Bureau of Mines
Report of Investigations 5258

ESTIMATE OF KNOWN RECOVERABLE RESERVES AND PREPARATION AND CARBONIZING PROPERTIES OF COKING COAL IN CAMPBELL COUNTY, TENN.

By Lloyd Williams, H. K. Gibbs, William L. Crentz, J. W. Miller, and D. A. Reynolds

United States Department of the Interior — September 1956

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UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director

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September 1956

FOREWORD

Since its creation by Congress in 1910, the Bureau of Mines has borne a heavy responsibility for technical progress in the mining, preparation, and utilization of our national fuel reserves. Similarly, it has pioneered in scientific studies leading to better health and safety in mining and more efficient conservation of fuel resources.

Conservation means a full but prudent use of the national resources with avoidance of waste. Conservation requires an inventory to determine the extent, availability, and condition of our resources, for without these facts it is impossible for either industry or Government to plan for sustained production and maintenance of the industrial capacity so essential to our peacetime prosperity and wartime survival. This is true particularly of fuels needed for special purposes, such as metallurgical coking coals that must possess certain favorable properties. Heavy use of our limited reserves of good coking coal has resulted in severe depletion and, in some areas, exhaustion of the thickest and best beds.

At the request of the Munitions Board, Department of Defense, the Bureau of Mines made preliminary arrangements early in 1948 for an investigation of known minable reserves of coal that were or could be made suitable for the manufacture of metallurgical coke. In August of that year, actual field work began in the low- and medium-volatile coking coal fields of the Appalachian region, specifically central Pennsylvania and southern West Virginia. As both the economic and technologic factors that determine whether a particular coal can be used for producing metallurgical coke will vary with changing conditions, the investigation was planned to cover three phases:

1. Determination, from available data, of coal reserves with coking properties that occur in beds thick enough and within depths considered economically minable by present methods, together with such additional reserves as may become economically minable under future conditions of improved technology and greater need.

2. Study of the preparation characteristics of the reserves thereby developed to determine (a) which coals are suitable under present standards for producing metallurgical coke either as mined or after beneficiation by conventional preparation methods, and (b) which coals would require special and more intensive treatment in mining, preparation, or both.

3. Study of the carbonizing properties of the reserves thus developed to determine the yield and quality of coke, gas, and chemical products that can be obtained from coals carbonized singly and in blends.

This report is one in a series, by counties, covering in detail the estimated known minable coking-coal reserves determined under the first phase of the investigation. It also includes the study, as determined under the second and third phases of the investigation, of the preparation and carbonizing properties of the most important beds, and a table of analyses of typical coals from the county.

The estimates of coking-coal reserves in these reports were derived from data made available to the Bureau of Mines by coal companies, landowners, Federal, State, and municipal engineers, geologists, land-record officials, and others having authentic records of the occurrence and characteristics of the coal in the respective counties. All of the data were assembled from mine maps, records of core drilling, test pitting and trenching, and related sources of information, for no new core-drilling or geologic exploration was undertaken. Consequently, there are areas covered by these reports wherein the known data now available are inadequate to estimate reserves of measured and indicated coal, as these are defined in the reports. Geologic data also may indicate the presence of large reserves of inferred coal in these areas, but no estimates of inferred reserves are presented in these reports. As their titles indicate, they include only known, minable reserves of measured and indicated coal and not total estimated reserves of coal. Therefore, any comparison of these and other coal-reserve estimates should be made with this distinction clearly understood.

The percentage recovery shown in these reports is a weighted average, based on the thickness of clean coal, less all partings three-eighths inch or more thick, recovered from the mined-out areas in each bed. Thus, it is an over-all net areal percentage recovery that, in many cases, will be lower than the recovery estimated by operators who eliminate from their calculations coal pillars left at property boundaries, under roads, and elsewhere. It is based on all coal removed since the beginning of mining operations and, therefore, may vary from that of recent operations in which recovery either has been improved substantially by technologic advances or has declined, owing to flooding or other conditions that make it expedient to leave more coal in the ground. As the estimates are dated and represent a factual record of all past operations in the particular area, the percentage recovery and estimate of minable coal may be adjusted by operators to suit their particular conditions at any given time.

