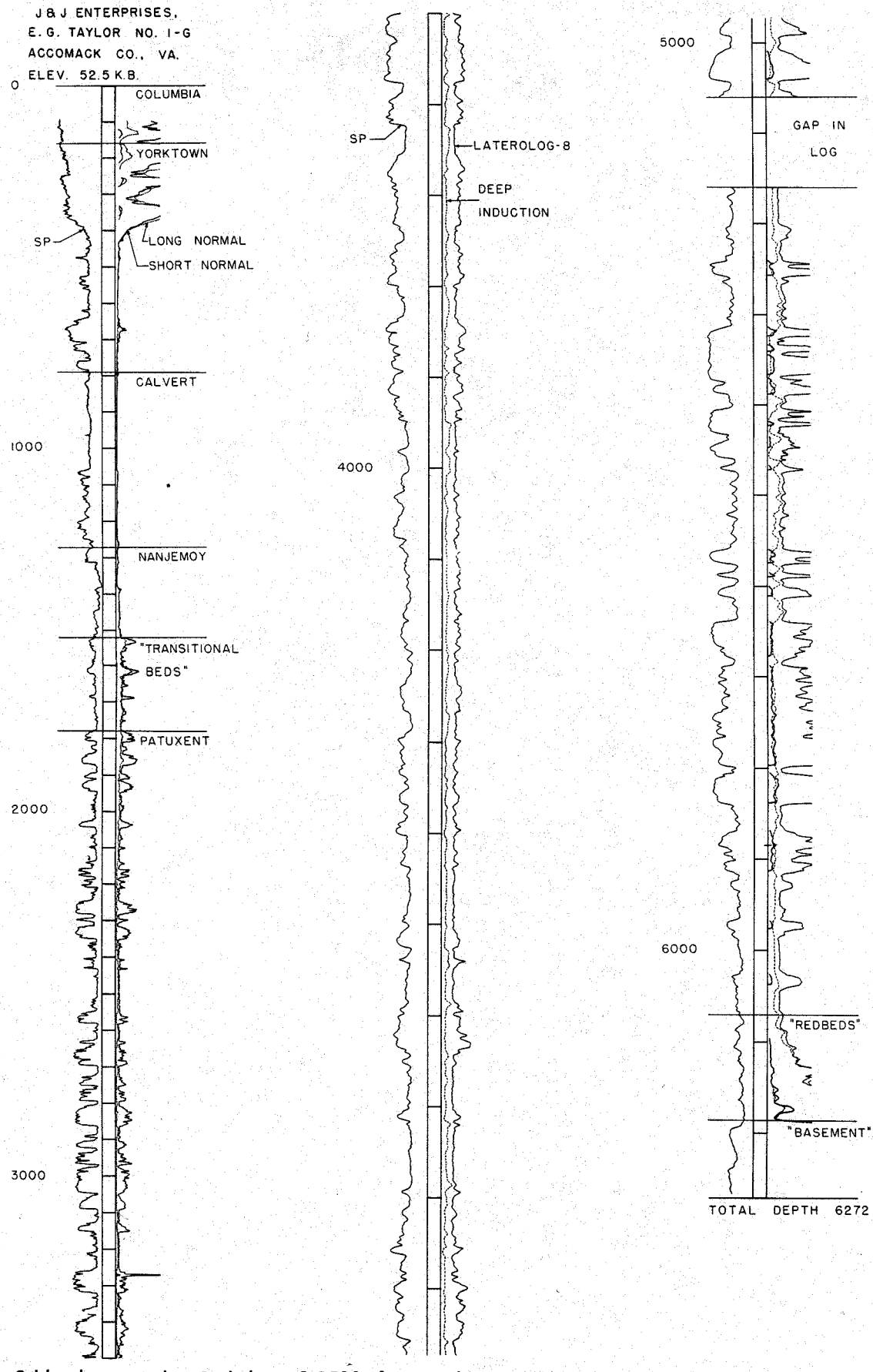

Figure 3. Schlumberger electrical log, 0-3500 feet; induction-laterolog, 3500-6267 feet; horizontal bars in center columns represent intervals of 100 feet.

of the "transitional beds." A thick section of brown to tan, silty to "clean", glauconitic clay occurs within the Nanjemoy interval.

