COAL RESOURCES OF THE FABIUS-FLAT ROCK AREA, JACKSON COUNTY, ALA.

By Reynold Q. Shotts and H. L. Riley
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by

Reynold Q. Shotts¹ and H. L. Riley²

ABSTRACT

A study was made of the coal resources of an area in Jackson County, Ala., forming a part of the Flat Rock, Henegar, and Stevenson quadrangles. The area studied is a portion of the Plateau coalfield on Sand Mountain and is near the Tennessee Valley Authority's Widows Creek steamplant. Since no detailed geological study of this area had been published, some reconnaissance work was done. The coalbeds and adjacent strata such as sandstones, conglomeratic sandstones, and conglomerates were studied. Available drill logs, together with the areal geology, provided sufficient information to permit correlation of the coalbeds and an estimation of coal reserves.

For all categories of reserves, computed on a regional basis, a total of 72,920,000 tons of coal more than 14 inches thick is estimated for the areas studied in Stevenson, Flat Rock, and Henegar quadrangles. Of this tonnage, 40,001,000 tons is estimated to have less than 60 feet of overburden. The total measured coal reserves for the above three quadrangles are 16,359,000 tons, with 12,471,000 tons under less than 60 feet of cover.

INTRODUCTION

An investigation was planned to determine the extent, quality, and economic minability of coal deposits in Alabama reasonably close to ample fresh water sources that might be available for possible thermal electric powerplants. Other factors, such as water quantity, mining methods, and fuel costs, were studied.

With the time, funds, and personnel available it was felt that the best results could be obtained by concentrating on a significant, but limited, aspect of the problem in a specific location.


Work on manuscript completed June 1965.
The project was begun by making a general investigation of the factors that determine the selection of powerplant sites, particularly with reference to "mine-mouth" sites. With this study as a basis, specific powerplant location and fuel problems for the southeast United States were investigated. As an initial step, officials of the Tennessee Valley Authority (TVA), the largest single power system in the area, were interviewed. TVA maintains a staff to study plant site selection and related problems. Sites are usually selected well in advance of actual construction, and the problem of site selection is very complex with questions of powerload distribution and of anticipated powerload growth-rate patterns often outweighing natural factors such as quality and location of fuel sources and of abundant water supplies. The question of building new plants versus the enlargement of existing ones complicates the problem, especially in sections like the southeast United States where power systems are very highly developed.

For information regarding anticipated powerload growth, projected powerplant locations, and fuel and transportation costs for the entire area, the regional offices of the Federal Power Commission in Atlanta, Ga., were visited and several engineers were interviewed. The private power companies, like TVA, also spend much time and effort on plant location studies and they, too, have plant sites at least tentatively selected for expected powerloads to 1970 and even to 1980. Copies of the reports of some of the advisory Committees to the National Power Survey were secured for study.

As a result of facts gathered from the interviews and from reports studied, it was concluded that possible new fuel sources for new or existing plants might be investigated, especially in the little-known areas near the plants or on navigable streams.

One such area is the Plateau coalfield of Alabama (8, 15, 19). This large field is known to be underlain by coal-bearing rocks of Pennsylvanian age; however, it is not now producing, nor has it ever produced, appreciable quantities of coal. The coalbeds in the field have always been reported to be thin and irregular in thickness and extent. This condition has been inimical to efficient underground mining but with highly developed present-day surface mining methods, the condition possibly can be tolerated if the other big item in delivered coal costs, transportation, is not too great.

A part of the Plateau coalfield, on top of Sand Mountain and near the Tennessee line, is within 2 miles of the largest steam-electric generating plant in the Nation. This is the TVA's Widows Creek plant which had a total rated capacity of 1,675,000 kw in 1965 and burned up to 17,500 tons of coal per day (29). Most of this coal is shipped by rail or barge from the Eastern Interior coalfield, principally from western Kentucky. It is obvious that if minable coal deposits could be found on Sand Mountain near the Widows Creek steamplant a very close approach to "mine-mouth" electric generation would be possible.

\(^3\)Underlined numbers in parentheses refer to items in the list of references at the end of this report.
In 1960 the North Alabama Mineral Development Co., holders of mineral rights to about 38,000 acres of land in the Fabius-Flat Rock area of Sand Mountain, approximately 6 miles south of the Widows Creek plant, began a drilling program. By 1963 approximately 4,000,000 tons of coal in one bed with overburden of 40 feet or less had been proved. In February 1964 the Farco Co., Inc., began a surface mining operation on North Alabama Mineral Development Co. land under a contract with TVA. Mining was started at the Fies No. 1 mine about 1 mile southwest of the Fabius, Ala., post office.

In view of this modest beginning of what could prove virtually a "mine-mouth" operation, favorably located with respect to a recently expanded steam-electric generating plant, that is now the Nation's largest, it was decided to concentrate on the study of the reserves and minability of coal in the Sand Mountain portion of the Plateau coalfield. A detailed geological study of the area has never been published; consequently, only highly generalized geological information was available, and this was based largely upon observations made in Georgia and Tennessee and in the Cumberland Mountain and Lookout Mountain portions of the Plateau coalfield of Alabama. Reconnaissance work was done in the spring and early summer of 1964 over the entire northeastern end of Sand Mountain in Alabama, with a little coverage of adjacent portions of Georgia and Tennessee. It was decided to concentrate on the Fabius-Flat Rock area in the Stevenson and Flat Rock topographic quadrangles. This report is restricted substantially to these two quadrangles, thus leaving an area, quite large but a little more distant from the Widows Creek plant, still uninvestigated.

Sand Mountain coals are of coking coal rank and if chemically acceptable, may eventually be of interest to the steel and foundry industries of Gadsden, Ala., and Chattanooga, Tenn. To the east of Sand Mountain, at moderate distances, there are steam-electric generating plants at Rome, Ga., and Gadsden, Ala.

ACKNOWLEDGMENTS

During the preliminary phases of this project officials of the Tennessee Valley Authority and the Atlanta Office of the Federal Power Commission were especially helpful. The authors particularly wish to thank Mr. E. P. Ericson, Assistant General Manager, and Mr. James E. Watson, Power Supply Division, Tennessee Valley Authority; and Mr. R. C. Price, Regional Engineer, Mr. C. L. Fishburn, Deputy Regional Engineer, and Mr. T. A. Swennes, Chief, Electrical Section, Federal Power Commission.


The assistance of Mr. T. W. Daniel, Jr., geologist, Geological Survey of Alabama, who observed much of the early drilling in the area, is also acknowledged.
LOCATION, ACCESSIBILITY, AND PHYSICAL FEATURES

Location of Field

Field studies were made in 1964 in the Stevenson, Flat Rock, Bridgeport, Shellmound, Trenton, Ider, Sulfur Springs, Henagar, Sylvania, Dugout Valley, and Hollywood quadrangles. Data suitable for coal reserve calculations were limited to the Stevenson quadrangle, a small area in the Henagar quadrangle, and the area of the Flat Rock quadrangle in Jackson County, Ala. Location of the calculated coal reserves is shown in figure 1.

Topography

Sand or Raccoon Mountain is the name given to the continuation into Alabama of the Physiographic feature known in Tennessee as Walden Ridge of the Cumberland Plateau. In Alabama, this synclinal mountain covers parts of Jackson, DeKalb, Marshall, Etowah, and Blount Counties. The northwestern and southeastern boundaries of Sand Mountain are distinct due to cliff-forming sandstones and conglomerates. To the southwest, Sand Mountain merges into the Coalburg basin of the Warrior coalfield in Jefferson County. The upper surface of Sand Mountain is plateau-like and level to rolling. Bordering cliffs are present most everywhere. The cliff outline is irregular and notched with deep coves or gulfs formed by erosion. The elevation of the plateau near Fabius is about 800 feet above that of the valley floor.

Climatology

The Sand Mountain area has a relatively mild climate. On the mountain, the nearest weather station reporting precipitation is Flat Rock in Jackson County. The average annual precipitation for 23 years of record ending in 1960 was 50.14 inches. The mean for the period 1951 through 1960 was 48.27 inches. For this 10-year period, average monthly precipitation ranged from a low of 2.59 inches in October to a high of 5.26 inches in March. The largest quantity of precipitation for any individual month was 11.06 inches and occurred in March. Mean temperature data were not published for Flat Rock. Scottsboro is in the valley about 28 miles southwest of Flat Rock. The average annual temperature for Scottsboro for 76 years of record was 61° F.

Water Supply

The drainage area of the Tennessee River basin at Guntersville Lake near Guntersville, Ala., is 24,450 square miles (30). From impoundment of the lake in 1939 to 1960, the maximum elevation of the water's surface above mean sea level was 596.29 feet and occurred on March 2, 1944. Minimum elevation of 591.65 feet occurred on September 8, 1953. Total level pool elevation at the top of the gates is 595.44 feet. The maximum pool capacity is 1,018,000 acre-feet (28). Of this, 162,900 acre-feet is controlled flood storage above 593 feet elevation, which is the minimum navigational pool elevation. The reservoir is used for navigation, flood control, and power; the water elevation is controlled to some extent by flow from upstream reservoirs. The Widows Creek steamplant uses 1.5 billion gallons of cooling water daily.
FIGURE 1 - General Location Map and Transportation Guide, Fabius-Flat Rock Area.