This investigation was made possible only through the complete cooperation of the coal operators, landowners, and others who have made available to the Bureau their confidential records and data relating to mining operations, drill-core and test pit operations, etc. This cooperation and assistance is appreciated and is gratefully acknowledged. To protect the confidence of data from private records, the Bureau of Mines is assembling and publishing the estimates on a county-wide basis only and will not release any supplementary or more detailed information.

This investigation will serve a triple purpose:

1. By providing an inventory of known, minable reserves of coking coal that are or can be made suitable for the manufacture of metallurgical coke.

2. By providing an inventory of known, minable reserves of coal with coking properties but unsuited for metallurgical coking-coal use by present standards and techniques because of high sulfur, high ash, or weakly coking properties. When warranted by economic and technologic developments, these reserves later may be adapted to metallurgical use by suitable preparation, blending, carbonizing, or metallurgical techniques.

3. By ascertaining the approximate location and magnitude of areas in which geologic data indicate the presence of inferred reserves but where exploratory work has been too limited to determine measured and indicated reserves. It is in these areas that more intensive exploratory work is needed in the future to complete the coking-coal inventory.

The first of these objectives is of prime importance for the present and immediate future, and the second for the more distant future. Accomplishment of the third objective will be of major aid to both industry and State and Federal agencies in more effectively planning and executing coal exploratory and testing investigations.

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ESTIMATE OF KNOWN RECOVERABLE RESERVES AND PREPARATION AND CARBONIZING PROPERTIES OF COKING COAL IN CAMPBELL COUNTY, TENN.

by

Lloyd Williams,[1] H. K. Gibbs,[2] William L. Crentz,[3] J. W. Miller,[4] and D. A. Reynolds[5]

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Reserves

1. The investigation shows that the Coal Creek has been the most productive bed in Campbell County and contains the largest recoverable reserves of coal. The Pewee, Red Ash, and Jellico have been relatively productive beds and contain appreciable recoverable reserves of coal. The Blue Gem also has been productive in the past, but available information indicates that most of the remaining coal is less than 28 inches thick. The Big Mary has relatively large reserves over 28 inches thick, but the coal is high in ash and sulfur. Thick partings in the Windrock bed have discouraged mining in that bed. The Poplar Creek and Rex beds generally are below drainage, and large areas have been excluded from the reserve estimate. Reserves in the Walnut Mountain bed will be difficult to mine due to the irregular thickness and lack of continuity of the bed. Estimated coal reserves are small in the remaining five beds.

2. Known measured and indicated reserves of coal, based on a minimum bed thickness of 14 inches and on 1,800 short tons per acre-foot of coal in place, are estimated to be 398 million tons as of January 1, 1953. Of this total, 267 million tons is in beds 28 inches and more thick. Areas in each bed were omitted from the estimate because available data relative to the bed characteristics are too meager to make an estimate that conforms with the definitions of measured and indicated coal adopted for this study. Should future drilling or development prove reserves in these areas, these should be added to the total estimated reserves.

3. Recoverable reserves of coal are estimated in beds 28 inches and more thick. This thickness is about the minimum now being mined by hand loading onto conveyors in the Appalachian region. The weighted average recovery for all beds in Campbell County, as determined by this investigation, is 55.9 percent. This percentage is based on the total thickness of coal in the bed (less partings three-eighths inch or more thick) rather than on the thickness of the coal mined. Based on the weighted average percentage of recovery for all beds in Campbell County, the recoverable reserves of coal are estimated to be 149 million short tons as of January 1, 1953. Campbell County is one of the major coal-producing counties in Tennessee.

Coal Analyses

Chemical analyses of coal samples taken for this study show that the coals in Campbell County are predominantly of high-volatile A bituminous rank.

Preparation

Although several mechanical cleaning units are available in Campbell County, Tenn., to wash certain sizes of coal, hand picking is the only preparation for virtually the entire coal production of the County.

Float-and-sink tests on coal samples collected in the Petree, Pewee, Walnut Mountain, Red Ash, Jordan, and Coal Creek beds indicate, from a chemical standpoint, that these deposits are potential sources of metallurgical coal. With many of these deposits the chemical requirements for a satisfactory metallurgical fuel probably could be met without resorting to mechanical cleaning, provided that the mining method did not contaminate the coal seriously with extraneous material.