The Calvert Formation, 480 feet thick and of Miocene age, overlies the Nanjemoy Formation and underlies the Yorktown from a depth of 790 (-738) to 1270 (-1218) feet. The Calvert-Yorktown contact is characterized by a prominent electrical log "break", by abundant clay (in the Calvert), and a marked decrease in shells in the Calvert compared to the Yorktown. The sediments are medium, subangular to subrounded, well-sorted, gray quartz sand interbedded with gray, silty, mostly diatomaceous, sandy clay. In the bottom quarter of the Calvert interval, the grain size of the sand increases to coarse and the youngest foraminifers in the hole, namely *Robulus* and *Siphogenerina,* appear. The bottom 20 feet of the formation consists of clay that contains diatoms and may be some part of the diatomaceous earth that was defined by Shattuck (1904, p. 72) as occurring at the base of the Calvert.

The Yorktown Formation, 630 feet thick and of Miocene age, overlies the Calvert Formation and underlies the Columbia Group from a depth of 160 (-108) to 790 (-738) feet. The Yorktown-Columbia contact is characterized by the youngest abundant occurrence of shells in the hole. The sediments are light- to medium-gray, medium-grained quartz sands with some interbedded gravels. Just above the underlying Calvert, the sediments contain some clay. The basal Yorktown sediments in this well are a mixture of sand and abundant shells interpreted as representing a transgressive sequence. At the top of the Yorktown interval in this hole, the regressive barrier sedimentary sequence as defined by Bernard and LeBlanc (1965, p. 158, Figure 20a) is repeated three times. This is interpreted as representing a general regression of the sea toward the end of Yorktown time.

The Columbia Group of Pleistocene age occurs at the surface over much of Virginia's Eastern Shore peninsula in which the hole is located. The group is 160 feet thick in the well and represents the interval from the surface to 160 (-108) feet where it overlies the Yorktown Formation. It consists of medium- to coarse-grained, subrounded, clear quartz sand, with a rusty orange color caused by iron oxide-stained quartz. The youngest glauconite in this well is in the basal part of the Columbia at a depth of 130-160 feet and is interpreted to indicate a marine origin for these basal sediments. Upward, the regressive barrier sedimentary sequence as defined by Bernard and LeBlanc (1965, p. 158, Figure 20a) occurs, perhaps twice (70-130 feet), overlain in turn by a possible fluvial point bar sedimentary sequence (30-70 feet) as defined by Visher (1965, p. 49, Figure 7). The sequence of depositional environments, as represented by the Columbia sediments, becomes more continental upward, a picture compatible with the interpretation of Jordan (1964, p. 69, Plate 9) of the Columbia in nearby Delaware.

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Bernard, H. A., and LeBlanc, R. J., 1965, Resume of the Quaternary geology of the northwestern Gulf of Mexico Province, *in* Wright, H. E., Jr., and Frey, D. G., eds., The Quaternary of the United States: Princeton Univ. Press, p. 137-185.

Hussey, K. M., 1949, Louisiana Cane River Eocene foraminifera: Jour. Paleontology, vol. 23, no. 2, p. 109-144.

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ADDITIONS TO STAFF

Mr. Ronald D. Kreisa joined the Division staff on October 1, 1971 and is assisting in geologic mapping and petrologic studies in the Piedmont. He received his B. A. degree from the University of Virginia in 1967 and is currently completing thesis requirements for an M. S. degree from Virginia Polytechnic Institute and State University. Mr. Kreisa was an officer in the U. S. Army for two years; one year was spent in Southeast Asia duty. He is married and has two children.

Mr. David K. Lasch was employed by the Division on January 1, 1972 and will be working in geophysical investigations. He received a B. S. degree in geology from Iowa State University in 1964 and is presently completing a thesis for the M. S. degree in geophysics from Texas A&M University. Two additional years of graduate study in geophysics were spent at Virginia Polytechnic Institute and State University.

Miss Shirley M. Rhodes was employed as a cartographic draftsman by the Division on January 1, 1972. Before coming to the Division, Miss Rhodes was employed by a private civil engineering and land surveying firm.