Transportation

The coal mined on Sand Mountain is hauled 4 miles by truck to a ramp on Guntersville Lake and loaded in 800-ton barges. All truck transportation is under contract. The loaded barges are moved by tug boat about 4 miles to the Widows Creek steam plant where they are unloaded.
Figure 1 also shows paved roads available for truck haulage, the nearest railroad, and the location of the Tennessee River relative to the Fabius-Flat Rock area.

HISTORY OF PRODUCTION

The Fabius-Flat Rock area has only a very recent, short history as a separate district. Because of its general isolation on the east side of the Tennessee River and because all Tennessee Valley towns are on the west side, the district was never developed industrially. The small, scattered rural Sand Mountain population furnished only a meager coal market. Until recent years, poor roads made it impractical to haul even small consignments of domestic coal more than a few miles. Coal was therefore mined close by the point of use and the better coals and mines east of the river had little or no competitive advantage in the small domestic market.

Same State production records exist (1) for both Jackson and DeKalb Counties, Ala., but virtually all recorded production for Jackson was from Cumberland Mountain, west of the Tennessee River and that for DeKalb County was from Lookout Mountain rather than from Sand Mountain.

Shotts (19) has summarized the available production statistics for Jackson County up to 1952. Up to 1939 the figures are for the calendar year; thereafter they are for the fiscal year, October 1 to September 30. First production of 6,011 tons was reported for 1894. After 1952, production remained under 20,000 tons per year until 1964 when Fies No. 1 mine began to operate. Production was always erratic, ranging from none in 1897 as well as none from 1901 to 1902, 1906 to 1909, 1919 to 1936, from 1952 to 1953 to the maximum production of 36,241 tons in 1942. The average annual recorded coal production for Jackson County over a 70-year period from 1894 to 1964 is approximately 9,140 tons.

None of the Jackson County production on record can specifically be identified with Sand Mountain until February 1964, when Fies No. 1 mine began to operate. Production at that mine was reported to be 94,512 tons for Alabama fiscal year 1964 (1). Mimeographed quarterly reports of the Division of Safety and Inspection, State Department of Industrial Relations, show 89,686 tons produced at Fies No. 1 mine during the first two quarters of the 1965 fiscal year. Thus, during approximately its first full year of operation, Fies No. 1 mine has recorded coal production of 184,000 tons, whereas the recorded production of all the remainder of Jackson County from 1894 to 1964 was only 545,000 tons.

GEOLOGY

Description of the Deposit

Sand Mountain in Jackson County, Ala., is underlain by coal-bearing rocks of Pennsylvania age. Sporadic, small-scale coal mining has been done in the Fabius-Flat Rock area of Sand Mountain since its settlement, but little was
really known of the coal deposits until drilling by the North Alabama Mineral Development Company, Birmingham, Ala., in 1961-62, revealed the presence of a fairly persistent coalbed. The bed ranges in thickness from a few inches to about 6 feet. The very thick and very thin areas do not appear to be extensive.

In some rather extensive areas in the vicinity of Fabius and in one area northeast of Flat Rock, the coalbed thickness apparently is fairly uniform and averages about 28 inches in thickness, with fairly common local variations ranging from 21 to 36 inches.

A broad plateau area in southcentral Stevenson and central Flat Rock quadrangles is underlain by this coal horizon. Most of the exploration work has been done within a mile or so of the outcrop, largely on the southern but partly on the northern fringe of the central plateau. There is evidence that the horizon may extend northward into the southeast corner of the Bridgeport quadrangle. On the eastern and southern sides of the Stevenson and Flat Rock quadrangles efforts to find bed outcrop were unsuccessful although drilling might reveal extensions in those directions. Streams in the eastern half of Flat Rock quadrangle apparently have cut below the horizon of the coalbed, and when the bed was not found, the obvious conclusion was that it pinched out in that direction.

Strata over the coal vary from rather soft shale and clay through sandy shale to hard, tough sandstone and conglomerate. Overburden is estimated to be up to 200 feet in thickness in the higher parts of west central Flat Rock quadrangle.

Stratigraphy

The coal-bearing rocks of Sand Mountain are of Pennsylvania age (7, 8, 11, 12, 13, 15, 18, 19, 26, 27, 31). The strata enclosing thin coalbeds which occur just below the cliff-making sandstone rimming Sand Mountain may be of late Mississippian age (7, 8). Hayes (11, 12) and McCalley (15) recognized two massive conglomerates or conglomeratic sandstones on Sand Mountain. McCalley designated the units as the lower conglomerate and the upper conglomerate. Hayes (12) used the upper of these two units, which often are only 50 to 100 feet apart on Sand Mountain, as the basis for his division of the Pennsylvanian into the Lookout and the Walden Formations (named for Lookout Mountain and Walden Ridge in the Chattanooga, Tenn., area):

"These ('coal measures') rocks are divided in the present report into two formations, Lookout sandstone below and Walden sandstone above. The division is made at the top of a bed of conglomerate from ten to seventy feet in thickness which is a constant feature throughout the greater part of this field."

Comparison of field observations with Hayes' (12) mapping indicates that he used the highest bed of conglomerate seen as the formation dividing line and that this may not always have been the same bed. In the area of this
report, however, his dividing line was rather consistently the uppermost pebbly beds of the upper conglomerate. Evidently, Hayes included the 40- to 150-foot shaley, coal-bearing stratigraphic interval, which occurs under the upper conglomerate of McCalley, wholly within his Lookout Formation.

Perhaps the earliest and most ambitious attempt to correlate coalbeds in the eastern United States was that of Stevenson (27). He rather clearly identifies the lower conglomerate as the Etna or Cliff Sandstone of Safford in Tennessee and the upper conglomerate as the upper or main Bonair Sandstone of Safford. If the Bonair is the modern "Sewanee," this agrees with Culbertson (7) as discussed in subsequent paragraphs.

Butts (5, 6) assigns all Alabama Pennsylvanian rocks to the earliest subdivision of that system—the Pottsville series. He subdivides the Alabama Pottsville series into upper, middle, and lower. The division between the middle and lower Pottsville is the Black Creek coaled in the Warrior basin, and all of the Pottsville series of northeast Alabama is assigned to the lower group.

Stearns and Mitchum (26) divide the Alabama Pottsville series into Pocahontas, New River, and Kanawha equivalent groups. No sections are shown for northeast Alabama but a section on Lookout Mountain, Dade County, Ga., shows New River equivalent age rocks at the base of the Pennsylvanian. This implies strongly that Stearns and Mitchum would consider the lower Pennsylvanian rocks of nearby Sand Mountain to be of New River age. The sections shown by Stearns and Mitchum (26) indicate that Hayes' Lookout Sandstone may be equivalent in age to the strata between the Rosa and Mary Lee coaled groups to the southeast in the Warrior basin and thus younger than the Boyles Sandstone Member of Butts (5). Shotts (22) considers the Boyles Sandstone Member and the lower conglomerate portion of the Lookout Sandstone as possibly equivalent.

Metzger (18) subdivides the Pennsylvanian age in Alabama into intervals designated A, B, etc., and roughly equivalent to McCalley's (16) coaled groups. He apparently follows Butts (6) in assigning all of northeast Alabama to the earliest Pottsville as he defines his "Interval A," which he shows to underlie all that area, as lying "...between the Pennington Formation of Mississippian age, at the base, and the Black Creek coal."

Culbertson (7, 8) makes no division of the Pottsville. He places all the coals of the Plateau field, which includes Sand Mountain, into two formations; the Parkwood of Mississippian and Pennsylvanian age and the Pottsville of Pennsylvanian age. All strata below the sandstone cliff bordering Sand and Lookout Mountains (McCalley's lower conglomerate) and above the Pennington Formation of Mississippian age are designated Parkwood Formation. Included are several thin coalbeds that have been mined in Georgia on Sand and Lookout Mountains. These include the Castle Rock (Cliff, Etna), the Dade, and the Rattlesnake beds (17).

Culbertson studied Lookout Mountain in some detail but gives no sections on Sand Mountain nor does he discuss its stratigraphy. Observations in the
field, when compared with Culbertson's sections and descriptions of strata (8), indicate that the stratigraphic successions on the two mountains are quite similar and correlation of units from one mountain to the other should be possible.