On the other hand, washability-test data on samples collected in the Big Mary, Upper Pioneer, and Poplar Creek beds indicate that these coals are high-sulfur deposits and offer little possibility of becoming sources of metallurgical coal.

A study of the washing characteristics of the Jellico bed, based on two face samples collected in widely separated areas, indicates that the deposit in the eastern part of Campbell County adjoining Claiborne County could be upgraded without difficulty to metallurgical grade, while the bed in the western part of the county is a high-sulfur deposit that offers little possibility of becoming a potential source of metallurgical fuel.

Float-and-sink tests on one sample taken in the Blue Gem bed showed that this bed is a low-ash deposit, but it would require intensive preparatory treatment to reduce the sulfur content in the washed coal to meet present-day limitations on sulfur in coal used for metallurgical purposes. Fine crushing and careful control of the washing process would be necessary to upgrade the Blue Gem bed sample for metallurgical use.

Carbonization

The composition and carbonizing properties of six coals representing the Pewee, Windrock, Coal Creek (two samples), Poplar Creek, and Red Ash beds of Campbell County, Tenn., were determined. These coals contained 56.4 to 61.7 percent dry, mineral-matter-free fixed carbon; therefore, they do not rank high in the high-volatile A classification. Excepting Poplar Creek, which contained 2.8 percent sulfur, none was high in ash or sulfur. Both samples from the Coal Creek bed qualify as metallurgical coals. The sample from Beech Valley mine cokes more strongly than that from Blue Rose mine. Pewee, Windrock, and Red Ash coals probably are suitable only as minor constituents of coking blends because their cokes are weak. The high sulfur content of Poplar Creek detracts from its value as a metallurgical coal.

INTRODUCTION

The investigation to evaluate the reserves of coking coal is being made by the Bureau of Mines in three parts: (1) To estimate known "measured" and "indicated" recoverable reserves of all coking coal; (2) to study upgrading of marginal coals through effective preparation; and (3) to study the carbonizing properties of coals and coal blends not now widely used for metallurgical coke making.

This is the 38th of a series of reports giving results of studies, by counties, of known minable reserves of coking coal. (See appendix.) This report covers Campbell County, Tenn., one of the counties in the northern part of the Tennessee coal field. All three phases of the investigation are covered in this report.

Campbell County comprises all of Ivydell, LaFollette, and Jacksboro 7-1/2-minute quadrangles and parts of Ketchen, Jellico West, Jellico East, Eagan, Pioneer, Well Spring, Norma, Block, Demory, White Hollow, Fork Mountain, Duncan Flats, Lake City, and Norris 7-1/2-minute quadrangles. (See fig. 1.)

Data on all coal beds in this county were obtained by personal reconnaissance and from landowners, mine operators, State agencies, and other authentic sources of information. Samples used for analyses, preparation and carbonization studies were obtained from mines and prospects in Campbell County.

ACKNOWLEDGMENTS

The information contained in this report could not have been obtained without the whole-hearted cooperation of the officials of the companies and individual landowners whose property records were studied, and their cooperation and courtesies extended are gratefully acknowledged. The advice and assistance of the Coal Resources Committees of both the National Bituminous Coal Advisory Council and American Institute of Mining and Metallurgical Engineers, members of the staffs of the Tennessee Division of Mines and the Tennessee Division of Geology, and consulting mining engineers are appreciated. The assistance and cooperation of the State geologist, William D. Hardeman, and also C. W. Wilson, Jr., of Vanderbilt University Department of Geology, in this investigation have been particularly helpful and are sincerely appreciated.

The Tennessee Valley Authority, through R. A. Kampmeier, assistant manager of power, and E. P. Ericson, chief, Fuels Branch, has made a major contribution to this investigation, and the cooperation and assistance are gratefully acknowledged.

PART I. - ESTIMATION OF KNOWN RECOVERABLE RESERVES

by

Lloyd Williams and H. K. Gibbs

Premises and Definitions of Terms Used

An estimate of coal reserves is the opinion of an individual or group of individuals based on certain premises and limitations adopted for that estimate. Therefore, to make a comparison between estimates, it is necessary to compare not only the final results but also the premises on which the estimates are based. The definitions "measured" coal and "indicated" coal used in this report have been agreed upon by the Bureau of Mines and the Federal Geological Survey. The premises and definitions of terms follow:

Coking coal. - All bituminous coals in the Appalachian region are potentially coking. All known reserves of coal in the county are considered as coking coal in preparing the reserve estimates. The results of this survey indicate the coking qualities of the coal. The possibilities of using these coals for metallurgical coke making are discussed in the preparation and carbonization portions of this report.