LARGE SUBSURFACE POTENTIAL OF LOW-SULFUR POCAHONTAS NO. 3 COAL, SOUTHWEST VIRGINIA

Marshall S. Miller

Recent exploration by coal companies in southwest Virginia for low-volatile and low-sulfur coal and regional subsurface studies by the Virginia Division of Mineral Resources and the U. S. Geological Survey indicate that the coal-bearing Pocahontas Formation of Pennsylvanian age is present in the subsurface in considerable portions of Buchanan, Dickenson, and Wise counties, and smaller portions of Scott and Russell counties. Within this formation occurs one of the most highly regarded fuels in the nation, the Pocahontas No. 3 coal bed. This coal, which has been mined extensively where exposed in northern portions of Tazewell County and nearby areas in southern West Virginia, is presently being produced from several large, deep, shaft mines in

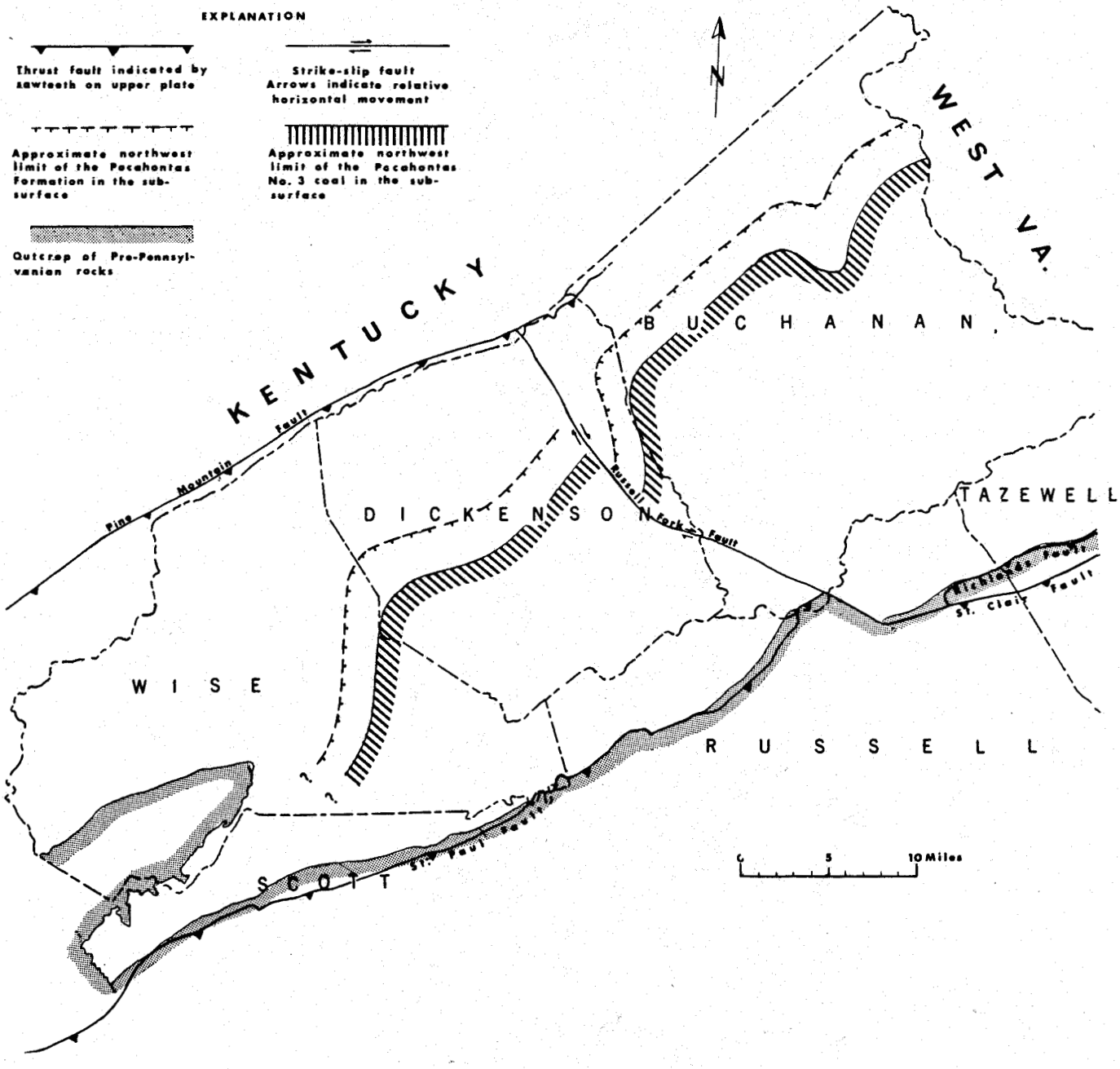


Figure 4. Index map showing northwestern extent of Pocahontas Formation No. 3 coal bed.