The rocks of the Parkwood and Pottsville Formations on Sand Mountain consist of conglomerates, sandstones, sandy shales, clays, underclays, and thin coalbeds. The thicker and more massive conglomerates are usually coarse sandstones with zones of quartz pebbles or with pebbles scattered rather sparsely throughout certain zones. In other zones, pebbles are numerous and may constitute 50 percent or more of the rock volume. These zones are usually near the base of the bed, but occasionally they are near the top. An example of the latter condition can be seen on Alabama Highway 117, in Norwood Cove, where the more pebbly beds are near the top of the lower conglomerate. Pebble zones often are lenslike and in many places less than 2 feet thick. Thin conglomerates found over some of the coalbeds, and in some places the basal foot or two of the lower conglomerate itself, may consist largely of shale pebbles with much iron carbonate. On weathering, a characteristic vesicular rock is produced. Culbertson (8) describes such a conglomerate as often overlying the Upper Cliff No. 2 coalbed on Lookout Mountain. Beautiful examples of this type of conglomerate over coalbeds can be seen on Sand Mountain in a little draw just east of Fabius post office on the old Caperton Road, in the north ditch of Alabama Highway 71, on the mountainside about 1/2 mile west of the Georgia line, and in many other less accessible places.

Quartz pebbles even larger than 1/2 inch in diameter are common in the pebbly zones of the lower conglomerate, and scattered pebbles are usually large. In the upper conglomerate, however, pebbles larger than 1/4 inch in diameter are seldom seen. In many places both conglomerates are only coarse sandstones, and in some places the upper conglomerate is a medium to fine sandstone.

The upper conglomerate appears to weather more readily on Sand Mountain than does the lower conglomerate and seldom forms extensive cliffs. It is probable that the central position of its outcrops, away from the edge of the mountain, accounts, in part, for this condition.

Most of the shale of Sand Mountain is quite sandy and the more argillaceous shales are thin. They are prevalingly gray in color, where unweathered, but some are black. Shales between the conglomerate and the coal in the Hammond and Smith strip pits are thin bedded, appearing almost like varved clays.

The logs of drill holes in the Fabius area often show soft clays or shales, even at depths too great for appreciable weathering. These clays usually are not accompanied by coals and may not be carbonaceous, although the coalbeds usually have underclays.

One to four coalbeds occur between the two conglomerates over almost the entire area. The lowest bed, which apparently occurs in a split near the top
of the lower conglomerate, usually lies only 1 to 5 feet above hard sandstone and is from 12 to 72 inches thick where seen or penetrated by the drill. This is the bed presently being mined near Fabius. Studies of the bed and of the strata above it exposed in outcrops and drill holes show that the coal bed in the Stevenson and Flat Rock quadrangles is generally overlain, from south to north, with increasing thicknesses of sandstone and conglomerate. Where a full section can be seen, the sandstone and conglomerate are separated from the upper conglomerate above by a stratigraphic interval consisting of thin sands, shale, and coals. This interval also appears to be present over the lower conglomerate in areas where the coal mined at Fabius seems to be absent. This stratigraphic succession supports the conclusion that the Fabius coalbed and its accompanying shale and clay beds occupy a split in the lower conglomerate. Sandstone, but little conglomerate, is found above the Fabius coal south of the Caperton Ferry Road. Along Ross Branch in SE1/4 sec 36, T 2 S, R 8 E, in the Hammond and Smith strip pits, on Ladd Creek near the south line of sec 21, T 2 S, R 9 E and on Indian Creek, sec 27, T 2 S, R 9 E, the coal horizon is overlain by a massive conglomerate 30 feet or more in thickness. However, only thin-bedded sandstone overlies the Fabius coal on Warren Smith Hill. Section C-C', figure 2, shows the scarcity or absence of conglomerate in a row of north-south holes along the east side of the Stevenson quadrangle. The holes consist of two rotary drill holes (RDH) and one diamond drill hole (DDH) drilled by the North Alabama Mineral Development Co., and one diamond drill hole (FDDH) drilled by the Farco Co.

The shaley interval underlying the upper conglomerate contains one to three thin coalbeds. In many places, the upper conglomerate rests directly upon a coalbed. In most localities, however, there are some shales and sandstones between the conglomerate and the uppermost coalbed.

Figures 2, 3, and 4 show three cross sections made from drill holes and one measured surface exposure. The illustrative cross sections show the nature of the beds and their enclosing strata in three directions: (1) Section C-C', north to south near the Stevenson-Flat Rock quadrangle line (fig. 2); (2) section B-B', northeast to southwest, roughly parallel to the brow of the mountain and to the strike of the strata (fig. 3); and (3) section A-A', west to east (fig. 4). The coalbeds are named in accordance with the correlations made in a subsequent part of this report.

Figure 5 shows the surface distribution of the strata in three units: (1) The upper conglomerate; (2) the interval either between the upper conglomerate and the mappable coalbed or between the upper and lower conglomerates where the coalbed appears to be missing; and (3) the lower conglomerate. Unit (3) is barren of persistent coalbeds and unit (1) generally has too much cover for strip mining. Unit (2), therefore, is the area of strippable coal and in most places, where drilled, the coal is of sufficient thickness for mining. The heavy dotted line in figure 5 separates two areas of unit (2). West and north of this line, the coalbed mined at Fabius is found, but east and south of it, no evidence of the presence of the coalbed was seen and apparently the shaley unit of the upper conglomerate with its thin coalbeds rests directly upon the lower conglomerate.
FIGURE 2. - Cross Section C-C', Fabius-Flat Rock Area.
FIGURE 3. - Cross Section B-B', Fabius-Flat Rock Area.
FIGURE 4. - Cross Section A-A', Fabius-Flat Rock Area.
Structure

Figures 2, 3, and 4 also illustrate the structure of the coalbeds and their enclosing strata. For the most part the beds are almost level with a general and very gentle, southeastward dip. In the Stevenson quadrangle, near the edge of the mountain, the dip steepens to 70 feet or more to the mile. The base of the upper conglomerate, for example, is about 140 feet higher at the head of Norwood Cove than at Warren Smith Hill to the southeast, an average dip of about 52 feet to the mile. This is not the true dip as the line between the two localities is not perpendicular to the strike of the beds. The top of the minable coal in RDH 1-61, SE1/4SE1/4SW1/4 sec 3, T 3 S, R 8 E, near the western outcrop of the bed, is at 1,420 feet, while the coal in DDH 7-61, 0.63 mile down dip, is at 1,360 feet, and in RDH M II-61, 1.05 miles still farther down dip, the coal is at 1,345 feet. These elevations give dips of 95 and 14 feet to the mile, thus also illustrating the flattening of the dip that generally occurs away from the western edge of the mountain. Section B-B' (fig. 3) shows how the principal coalbed rises as the edge of the mountain is approached, despite the fact that the section is taken almost in the northeast-southwest direction or the direction of the normal regional strike.

At least two other areas of increased bed dips appear to be contrary to the general regional trend. The first of these is apparently a subsurface ridge running northeast-southwest from about the middle of sec 12, T 3 S, R 8 E. Stratigraphic section C-C' (fig. 2) crosses this ridge with DDH Cl-61 located near its top. The principal coalbed, both north and south of this hole, has a lower elevation than either to the east or west of hole DDH Cl-61. The ridge may extend farther to the northeast than indicated but there are no coal outcrops or drill holes available for checking this possibility south of Indian Creek (sec 27, T 2 S, R 9 E) where the coalbed is only at 1,318 to 1,320 feet above sea level.

The other area of anomalous dips occurs in the Flat Rock quadrangle. Section A-A' (fig. 4) shows a rise in elevation of all strata east of the center of the quadrangle. The rise from RDH Y-61 to RDH Y11-61 is about 47 feet to the mile. Again the true dip is a little different because the line connecting the two holes is at about 45° to the strike.

The eastward rise of the principal coalbed occurs also to the south of section A-A' as can be seen by comparing the elevation of outcrops in the SE1/4 sec 16 and the SE1/4 sec 15, T 3 S, R 9 E; of outcrops near Kash Creek, SW1/4 sec 7 and near the center of sec 17, T 3 S, R 9 E; and of the coalbed in holes FDDH14-64 in the SW1/4 sec 18 and FDDH13-64, NE1/4 sec 19, T 3 S, R 9 E.

Considering the entire area shown in figure 5, there appears to be a "low" or principal synclinal axis which enters northwest Georgia from about 3 miles west of Whiteside, Tenn., passes about a mile west of old Cole City, Ga., and continues through the old Castle Rock mines which lie about 1/2 mile east of the Alabama state line. The axis enters Alabama in sec 20, T 1 S, R 10 E, cuts across the Bridgeport quadrangle about 1 mile northwest of its southeast corner, and extends to the middle of the Flat Rock quadrangle. The elevation of
the Castle Rock coal just under the lower conglomerate at Castle Rock mines is about 1,350 feet. What is probably the same bed is at 1,290 feet just south of the Alabama Highway 73 bridge crossing Lively Creek and also near the synclinal axis, southwest corner, Shellmound quadrangle.

The axis enters the Flat Rock quadrangle, probably in sec 11 or sec 12, T 2 S, R 9 E. From here it seemed to enter a broad, shallow area differing little in elevation from north to south and occupying most of the west central and southwest parts of the Flat Rock quadrangle. One synclinal axis probably extends beyond the quadrangle 2 to 3 miles east of its southwest corner as indicated by the very small scale map of Hayes (11). Elevations measured at the base of the upper conglomerate suggest, however, that a synclinal axis also crosses the southeast corner of the Stevenson quadrangle, the northwest corner of the Henegar quadrangle, and into the Hollywood quadrangle. A third synclinal axis may split from the same platform in the Flat Rock quadrangle and run southeastward from it and north of the apparent ridge on which DDH CI-61 is located as suggested in the 2d paragraph of this section. The third axis may not be a split off the major synclinal axis of Sand Mountain, but the second one probably is.