Unit area. - The unit area used in estimating reserves is the 15-minute topographic quadrangle. All unit area estimates within the county are combined to give the county total estimates.

Bed thickness range. - Reserves in each coal bed are tabulated in bed-thickness ranges, as follows:

14 to 28 inches.
28 to 42 inches.
42 inches and more.

These measurements represent total bed thickness, including all coal and partings in the bed. If the top or bottom bench of a coal bed is separated from the remainder of the bed by a parting of equal or greater thickness and usually is not mined, such bench and partings are omitted in determining the bed thickness.

Measured coal. - Measured coal is coal for which tonnage is computed from dimensions revealed in outcrops, mine workings, and drill holes. The points of observation and measurement are so closely spaced and the thickness and extent of the coal are so well defined that the computed tonnage is judged to be accurate within 20 percent or less of the true tonnage. Although the spacing of the points of observation necessary to demonstrate continuity of coal will vary in different regions according to the habit of the coal beds, the points of observation are, in general, about one-half mile apart. The outer limit of a block of measured coal, therefore, shall be about one-fourth mile from the last point of positive information (that is, roughly one-half the distance between points of observation).

Where no data are available other than measurements along the outcrop, but where the continuity of the outcrop is measured in miles and suggests the presence of coal at great distances in from the outcrop, a smooth line drawn roughly one-half mile in from the outcrop shall be used to mark the limit under cover of a block of coal that can also be classed as measured.

Indicated coal. - Indicated coal is coal for which tonnage is computed partly from specific measurements and partly from projection of visible data for a reasonable distance on geologic evidence. In general, the points of observation are about 1 mile apart but may be as much as 1-1/2 miles for beds of known geologic continuity. For example, if drilling on 1/2-mile centers has proved a block of measured coal of fairly uniform thickness and extent, the area of measured coal, according to the judgment of the estimator, is larger than the actual area of drilling by as much as one-fourth mile on all sides. If, from geologic evidence, the bed is believed to have greater continuity, the area of measured coal is surrounded by a belt of indicated coal, which, according to the judgment of the appraiser, may be as much as 1-1/2 miles wide.

Where no data are available other than measurements along the outcrops but where the continuity of the outcrop is measured in miles and suggests the presence of coal at great distances in from the outcrop, two lines drawn roughly parallel to the outcrop, one one-half mile in from the outcrop and one 2 miles in from the outcrop, define a block of coal that may be classed as indicated.

Inferred coal. - As no estimate of reserves has been made from geologic inference alone, inferred coal is not included in this report.

Areas excluded from estimate. - In each bed are areas in which coal may be present but for which reserves have not been estimated. There are too few or no bed

sections from drill holes, mine workings, or coal outcrops in the area on which to base estimates that would qualify under the definitions of "measured" or "indicated" reserves. These areas correspond approximately to areas of inferred reserves and frequently contain significant quantities of coal.

Overburden. - This includes all of the material that overlies the coal bed. All known reserves in Campbell County are under less than 2,700 feet of overburden.

Thickness of coal. - In computing the volume of reserves in each thickness category for each bed, the total thickness of clean coal in the bed section is used. If the top or bottom bench of coal described under definition of "bed-thickness range" usually is not mined, the thickness of the bench is not used in the computation of volume of reserves. A weighted average thickness in each thickness category is computed to be used for limited areas, not to exceed a 7-1/2-minute quadrangle.

Weight of coal. - Estimated coal in place is based on 1,800 short tons per acre-foot.

Percentage of recovery. - The weighted average percentage of recovery is usually computed for each bed in each 15-minute quadrangle. The total number of tons of coal produced from each mine is obtained from either the mine operator or the published reports of the Tennessee Division of Mines. An estimate is made of the tons of coal originally in place in the mined-out area of each mine. The percentage of recovery for each mine is the ratio of the total number of tons produced from a mine (to January 1, 1953, the date of this estimate) to the total tons originally in place in the mined-out area. The weighted average percentage of recovery for all mines in the same bed in a 15-minute quadrangle is the percentage of recovery used in calculating recoverable reserves for that bed in the quadrangle. If total mine production figures are not available from any source, the percentage recovery is estimated by comparison with mining in other beds of same thickness and with similar mining conditions.