Buchanan County. The latest mine was developed near Pilgrims Knob, Virginia, in 1971 to a depth of over 1300 feet.

Stratigraphic studies of well cuttings of subsurface rock penetrated by oil and gas companies and core sections drilled by coal companies indicate that the Pocahontas Formation thins northwestward in the subsurface and is totally absent in the extreme northwestern portions of Buchanan and Dickenson counties and most of Wise County. The Pocahontas Formation is unconformably overlain by a massive, quartzose, conglomeratic sandstone that marks the base of the Lee Formation. This sandstone member progressively truncates the Pocahontas Formation northwestward, eventually removing the entire coal-bearing sequence. Figure 4 illustrates the approximate northwestern limit of the Pocahontas Formation and, more importantly, the northwestern extent of the Pocahontas No. 3 coal bed in the subsurface. As shown on the map, the Pocahontas No. 3 coal occurs in over half the area of Buchanan County, slightly less than half of Dickenson County, about a quarter of Wise County, and two separate areas in northwestern Russell County. Also, a limited amount of deep core information indicates that the coal extends into the northern portion of Scott County. This would indicate a total area of approximately 750 square miles of Pocahontas No. 3 coal in southwest Virginia. Only in some areas of Buchanan County, however, has this coal been analysed sufficiently to be established as a good-quality, low-sulfur coal in the subsurface.

A major structural feature, the Russell Fork fault, has had a considerable effect on the Pocahontas Formation. As the map illustrates, the Pocahontas Formation and the Pocahontas No. 3 coal, south of the fault, have been laterally displaced to the northwest. A strike-slip movement of 4 miles along the fault has been estimated by Englund (1971, p. 16). The effect of this movement and resulting pressure upon the coal in the "southern block" has not been determined. The effects of thrust and pressure upon coal in other areas have often altered the amount of volatile material.

As exploration and study of the Pocahontas Formation continues, the total coal reserve of Pocahontas No. 3 coal will eventually be determined. If the quality and thickness remain favorable, southwest Virginia would appear to have a large increase in low-sulfur bituminous coal reserves.

REFERENCE

Englund, K. J., 1971, Displacement of the Pocahontas Formation by the Russell Fork Fault, Southwest Virginia: U. S. Geol. Survey Prof. Paper 750-B, p. B13-B16.

NEW PUBLICATIONS

Report of Investigations 28. GEOLOGY OF THE NEWPORT NEWS SOUTH AND BOWERS HILL QUADRANGLES, VIRGINIA, by Nicholas K. Coch; 26 p., 2 maps in color. Price: $3.00 (plus 4 percent State sales tax).

The Newport News South and Bowers Hill 7.5-minute quadrangles, covering an area of about 119 square miles, are located in the southeastern Virginia portion of the Coastal Plain and include portions of Nansemond and Isle of Wight counties and the cities of Chesapeake, Hampton, Portsmouth, and Newport News. Stratigraphic units exposed in the quadrangles range in age from late Miocene to Recent and consist of the Miocene Yorktown Formation, the Pleistocene Norfolk and Sand Bridge formations, and the Holocene Dismal Swamp peat and estuarine sediments.

Information Circular 16. FIELD TRIP TO THE IGNEOUS ROCKS OF AUGUSTA, ROCKINGHAM, HIGHLAND, AND BATH COUNTIES, VIRGINIA, by Robert W. Johnson, Jr., Charles Milton, and John M. Dennison; 68 p. Price: $1.00 (plus 4 percent State sales tax).

This guidebook to a two-day field trip, first used for a Geological Society of America excursion, October 30-31, 1971, during the first day consists of a road log and discussion of representative localities of the alkalic complex of Augusta County, including Jurassic nepheline-natrolite syenites, teschenites with basement xenoliths, and a calc-silicate contact hornfels. Rare minerals, containing titanium, niobium, and rare earths, are characteristic of the alkalic rock occurrences; neadkevichite, astrophyllite, and bastnaesite are present in Augusta County. Olivine diabases that are indistinguishable from the common Triassic diabases of the eastern North American seaboard occur peripherally to the 400-square-mile area containing the alkalic rocks.