None of the structural features described here can have more than minor influence upon strip-mining operations on the coalbeds. Even if underground mining were attempted, only near the western edge of the field would the dip of the beds have to be considered because of its influence on mine drainage or haulage. In exploration work, however, the thin upper coalbeds may be confused with the principal one unless the driller is familiar with field structure and knows at about what elevation to expect to encounter the coal.

No evidence of faulting has been seen in the strip mines. The only place in the field where possible evidence of faulting was seen is in a ditch on Highway 117 above the outcrop of the upper conglomerate in the NW1/4 sec 7, T 3 S, R 9 E. Here, sandstone beds dip approximately 20° to the south or southwest in the ditch, but in the highway cut a hundred yards away the upper conglomerate beds are practically horizontal.

**Bed Correlations**

Because the Fabius-Flat Rock area is isolated from areas of former mining activity and has had little specific study, the correlation of the coalbeds has long been uncertain and cannot be separated from correlation of the accompanying strata.

Hayes (11, 12) makes no attempt to correlate any of the strata, names no coalbeds, and shows no mines in Alabama on his economic geology map (12). He says there are five coalbeds in the Lookout Sandstone in the Cole City, Ga., area on Sand Mountain where coal was being mined at the time of his report and merely states that the same beds should show up in the coves on the west side of the mountain in Alabama. He mentions unexplored coals in the Walden Forma
tion but names only the mines at Etna, Tenn., where he says there are two beds within 100 feet above the Lookout conglomerate and two others between 200 and
300 feet above that formation. It is now believed that these coals are stratigraphically higher than those of Sand Mountain (7, 20, 32).

McCalley names coalbeds, including an interconglomerate bed called the Sewanee but which probably was so named because of an error in interpretation (17, 20). The bed mined in sec 2, T 2 S, R 9 E (Old Pearce mines), is termed the "Cliff" (Etna, Castle Rock mines). A coalbed, designated the Sewanee, occurs in sec 1, T 3 S, R 8 E and in sec 16, T 3 S, R 9 E, and is probably the same as the "Cliff" coalbed. In the Rocky Branch section, SE1/4 sec 4, T 4 S, R 8 E (Henegar quadrangle), McCalley terms one of the thin beds in the shaly interval just under the upper conglomerate, the Sewanee. This bed is, however, stratigraphically higher than the Sewanee bed in sec 1, T 3 S, R 8 E.

Stevenson (27) identifies the lowest bed in the interval between his "Bonair" and "Etna" conglomerates (upper and lower conglomerates) as the "Cashie." The name evidently came from Gibson (10), who probably correctly spelled it "Caskie." As Stevenson places the bed generally 30 to 40 feet above the Etna Sandstone, it could have corresponded to the lower of the thin beds on Sand Mountain in the shaly interval under the upper conglomerate rather than to the bed being mined near Fabius. These thin beds, as will be seen later, occupy a wider geographical area than does the bed being mined; however, they may be thicker in some areas than they are in the Stevenson and Flat Rock quadrangles. Stevenson correlates the "Cashie" with the Sewanee bed of Tennessee.

Weygand examined the Fabius-Flat Rock area and adopted bed names used on Sand Mountain in Georgia during the period of most active mining in that area. Apparently he assigned the name Castle Rock to any bed found under conglomerate as this is the upper bed just below the conglomerate in Georgia. The thickest bed in the Fabius area was termed the Rattlesnake (third from the top in Georgia) and was correctly correlated with the bed found on the Hammond property in sec 20, T 2 S, R 9 E.

Barksdale, Shotts, and Rice (4) studied beds on both Cumberland and Sand Mountains in Jackson County, Ala., but merely listed them as A, B, C, and D:

"The uppermost of these seams, designated A, occurs just below the Upper Conglomerate... The B seam occurs between the Upper and Lower Conglomerates and corresponds to the Sewanee seam of McCalley.---The Seam designated D occurs below the Lower Conglomerate at various distances..."

They correctly identified beds found in the Fabius area as A, B, and C, but it is suspected the minable bed was sometimes labeled B and sometime C.

Vestal and Mellen (31) adopted a lettering notation also but with A used for the lowest bed. They recognized only one bed between the conglomerates. Their map shows no locality visited north of Coon Gulf so that they did not enter the Fabius-Flat Rock area. Two beds under the upper conglomerate, just south of Coon Gulf, were correctly labeled beds D (upper) and C.
Shotts (19, 20, 22, 23) examined the literature with respect to the correlation of northeast Alabama coalbeds with those of southern Tennessee and of other fields in Alabama. Because little of a specific nature had been published on Sand Mountain, Shotts was able to do no more than correlate McCalley's Sewanee bed on Cumberland Mountain (which may not be the same as his Sewanee bed on Sand Mountain) with the Bear Creek bed in the northwestern Warrior basin of Marion and Winston Counties, the Rosa bed of northern Jefferson County, and the Underwood bed of Lookout Mountain (20, 23).

A few other reports of very limited scope mention other northeast Alabama coalbeds (25).

The most recent work on Alabama coals is that of Culbertson (7, 8). He gives specific attention to Lookout Mountain but not to Sand Mountain. A comparison, however, of Culbertson's sections and his description of Lookout Mountain strata and of their relation to the two conglomerates, with observations made in the field on Sand Mountain, make it possible to correlate the principal beds on the two mountains. The only prior assumption required is that the two conglomerates found on Sand Mountain are, in fact, equivalent to the two similar beds described on Lookout Mountain. McCalley (15) considered them the same and apparently Culbertson concurs.

Figure 6 shows four stratigraphic sections:

1. A composite section on the Western edge of Sand Mountain measured in the field. The section from the position of the coalbed mined near Fabius in the lower conglomerate, and downward, is found on Alabama Highway 117 in Norwood Cove, secs 25 and 26, T 2 S, R 8 E, and the part from this coal upward, on Warren Smith Hill, Caperton Ferry Road, SW1/4 sec 1, T 3 S, R 8 E. The lower part of this section is exposed in Norwood Cove where the upper part is hidden or eroded, and the upper part is most fully developed on Warren Smith Hill.

2. A generalized section on Lookout Mountain from Culbertson (7).

3. A section on Lookout and Sand Mountains in Georgia, also from Culbertson (7) who modified it from Johnson (14).

4. A section from Raccoon Mountain and Walden Ridge, Tenn., from Wilson and others (32), as modified by Culbertson (7). Raccoon Mountain is the extension of Sand Mountain from Georgia and Alabama into Tennessee, south of the Tennessee River, while Walden Ridge is the further extension of the same mountain, north of the river.

It is clear from these sections that the coalbed mined near Fabius is equivalent to the Underwood bed of Lookout Mountain. Although only the sandstone and conglomerate below the Underwood is referred to as the lower conglomerate on Lookout Mountain, the interval upward to the shaly Upper Cliff beds is quite sandy. The Underwood bed could be said to occur, therefore, in a split in the lower conglomerate on that mountain also. Where this coalbed does not occur on Sand Mountain, as east and south of dotted line on figure 5,
FIGURE 6. - Stratigraphic Sections of Sand and Lookout Mountains in Alabama, Georgia, and Tennessee.

The lower conglomerate is continuous to the Upper Cliff interval. Indeed, the same condition is evident on Johnson's Georgia section where, perhaps mistakenly, it is labeled the Sewanee Sandstone Member.

The thin coalbeds found in the shaly interval under the upper conglomerate are the Upper Cliff beds. On Lookout Mountain only two Upper Cliff beds are found but on Warren Smith Hill, and in several drill holes (fig. 2) on Sand Mountain, three beds occur. Upper Cliff No. 3 bed is usually very thin.
For the remainder of this report, the four coalbeds occurring in the Sand Mountain area examined will be designated, from top to bottom, as the Upper Cliff Nos. 1, 2, and 3 beds and the Underwood beds.

Figure 6 shows that the Underwood coalbed has no equivalent in Sand and Lookout Mountains of Georgia or in Raccoon Mountain or Walden Ridge of Tennessee. It is, therefore, believed to be restricted to a split or interval in the lower conglomerate, in the southeast quarter of the Bridgeport quadrangle, the Stevenson quadrangle, the portion of Flat Rock quadrangle west and north of the dotted line shown in figure 5, and in Lookout Mountain. Insufficient work has been done south of these quadrangles to determine if the Underwood coalbed occurs anywhere in this area of Sand Mountain. There is a strong possibility that the coalbed surface-mined a few years ago in secs 34 and 35, T 5 S, R 8 E and secs 1 and 2, T 6 S, R 8 E, Sylvania quadrangle about 2 miles southeast of Sylvania, Ala., is the same bed.