All coal remaining for any reason within the mined-out area of a mine is considered a loss. No distinction is made between avoidable or unavoidable losses. Included in these losses is some coal considered too thin to mine and coal that legally is required to be left unmined, such as coal under some highways, railroads, and rivers; coal left to protect gas and oil wells; and coal left in barrier pillars between mines and adjacent to property boundaries.

Recoverable reserves. - The recoverable reserves are estimated tons of unmined coal in beds 28 inches and more thick, as of the date of the estimate, multiplied by the percentage of recovery. Twenty-eight inches is about the minimum thickness of coal being mined by hand loading onto conveyors. Some areas in some of the beds in this county may not be considered economically minable at present because of conditions considered adverse today.

Methods Used to Compute Reserves

A base map for each coal bed was prepared for each 15-minute quadrangle area to the scale of 1 inch equals 2,000 feet. This scale was adopted as it is the scale of both the Tennessee Valley Authority and Federal Geological Survey 7-1/2-minute quadrangles, which are the latest topographic maps available. A 15-minute quadrangle is composed of four 7-1/2-minute quadrangles, each covering an area 7-1/2 minutes of longitude by 7-1/2 minutes of latitude. The TVA 15-minute quadrangles are identified by number; the corresponding 7-1/2-minute quadrangles are identified

by directional quarter of the 15-minute quadrangle number. The 7-1/2-minute quadrangles also are identified by name.[6/] Names for the 15-minute quadrangles are available only on special Federal Geological Survey index maps for administrative planning. These names are used in this report to identify the 15-minute areas which are not identified by a TVA number. The key map is divided into 7-1/2-minute quadrangles. (See fig. 1.)

Campbell County comprises parts of the following 15-minute areas, with the corresponding 7-1/2-minute quadrangles.

15-minute area No.	15-minute area Name	7-1/2-minute quadrangle names
128	Huntsville	Pioneer, Norma, Block.
129	Oliver Springs	Fork Mountain, Duncan Flats.
136	LaFollette	Ivydell, LaFollette, Jacksboro, Demory.
137	Norris Dam	Lake City, Norris.
144	Log Mountain	Eagan.
145	McLean Rock	Well Spring, White Hollow.
	Stearns	Ketchen.
	Saxton	Jellico West, Jellico East.

Mine workings, locations of drill holes, outcrops and thicknesses of bed, and total clean-coal thicknesses were plotted on the base maps. Isopach lines then were drawn to limit areas of known unmined reserves in beds up to 14 inches thick, 14 to 28 inches thick, 28 to 42 inches thick, and over 42 inches thick. These areas of coal reserves also were divided into measured and indicated categories. All areas in each thickness range and in each category, mined-out areas, areas excluded from the estimate but that may contain reserves based only on geologic inference, and areas outside the outcrop were measured by planimeter on the base maps. These areas were adjusted to conform to the theoretical area based on Federal Coast and Geodetic Survey data for each quadrangle. Estimates of total reserves 14 inches and more thick for individual beds were prepared from these data. A map was prepared from the work maps for each bed. On these maps areas of known coal up to 14 inches thick and 14 to 28 inches thick were combined and shown as reserves in beds less than 28 inches thick. Areas of known coal 28 to 42 inches thick and over 42 inches thick were combined and shown as reserves in beds over 28 inches thick.

Description of Coal Measures

The major part of Campbell County is in the northeast section of the Cumberland Plateau of Tennessee. The remainder of the county is in the Valley and Ridge Province and is separated from the plateau by the Cumberland escarpment. The coal measures from the Cumberland Plateau, which represents about 60 percent of the county, or 190,000 acres.

That part of the coal field in Campbell County is divided into three areas by two faults: (1) The Jacksboro fault, which extends from Caryville northwestward to Pioneer; and (2) the Pine Mountain fault, which extends from Pioneer northeastward into Kentucky just east of Jellico. These areas are designated in this report: (1) New River area, which is southwest of the Jacksboro fault; (2) Elk Fork Creek area, which is northwest of the Pine Mountain fault; and (3) Hickory Creek area, which is east of both faults. (See fig. 2.) Movement along the faults has resulted in the geologic formations in the Hickory Creek area being about 350 to 500 feet above the corresponding formations in the New River and Elk Fork Creek areas.