Tioga Bentonite of Devonian age can be seen on the second day in Highland County. The for-

mation is widespread in the middle-eastern states; its source is believed to be in nearby central-western Virginia. Many basaltic and andesitic volcanics of Eocene age (the youngest known igneous rocks of the eastern United States) can be seen. One andesitic dike(?) has undergone striking barium metasomatism, with harmotome, a barium zeolite, replacing normal rock-forming minerals and formation of barite with α-cristobalite.

NEWS NOTE

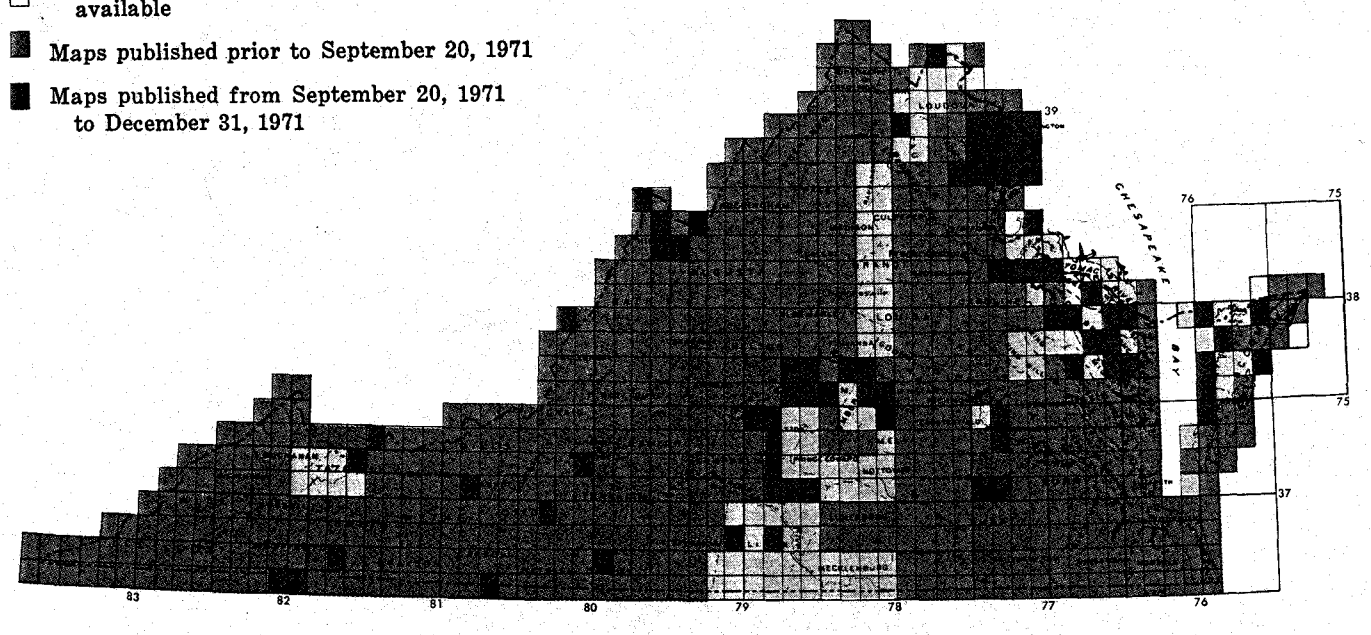
The sand and gravel plants, crushed stone quarries, and other facilities of the former Southern Materials Company, Inc. and the cement plant and raw material operations of the former Lone Star Cement Corporation in Nansemond and Botetourt counties and the City of Chesapeake are now operated under the name Lone Star Industries, Inc. The name change became effective on May 20, 1971.