The Upper Cliff No. 1 bed is correlated with the unnamed bed just under Johnson's (14) "Bon Air Sandstone" on Sand and Lookout Mountains in Georgia and with the Angel coal in the Signal Point shale of southern Tennessee (fig. 6). Apparently coalbeds in this interval are also better developed farther south in Alabama, in both Sand and Lookout Mountains, just as is the Underwood bed.

R. L. Wilson, professor of geology, University of Chattanooga, from his study of the Scratch Ankle Hollow area, Marion County, Tenn., and Dade County, Ga., where great thicknesses of Raccoon Mountain (32) strata occur with many coalbeds, believes that the cliff-forming sandstone of Sand Mountain in Alabama is not the equivalent of the Warren Point Sandstone Member of Tennessee as shown by the sections in figure 6, but that it is one of the rather minor Raccoon Mountain Sandstones of Tennessee, which has thickened considerably to the south. In this case, the Warren Point Sandstone Member is actually the equivalent of the upper conglomerate. Figure 6, however, shows the upper conglomerate as equivalent to the Sewanee Sandstone of Tennessee. If Wilson is correct, the coalbeds in the Fabius-Flat Rock area, while still correlated with the same beds in Lookout Mountain, are the correlates of certain beds as follows: (1) The Upper Cliff coalbeds are equivalent to the "Bon Air" (Nelson, Etna, Battle Creek, Orme) coalbeds and (2) the Underwood coalbed is equivalent to the lower "Bon Air" (Dade or Rattlesnake) coalbed. The Warren Point Sandstone cliffs apparently are traceable into Alabama on the Cumberland Mountain side of the Tennessee river and possibly on the Raccoon (Sand) Mountain side, according to the mapping of Wilson and others (32). Until further study, it will be assumed, therefore, that the correlations indicated in figure 6 are correct.

COAL RESERVES

Reserves have been calculated in the Fabius-Flat Rock area for portions of the Henegar, Stevenson, and Flat Rock quadrangles for the following townships: T 2 S, Rs 8 and 9 E and T 3 S, Rs 8 and 9 E. Although the dotted line on figure 5 is positioned somewhat arbitrarily because detailed data are lacking, it was used at the eastern and southern boundary of the reserve area in TPs 2 and 3 S, R 9 E and T 3 S, R 8 E.
Reserve estimates have been made only for the Underwood coalbed. Field observations and drill records indicate a few areas may exist where coal from one or more of the Upper Cliff beds may be recovered from the overburden above the Underwood bed. Only in DDH 106-62, SW1/4NE1/4SE1/4 sec 2, T 3 S, R 8 E, is a single thickness indicated great enough to justify mining one Upper Cliff bed by itself. In certain other places, such as the northwest corner of the Trenton quadrangle, near the Georgia state line, sec 16, T 2 S, R 6 E, two Upper Cliff beds may be developed sufficiently to justify simultaneous mining if overburden is not too great. No estimates of reserves, however, have been made for any of these areas.

Because little Underwood coal can be mined by underground methods at the present utility coal prices and at the present state of mining technology, the depth and character of the overburden is an important criterion for estimating recoverable coal reserves. Surface mining technology has progressed so rapidly in recent years that any overburden limit considered reasonable now may readily be exceeded in a few years. The same is true, of course, regarding assumed restrictions on underground mining. Probably no 14-inch coalbed with maximum cover of 250 feet should be classified as ultimately unrecoverable.

The estimate based on 60 feet of overburden is probably in line with present day practice. No doubt the thickness of overburden can readily be exceeded with proper equipment in soft shale overburden, but in the variable, often heavy overburden containing much sandstone and conglomerate as found in the northern part of the Fabius-Flat Rock area, 60 feet of overburden appears to be a maximum.

To assist in estimating the thickness of the overburden in areas not yet explored, table 1 was prepared. It shows the lines measured on the outcrops from the top of the Underwood coalbed to the base of the upper conglomerate in 11 widely scattered localities. Measured intervals were calculated from these measured lines and then corrected to conform with the regional dips and strikes of the two horizons. In addition, the thickness of this interval is shown in three vertical drill holes that appear to have been started above the base of the upper conglomerate. The corrected intervals range from 40 to 150 feet, indicating an apparent increase in thickness toward the north in both the Stevenson and Flat Rock quadrangles.

Coal reserves were estimated on a regional basis by methods (3, 24) used by the Geological Survey and the Bureau of Mines for three categories of reserves: Measured, indicated, and inferred. The areas around isolated drill holes subtended by circles or arcs of 1/4-mile radius were considered as indicated reserves. Where the drill holes are closer together and these arcs overlap, the overlap areas were included in the measured category. Measured reserves were limited to areas where the distance between points of observation along an outcrop did not exceed one-half mile. Where observation data points were more isolated (1 mile apart), the areas were considered as inferred reserves. Where the distance between data points was up to 2 miles, the areas were considered as inferred reserves. Minimum thickness of 14 inches of coal was used in outlining areas.
TABLE 1. - Interval between the top of the Underwood coalbed and the base of the upper conglomerate

<table>
<thead>
<tr>
<th>Locality No.</th>
<th>Description</th>
<th>Direction</th>
<th>Length, miles</th>
<th>Measured, feet</th>
<th>Corrected, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From SW1/4 sec 25, T 2 S, R 8 E, near Fabius bench mark to RDH 174-64, NW1/4 sec 35, T 3 S, R 8 E.</td>
<td>S 40° W</td>
<td>1.2</td>
<td>110</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>From SW1/4 sec 36, T 3 S, R 8 E, to DDH 109-62, SE1/4SW1/4NE1/4 sec 2, T 3 S, R 8 E.</td>
<td>S 40° W</td>
<td>.6</td>
<td>120</td>
<td>105</td>
</tr>
<tr>
<td>3</td>
<td>From NE1/4 sec 21, T 3 S, R 8 E, to DDH 119-62, SE1/4SE1/4NE1/4 sec 16, T 3 S, R 8 E.</td>
<td>S to N</td>
<td>.9</td>
<td>65</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>Warren Smith Hill, SW1/4SW1/4SW1/4 sec 1, T 3 S, R 8 E.</td>
<td>-</td>
<td>Short</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>From NE1/4 sec 7, T 3 S, R 9 E along Caperton Ferry Road to Kash Creek, SE1/4 sec 7, T 3 S, R 9 E.</td>
<td>NW to SE</td>
<td>.5</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>From top of hill, SW1/4 sec 18, T 3 S, R 9 E, to FDH 14-64, SW1/4 sec 18, T 3 S, R 9 E.</td>
<td>E to W</td>
<td>.75</td>
<td>103</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>From Libert Hill Church, sec 29, T 2 S, R 9 E, to Hammond pit, SW1/4 sec 20, T 2 S, R 9 E.</td>
<td>S to N</td>
<td>.8</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>8</td>
<td>From top of hill, NE1/4 sec 33, T 2 S, R 9 E, to W side, Indian Creek, SE1/4 sec 27, T 2 S, R 3 E.</td>
<td>N 60° E</td>
<td>.7</td>
<td>125</td>
<td>120</td>
</tr>
<tr>
<td>9</td>
<td>From top of hill near line between NW1/4 and SW1/4 sec 10, T 3 S, R 9 E, to Buckner pit, NE1/4 sec 16, T 3 S, R 9 E.</td>
<td>N to S</td>
<td>.8</td>
<td>150</td>
<td>140</td>
</tr>
<tr>
<td>10</td>
<td>From near SW corner sec 14 to point on S line of sec 15, T 3 S, R 9 E.</td>
<td>E to W</td>
<td>.5</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>From NW1/4SW1/4 sec 19, T 1 S, R 10 E, to old Pearce mine SE1/4NE1/4 sec 2, T 2 S, R 9 E.</td>
<td>S 30° W</td>
<td>2.9</td>
<td>190</td>
<td>150</td>
</tr>
<tr>
<td>12</td>
<td>DDH Cl-61, SW1/4NE1/4SE1/4 sec 14, T 3 S, R 8 E.</td>
<td>-</td>
<td>-</td>
<td>64.8</td>
<td>64.8</td>
</tr>
<tr>
<td>13</td>
<td>RDH Pl-61, NE1/4NW1/4NW1/4 sec 12, T 3 S, R 8 E.</td>
<td>-</td>
<td>-</td>
<td>64.3</td>
<td>64.3</td>
</tr>
<tr>
<td>14</td>
<td>DDH 7-61, NE1/4NW1/4SE1/4 sec 10, T 3 S, R 8 E.</td>
<td>-</td>
<td>-</td>
<td>52.8</td>
<td>52.8</td>
</tr>
</tbody>
</table>
To determine the volume of coal, each individual area was planimetered. Based on the area, the seam thickness, and allowing 1,800 tons of coal per acre-foot, the coal tonnage was calculated. Estimates of coal reserves are given in tables 2 and 3.