6/ Federal Geological Survey, Index to Topographic Mapping in Tennessee.

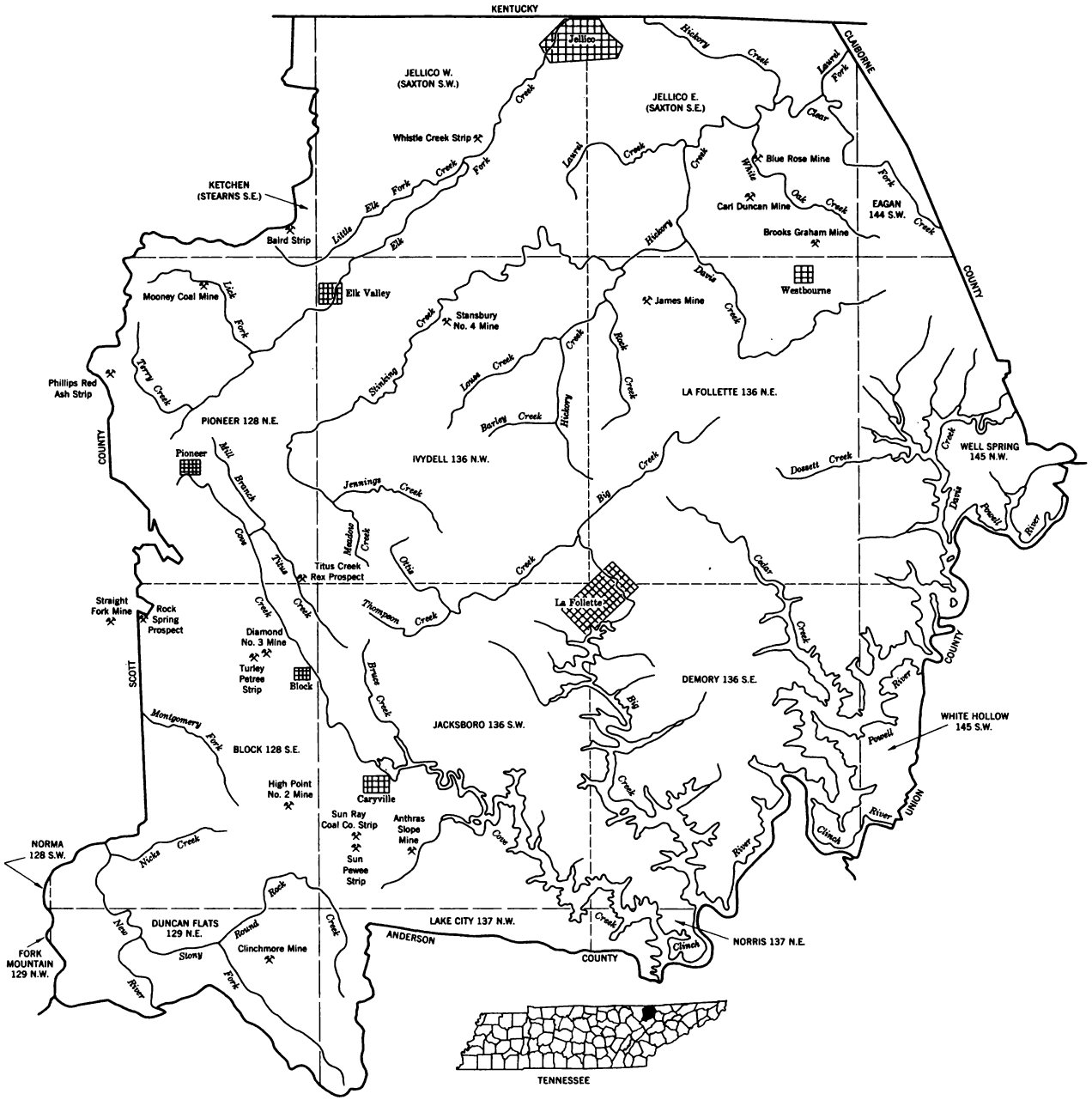

Figure 1. - Key map of Campbell County, Tenn.