TOPOGRAPHIC MAPS

*Alexandria
Alvon
Anawalt
*Annandale
Appomattox
Arvonia
Aspen
Ballsville
*Bent Mountain
Buckingham
Cana
Carson
Charlotte Court House
Chesconessex
Colonial Beach South
Dillwyn
Dutch Gap
Eureka
*Fairfax
*Falls Church
Floyd
*Fort Belvoir
Franktown
Glenmore
Great Fox Island
Hallwood
Harpers Ferry
Heathsville
*Herndon
*Holston Valley
Hopewell
Howardsville
*Independent Hill
Irvington
Jamesville
*Konnarock
Lakeside Village
Lively
Lottsburg
Machodoc
*Manassas
Mathias Point
McDowell
Metomkin Inlet
Monterey
Monterey SE
Morattico
Mount Landing
*Mount Vernon
Nandua Creek
*Nokesville
*Occoquan
Palo Alto
Port Royal
Prince George
*Pulaski
Rappahannock Academy
Red House
Rollins Fork
Saint Joy
Scottsburg
*Shady Valley
Stonewall
Tappahannock
Tazewell North
Templeton
Thornwood
Trenholm
Truhart
Upperville
Urbana
Vera
Vernon Hill
*Vienna
*Washington West
Whiteville

*Updated Map

7.5-MINUTE QUADRANGLE TOPOGRAPHIC MAPS



ADVANCE PRINTS AND REVISION COMPILATIONS

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

PUBLISHED MAPS

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

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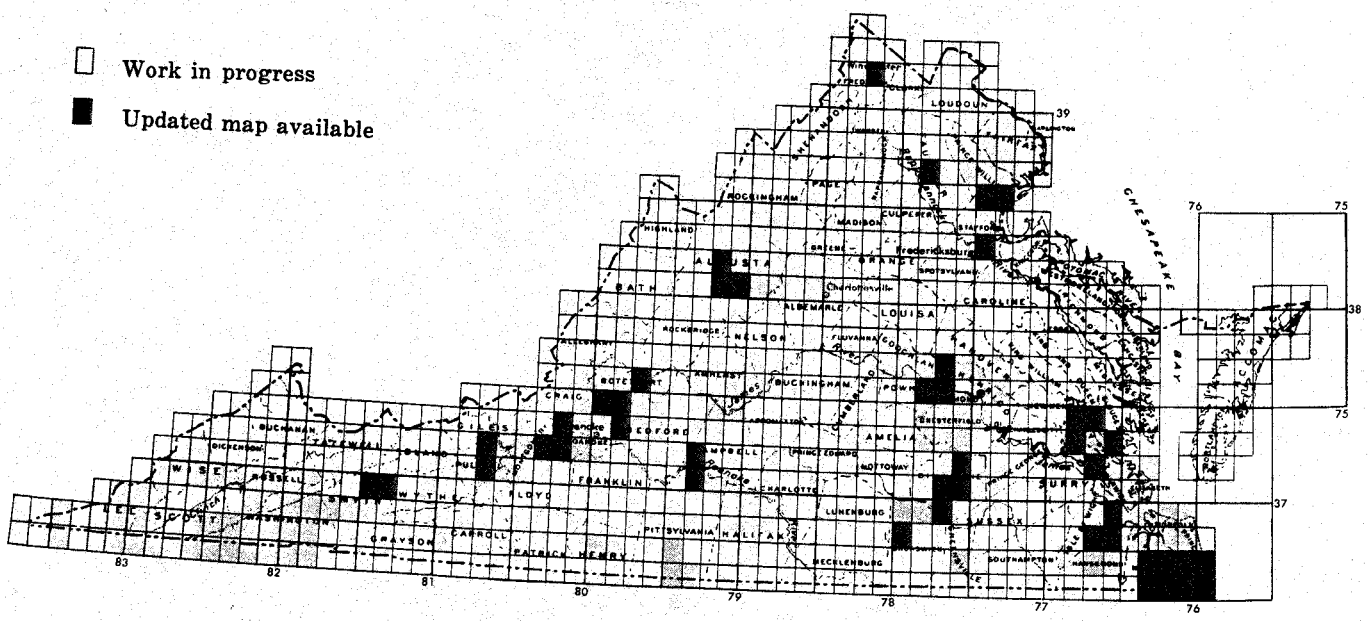
UPDATED 7.5-MINUTE TOPOGRAPHIC MAPS



Updated maps depict in magenta on existing maps cultural changes noted from inspection of aerial mapping photographs. These are available at 50 cents each from the Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903.