### TABLE 2. - Estimated reserves of coal in three probability categories for Flat Rock, Henegar, and Stevenson quadrangles, Alabama

<table>
<thead>
<tr>
<th>Quadrangle</th>
<th>Category</th>
<th>Thickness of bed, inches</th>
<th>Coal, short tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Rock......</td>
<td>Measured.....</td>
<td>30</td>
<td>2,483,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>32</td>
<td>25,024,000</td>
</tr>
<tr>
<td></td>
<td>Inferred.....</td>
<td>34</td>
<td>20,981,000</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal...</strong></td>
<td></td>
<td><strong>48,488,000</strong></td>
</tr>
<tr>
<td>Henegar.........</td>
<td>Measured.....</td>
<td>27</td>
<td>280,000</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal...</strong></td>
<td></td>
<td><strong>280,000</strong></td>
</tr>
<tr>
<td>Stevenson......</td>
<td>Measured.....</td>
<td>27</td>
<td>13,596,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>28</td>
<td>5,320,000</td>
</tr>
<tr>
<td></td>
<td>Inferred.....</td>
<td>28</td>
<td>5,236,000</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal...</strong></td>
<td></td>
<td><strong>24,152,000</strong></td>
</tr>
<tr>
<td>Total...........</td>
<td>Measured.....</td>
<td>27</td>
<td>16,359,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>31</td>
<td>30,344,000</td>
</tr>
<tr>
<td></td>
<td>Inferred</td>
<td>33</td>
<td>26,217,000</td>
</tr>
<tr>
<td><strong>Grand total.</strong></td>
<td></td>
<td></td>
<td><strong>72,920,000</strong></td>
</tr>
</tbody>
</table>

For all categories of reserves, a total of 72,920,000 tons of coal more than 14 inches thick is estimated for the areas studied in Stevenson, Flat Rock, and Henegar quadrangles. Of this tonnage, 40,001,000 tons are estimated to have less than 60 feet of overburden. The total measured coal reserves for the three quadrangles are 16,359,000 tons, with 12,471,000 tons under less than 60 feet of cover.

Coal reserves in the Stevenson quadrangle totaled 24,152,000 tons, with 13,596,000 tons in the measured category. All categories of reserves under less than 60 feet of cover in the Stevenson quadrangle totaled 16,133,000 tons with 10,214,000 tons in the measured classification. In the Flat Rock quadrangle, a total of 48,488,000 tons of coal is estimated, with 2,483,000 tons in the measured classification. For all categories of reserves with less than 60 feet of cover, 23,588,000 tons of coal are estimated. In the Henegar quadrangle, 280,000 tons of measured coal reserves are estimated and are beneath less than 60 feet of cover.
### TABLE 3. - Estimated reserves of coal in three probability categories and with less than 60 feet of cover for Flat Rock, Henegar, and Stevenson quadrangles, Alabama

<table>
<thead>
<tr>
<th>Quadrangle</th>
<th>Category</th>
<th>Thickness of bed, inches</th>
<th>Coal, short tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat Rock........</td>
<td>Measured.....</td>
<td>32</td>
<td>1,977,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>31</td>
<td>15,505,000</td>
</tr>
<tr>
<td></td>
<td>Inferred.....</td>
<td>29</td>
<td>6,106,000</td>
</tr>
<tr>
<td>Subtotal.........</td>
<td></td>
<td></td>
<td>23,588,000</td>
</tr>
<tr>
<td>Henegar...........</td>
<td>Measured.....</td>
<td>27</td>
<td>280,000</td>
</tr>
<tr>
<td>Subtotal.........</td>
<td></td>
<td></td>
<td>280,000</td>
</tr>
<tr>
<td>Stevenson........</td>
<td>Measured.....</td>
<td>27</td>
<td>10,214,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>30</td>
<td>1,987,000</td>
</tr>
<tr>
<td></td>
<td>Inferred.....</td>
<td>28</td>
<td>3,932,000</td>
</tr>
<tr>
<td>Subtotal.........</td>
<td></td>
<td></td>
<td>16,133,000</td>
</tr>
<tr>
<td>Total............</td>
<td>Measured.....</td>
<td>28</td>
<td>12,471,000</td>
</tr>
<tr>
<td></td>
<td>Indicated....</td>
<td>31</td>
<td>17,492,000</td>
</tr>
<tr>
<td></td>
<td>Inferred.....</td>
<td>29</td>
<td>10,038,000</td>
</tr>
<tr>
<td>Grand total......</td>
<td></td>
<td></td>
<td>40,001,000</td>
</tr>
</tbody>
</table>

#### QUALITY OF THE COAL

**Rank**

Eleven proximate analyses of coal from the Underwood bed of the Fabius-Flat Rock area on Sand Mountain in Alabama are shown in table 4. The first two analyses are incomplete. All the analyses are from the Stevenson topographic quadrangle and from T 3 S, R 8 E, except for the partial analysis of coal from the Hammond pit which is in the Flat Rock quadrangle center, sec 20, T 2 S, R 9 E.

The American Society for Testing Materials standard specifications for classification of coals by rank (2) uses dry, mineral-matter-free fixed carbon as the sole chemical criterion for coals higher in rank than high-volatile A bituminous (hvab). This rank of coal must have a dry mineral-matter-free fixed carbon under 69 percent and a moist mineral-matter-free heating value more than 14,000 Btu per pound.
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Kind of sample</th>
<th>Analysis, percent</th>
<th>Heating value, Btu per pound</th>
<th>Free-swelling index</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Ginn pit, coal from trucks to Widows Creek steamplant.</td>
<td>Basis: A = 2.7, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>22</td>
<td>Hammond pit, coal from trucks to Widows Creek steamplant.</td>
<td>Basis: A = 1.9, B = 21.4, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>33</td>
<td>Ginn pit coal, channel sample, SE1/4SE1/4 sec 3, T3S, R8E.</td>
<td>Basis: A = 1.2, B = 1.9, C = 1.5; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>34</td>
<td>Ginn pit coal, float fraction at 1.45 specific gravity separation of No. 3 channel sample.</td>
<td>Basis: A = 1.5, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>45</td>
<td>Ginn pit coal, float fraction at 1.55 specific gravity separation.</td>
<td>Basis: A = 1.1, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>56</td>
<td>DDH 1-61 core, float fraction at 1.55 specific gravity separation, SE1/4SE1/4 sec 3, T3S, R8E.</td>
<td>Basis: A = 1.3, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>57</td>
<td>DDH 2-61 core, float fraction at 1.55 specific gravity separation, SW1/4NW1/4 sec 2, T3S, R8E.</td>
<td>Basis: A = 1.2, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>58</td>
<td>DDH 4-61 core, float fraction at 1.55 specific gravity separation, SW1/4SE1/4 sec 9, T3S, R8E.</td>
<td>Basis: A = 1.4, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>59</td>
<td>DDH 16A-61 core, float fraction at 1.55 specific gravity separation, NW1/4SW1/4 sec 15, T3S, R8E.</td>
<td>Basis: A = 1.4, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Ginn pit coal from second channel sample in 6-inch increments for total of 35 inches, SE1/4SE1/4 sec 3, T3S, R8E.</td>
<td>Basis: A = 1.3, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Fies No. 1 pit coal, SW1/4SW1/4 sec 3, T3S, R8E.</td>
<td>Basis: A = 1.3, B = 1.9, C = 1.2; Ash: A = 17.9, B = 21.4, C = 18.6; Volatile matter: A = 29.7, B = 37.0, C = 35.4; Fixed carbon: A = 50.5, B = 63.0, C = 46.4; Sulfur: A = 1.1, B = 1.6, C = 1.5</td>
<td>12,140, 11,630, 12,100</td>
<td>-</td>
</tr>
</tbody>
</table>

1A = As-received (usually air-dry) basis. B = Moisture- and ash-free basis. C = Unit coal or dry, mineral-matter-free basis.
2Sampled and analyzed by TVA at Widows Creek steamplant.
3Sampled by W. T. Daniel, geologist, Geological Survey of Alabama, and analyzed by a commercial laboratory.
4Sampled by Dr. Milton H. Fies; analyzed by a commercial laboratory.
5Ash fusion temperatures as follows: Sample 6 - 2,822° F; sample 7 - 2,795° F; sample 8 - 2,832° F; sample 9 - 2,695° F.
Table 4 shows fixed carbon, on the required basis, of 65 to 68 percent. These values are not very far below the minimum of 69 percent for medium-volatile bituminous (mvb) rank coal. Moist mineral-matter-free heating values are not given in table 4, but all reach or exceed 15,000 Btu per pound. The values in table 4 for moisture are not "bed moisture" as specified by the ASTM standard; however, coals of the fixed carbon analyses of table 4 do not carry enough bed moisture to reduce the moist, mineral-matter-free heating values below 14,000 Btu per pound. Thus, all the Underwood bed samples are clearly of hvab rank and evidently not far below mvb rank. The free-swelling indexes (7 to 8-1/2) emphasize the closeness of the coal to mvb rank. Other Alabama coals with free-swelling indexes of 7 to 8-1/2 are also high in the hvab or in the mvb rank classification (21).

Chemical Analyses

Nine complete and two incomplete proximate analyses plus heating value and sulfur content are given in table 4, but no ultimate analysis is available.

Coal from the Underwood bed in the Stevenson quadrangle is a prevailing of high-ash coal. Ash analyses of the float-and-sink fractions suggest that inherent ash is high. Air-dry moisture is low, consistent with the coal rank, and the sulfur impurity is moderate to low. Samples range from 0.71 to 1.60 percent sulfur but probably average only a little more than 1 percent.

Consistent with its rank, the heating value of coal from the Underwood bed is high. Although some of the samples may have been slightly weathered, a condition which lowers heating values, few of the as-received samples had heating values under 12,000 Btu per pound. None were under 15,000 Btu per pound on a dry, ash-free basis. On the theoretical "pure coal" or dry, mineral-matter-free basis, heating values range from 15,300 to 15,630 Btu per pound. These values are comparable with those of most of the coking coals of the Warrior coalfield of Alabama on the same basis (21).

Physical Characteristics

No petrographic, friability, or grindability studies of coal from the Underwood bed have been made.

Ash fusibility temperatures are uniformly high. The high inorganic matter and low sulfur are consistent with the ash fusion range of 2,795°F to 2,895°F shown in footnote 5 in table 4. Visual inspection of the coal shows most of the visible inorganic matter to be shale or clay. The inherent mineral matter could be fine sand or clay minerals or both. Some contamination from sandstone overburden is possible in some cases.

The free-swelling index of 7 to 8-1/2 indicates a moderately to strongly swelling coal, consistent with the rank of coal from the Underwood bed.

The Underwood coalbed is almost everywhere twisted and contorted and has a noncubic fracture suggesting postdepositional movement. There is little or
no evidence of such movement in the overlying strata so that it could have occurred soon after deposition or while the plant matter was still in a somewhat plastic condition. Cleat and butt joints, so frequently seen in bituminous coals, are almost wholly absent in the Underwood bed where it is presently being mined.

Although contorted, coal from the Underwood bed appears to be of the bright banded variety. Some fusain or "mother coal" is present, but the quantity is low. Dull bands can be seen. These may be due to concentration of mineral matter in bands ("boney" coal) or to the presence of splint or dull coal, but it appears to be the former. In general, dull coal (including fusain) analyses higher in fixed carbon and in mineral matter than does bright coal in the same bed. In table 4, the three samples of raw coal (No. 3, 10, and 11) average 65 percent dry, mineral-matter-free fixed carbon while the six samples of float coal (No. 4, 5, 6, 7, 8, and 9) at 1.40 to 1.65 specific gravity of separation average 67 percent. This small difference is opposite to what would be expected if considerable high, fixed-carbon dull coal had been removed in the sink. It is concluded, therefore, that the proportion of true dull coal in the Underwood bed is small.

The results of 13 specific gravity separations are shown in table 5. All figures emphasize the rather high mineral matter in coal from the Underwood bed in the Fabius area. Separations at specific gravities that will insure good recoveries do not yield a float fraction with low mineral matter. The three separations made on the core sample from DDH 16A-61 (No. 10, 11, and 12) illustrate the fact. The calculated ash analysis of the raw coal is 21.5 percent. Separation at 1.55 specific gravity resulted in an 85 percent recovery but lowered the ash analysis only to 14 percent. This was a beneficial reduction of over one-third but still not a really low-ash product. Separations at 1.45 and at 1.40 specific gravity gave lower recoveries of 73 and 64 percent, respectively, but ash was reduced only to 12.0 and 11.4 percent, respectively. All free extraneous matter is certainly eliminated as sink at specific gravity 1.40. No float-and-sink tests were made on identical samples crushed to varying degrees of fineness to determine the extent of release of "inherent" or closely admixed mineral matter with size reduction.

Variations in the ash analyses of the 1.55 float fractions of the various samples from 13.80 to 15.00 percent indicate that the specific gravity of the coal material itself or the nature of the intermixed mineral matter or both is variable from place to place in the bed. The sample shown in item 13, table 5, while comparatively low in ash in the raw condition, is not greatly improved even by separation at 1.65 specific gravity.
### TABLE 5. - Ash analyses and float-and-sink fractions of coal from the Underwood bed, Fabius-Flat Rock area

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Kind of sample</th>
<th>Specific gravity of separation</th>
<th>Float fraction</th>
<th>Sink fraction</th>
<th>Calculated ash in raw coal, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ginn pit coal, channel sample (see sample 3, table 4).</td>
<td>1.45</td>
<td>53.5</td>
<td>11.6</td>
<td>46.6</td>
</tr>
<tr>
<td>2</td>
<td>Ginn pit coal (see sample 5, table 4).</td>
<td>1.55</td>
<td>84.2</td>
<td>13.9</td>
<td>15.9</td>
</tr>
<tr>
<td>3</td>
<td>DDH 1-61 core sample (see sample 6, table 4).</td>
<td>1.55</td>
<td>82.2</td>
<td>13.5</td>
<td>17.8</td>
</tr>
<tr>
<td>4</td>
<td>DDH 2-61 core sample (see sample 7, table 4).</td>
<td>1.55</td>
<td>88.1</td>
<td>13.4</td>
<td>11.9</td>
</tr>
<tr>
<td>5</td>
<td>DDH 4-61 core sample (see sample 8, table 4).</td>
<td>1.55</td>
<td>85.2</td>
<td>13.5</td>
<td>14.8</td>
</tr>
<tr>
<td>6</td>
<td>DDH 4-61 core sample (see sample 8, table 4).</td>
<td>1.45</td>
<td>80.4</td>
<td>12.3</td>
<td>19.7</td>
</tr>
<tr>
<td>7</td>
<td>DDH 3A-61 core sample, NE1/4SW1/4 sec 2, T 3 S, R 8 E.</td>
<td>1.45</td>
<td>66.7</td>
<td>12.8</td>
<td>33.3</td>
</tr>
<tr>
<td>8</td>
<td>DDH 3A-61 core sample (see sample 7, table 5).</td>
<td>1.55</td>
<td>85.7</td>
<td>15.0</td>
<td>14.6</td>
</tr>
<tr>
<td>9</td>
<td>DDH 8A-61 core sample NE1/4SE1/4 sec 9, T 3 S, R 8 E.</td>
<td>1.55</td>
<td>88.0</td>
<td>13.8</td>
<td>12.0</td>
</tr>
<tr>
<td>10</td>
<td>DDH 16A-61 core sample (see sample 9, table 4).</td>
<td>1.40</td>
<td>64.0</td>
<td>11.4</td>
<td>36.0</td>
</tr>
<tr>
<td>11</td>
<td>DDH 16A-61 core sample (see sample 9, table 4).</td>
<td>1.45</td>
<td>72.9</td>
<td>12.0</td>
<td>27.1</td>
</tr>
<tr>
<td>12</td>
<td>DDH 16A-61 core sample (see sample 9, table 4).</td>
<td>1.55</td>
<td>84.9</td>
<td>14.0</td>
<td>15.1</td>
</tr>
<tr>
<td>13</td>
<td>Fies No. 1 pit, channel sample (see sample 11, table 4).</td>
<td>1.65</td>
<td>91.3</td>
<td>13.9</td>
<td>8.7</td>
</tr>
</tbody>
</table>

\*Calculated from analyses reported on dry basis so that the calculated percent is slightly larger than as-received percent shown for same sample, No. 11, in table 4.

**MARKET**

Until the building of the Widows Creek steamplant in 1952, no market existed for Jackson County coal except for domestic use in the rural countryside and in the towns of Scottsboro, Bridgeport, Stevenson, Guntersville, Ala., and South Pittsburg, Tenn.
Small mines on Cumberland Mountain, west of the Tennessee River, were nearer and more accessible to all these towns than were those in the Fabius-Flat Rock area, east of the Tennessee River. Coal from the latter area had to be ferried across the river at Caperton Ferry or be hauled 37 miles north to a bridge near Jasper, Tenn., or 28 miles south to one near Scottsboro, Ala.

The Widows Creek steamplant, like the towns, was located west of the river so that this market, too, was not available to all truck haulage from the Fabius-Flat Rock area. After construction of the Caperton Ferry bridge, 4 miles down river from the steamplant, the Fabius-Flat Rock area became the nearest and most accessible area of coal-bearing rocks to the Widows Creek plant for all methods of transportation, even closer than the formerly much more productive Crow Creek-Summerhouse Mountain-Orme area of Cumberland Mountain.

In view of the large proportion of the delivered price of coal from the Fabius-Flat Rock area that would be chargeable to transportation in distant markets, low-grade coals render this area a one-market district.

**VALUE OF COAL**

The value of the coal as fuel must compete, on a Btu basis, with coal from the Eastern Interior coalfield, delivered to the Widows Creek steamplant by rail or barge. According to the Federal Power Commission (9), in 1963 the total coal consumed was 2,445,000 tons valued at an average of $4.48 per ton f.o.b. plant. The "A" unit burned 905,500 tons with an average of 11,937 Btu per pound. The "B" unit consumed 1,539,500 tons with an average of 11,981 Btu per pound (9). In 1963 the total generating capacity was listed by TVA as 1,175,000 kw.

**MINING METHODS AND EQUIPMENT**

Presently, broken overburden is being removed by two diesel-powered draglines rated at 6 cubic yards but with 7-1/2-cubic-yard buckets. One dragline has a 120-foot boom and the other a 125-foot boom. The draglines are effective in areas where there is not too great a thickness of sandstone over the coal or where the sandstone is not too tough for proper fragmentation. Fine grained, tough sandstone appears to be more difficult to handle than the coarser but more nonuniform conglomerate that is common in many places. A stripping shovel of 40-cubic-yard capacity has been purchased for areas where the overburden contains much tough sandstone. Figures 7, 8, and 9 show strip mining at Fries No. 1 mine. After removal of the overburden, the surface of the coalbed, which is relatively smooth, is cleared by either a medium or large size bulldozer and swept by a tractor-powered, cylindrical wire brush. The coal is loaded into trucks by a loading shovel equipped with a specially designed 2-1/2-cubic-yard coal-loading bucket. The trucks are not owned by the company but are operated under contract. Most of the trucks are of 20-ton capacity. Trucks are weighed near the pit before descending the mountain to the dock. Figure 10 shows a truck dumping into a barge at the dock.
FIGURE 7. - Dragline Stripping Overburden.

FIGURE 8. - Strip Mining at Fies No. 1 Mine.
FIGURE 9. - Loading Coal With Power Shovel.

FIGURE 10. - Truck Discharging Coal Into Barge.
Overburden disposal is conventional and all overburden contains much rock. The company has begun a reforestation program on the first or 1-year-old spoil banks. In cooperation with the State Forest Service and the TVA 40,000 pine trees have been planted. Grass seed has been scattered over some of the spoil banks. The company has also planted 20,000 cottonwood trees as an experimental approach to reforestation with a species of tree that is not native to the area.

Where vertical drill holes are utilized, overburden drilling is done by a 9-inch diesel-powered, crawler-mounted, high-pressure rotary drill with pneumatic bit cooling and cuttings removal. Where there is shale between the coal and the sandstone, which is the most common condition, two 6-inch horizontal wheel-mounted auger-type drills are available.

The area to be stripped is first cleared of young timber, brush, and soil by the use of a large bulldozer. To break the rock strata and loosen the overburden, the formations are drilled and blasted by one of two methods. If 3 to 4 feet of shale lies between the coal and the sandstone, the 6-inch auger drills a series of 60-foot holes into the shale parallel to and several feet above the coaled bed. The holes are spaced 15 to 18 feet apart with the spacing varied according to the nature of the overburden. Vertical holes are drilled 60 feet back from the face and are bottomed in the shale above the coal. The 9-inch vertical holes are also spaced 15 to 18 feet apart depending on the strata. The primer consists of 1 pound of explosive with a strength equivalent of 60 percent gelatin attached to a detonating fuse. After loading the primer, the hole is loaded to within 8 feet of the collar with a ammonium nitrate-fuel oil (AN-FO) mixture. Stemming is used to fill the balance of the hole. An average of 150 pounds AN-FO is loaded per hole but may be as much as 300 pounds depending on the overburden. In the event the holes are wet, dynamite cartridges are substituted for the AN-FO mixture. In horizontal holes, the same type of primers are used as in the vertical holes. The holes are loaded with five 5-inch-diameter, 30-pound cartridges of low-intensity dynamite. The balance of the holes are filled with stemming. With the exception of those holes in box cuts, all blastholes are detonated simultaneously by an electric detonating cap attached to the detonating fuse forming the trunkline. The blasthole primer detonating fuses are attached to the trunkline just prior to blasting.

The blasthole pattern for vertical holes only is 15 feet between the drill holes and 18 feet of burden. The second row of drill holes is staggered in relation to the first. The holes are bottomed several feet above the coaled bed. Loading is substantially the same as described previously for vertical holes. All firing is simultaneous, except for box cuts for which delays are provided by the use of millisecond delay connectors inserted at the proper places in the trunkline.

Up to the present, the mining at Pies No. 1 has been one of area stripping rather than contour stripping. There are other areas in both the Stevenson and Flat Rock quadrangles, where contour stripping may be more practical.
The pits are laid out so as to take advantage of the natural drainage pattern to keep them free of water. Most pits will, therefore, parallel the natural drainage. Pits are approximately 70 feet wide. Overburden removed has averaged about 30 feet. Haulage roads follow the pit bottoms even in areas requiring long roads over mined-out areas. This pattern is easy to maintain now as mining activities are advancing toward the permanent haulage roads rather than away from them.

Box cuts are necessary only where unsuitable areas are to be bypassed or on property lines. A second handling of overburden is not required.

COAL CLEANING TEST AT A COMMERCIAL PLANT

A 74.2-ton coal sample, strip mined near Fabius, Ala., was trucked to a heavy media coal preparation plant in Tennessee for a coal cleaning test. This plant produced a cleaned 7/8- by 1/4-inch stoker-grade coal and an unwashed minus 1/4-inch product, marketed as a steam coal. Coal larger than 7/8-inch square mesh was crushed to pass through this size opening. The openings in the 1/4-inch screen were rectangular. This type aperture tends to permit larger flat or flaky particles to pass through the screen than would be retained on a square mesh screen. In the Underwood coal the bone or high-ash particles tend to be flat or flaky, and this condition may partially explain the higher ash in the minus 1/4-inch fraction.

The heavy media suspension was controlled to effect a separation at 1.45 specific gravity. Cleaned coal recovery was 80 percent of the 7/8- by 1/4-inch size of raw coal fed to the plant.

Analysis on a dry basis of the 7/8- by 1/4-inch cleaned coal was as follows:

<table>
<thead>
<tr>
<th></th>
<th>Dry basis</th>
<th>Dry ash-free basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile matter, percent</td>
<td>30.9</td>
<td>35.6</td>
</tr>
<tr>
<td>Fixed carbon..........do</td>
<td>56.0</td>
<td>64.4</td>
</tr>
<tr>
<td>Ash................do</td>
<td>13.1</td>
<td>-</td>
</tr>
<tr>
<td>Total.........................</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Heating volume, Btu percent</td>
<td>13,038</td>
<td>15,006</td>
</tr>
</tbody>
</table>

The free-swelling index was 8 and indicates a strongly swelling coal. Under present conditions, the ash content of the cleaned coal from this test is too high for its use as a coking coal.

The 7/8- by 1/4-inch refuse analyzed 34.4 percent ash. A float and sink test at 1.45 specific gravity separated a float product containing 14.2 percent ash, which represented 20.6 percent of the refuse sample. The sink product analyzed 39.5 percent ash and represented 79.4 percent of the refuse sample.

Minus 1/4-inch raw coal was 34 percent of the total raw coal and analyzed 19.4 percent ash. Float and sink tests at 1.45 specific gravity resulted in a
float product with an analysis of 13.0 percent ash and represented 72.2 per-
cent of the raw coal tested. The sink product analyzed 36.0 percent ash and
27.8 percent of the raw coal sample.

CONCLUSIONS

At least one coalbed, Underwood, is being surface-mined, in the Fabius-
Flat Rock area, Stevenson, Flat Rock, and Henagar quadrangles, Jackson County,
Ala. The entire area lies on top of Sand Mountain about 800 to 1,000 feet
higher than the TVA Widows Creek steam-electric generating plant and from 2 to
10 miles from that plant.

It is estimated that 72,920,000 tons of original coal reserves, averaging
31 inches in thickness, lie in the area. Of this tonnage, 22.4 percent is in
the measured, 41.6 percent in the indicated, and 36.0 percent in the inferred
category. Of this reserve, 40,001,000 tons or 54.9 percent, lie under 60 feet
or less of cover and, therefore, may be considered amenable to surface mining
under present strip-mining technology.

Three thin coalbeds, Upper Cliff Nos. 1, 2, and 3, lie above the Underwood
bed but are only from 1-1/2 to 14 inches thick. It is not believed that these
beds will add to the coal reserve except perhaps in a few places where they
may be partially recovered in mining the Underwood bed.

Underwood bed coal, where mined and sampled, has a high-mineral-matter
and moderate sulfur content. Ash analyses of raw coal range from about 15 to
more than 21 percent. Float and sink tests and one commercial coal-washing
plant test have shown that washing at a specific gravity high enough to give
acceptable yields lowers the ash analysis to about 12 to 15 percent. Washing
is not now practiced.

Sulfur analyzed from 1 to 1-1/2 percent. Shipments to the Widows Creek
plant have thus far averaged only a little more than 1 percent. Pyrite is
visible in Underwood bed coal so that some sulfur reduction may be expected
from any cleaning process.

Some areas in the field are readily surface-mined with draglines but
others with thick, tough sandstone overburden probably will require a strip-
ning shovel. Such equipment is scheduled for installation at Fies No. 1 mine.

The Fabius-Flat Rock area, in relation to the Widows Creek steam-electric
generating plant, is almost a mine mouth generating situation. These are
rather rare in Alabama and also rare is the proximity of this coalfield to a
large fully navigable stream.
REFERENCES