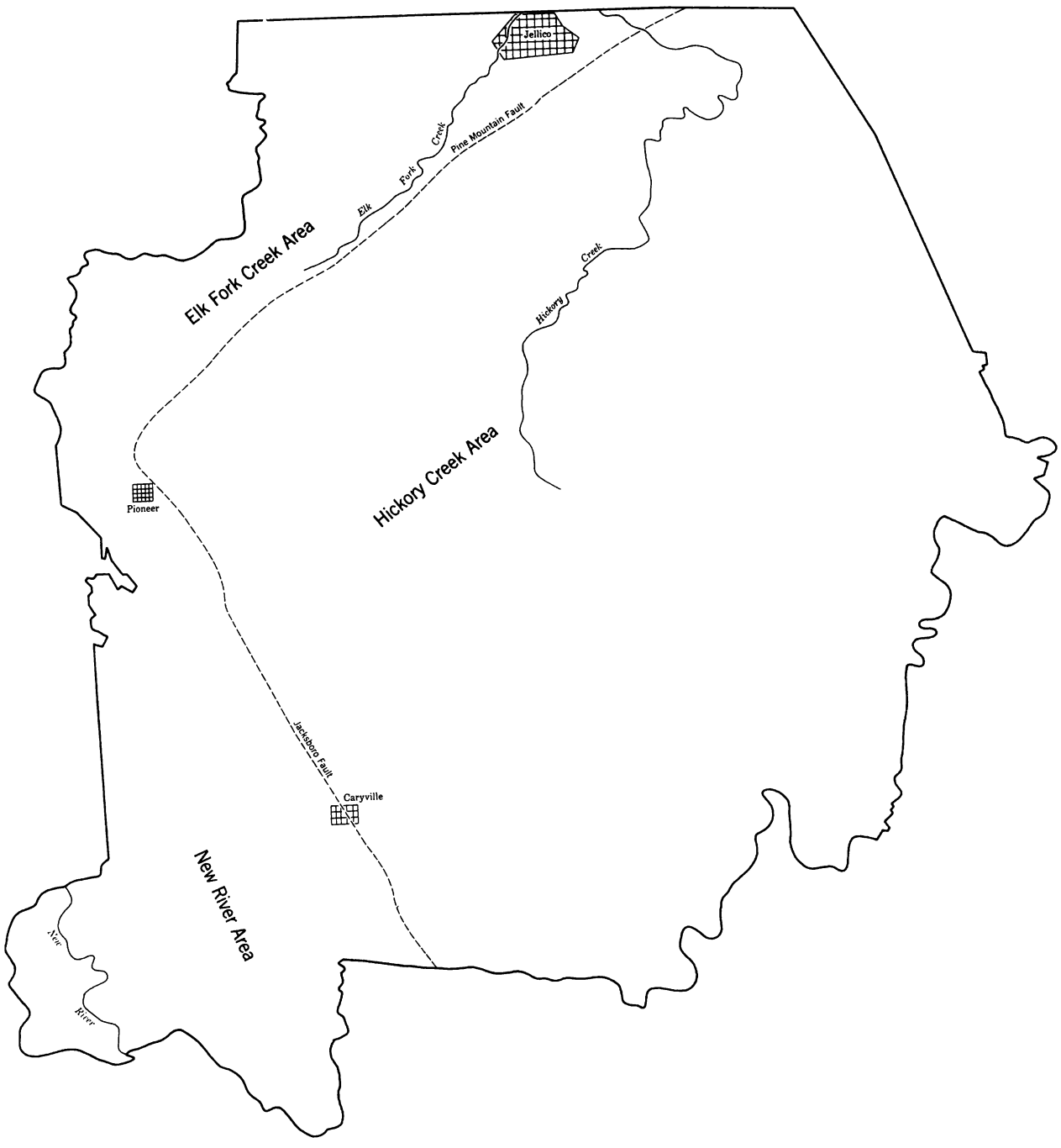

Figure 2. - Areas of the northern Tennessee coal field in Campbell County, Tenn.

The Pennsylvanian system in Campbell County is represented by formations in the Lee and Kanawha groups of the Pottsville series. (See fig. 3.) Data on the Lee group, which contains the oldest formations in the Pennsylvanian system, are meager. This group generally is below drainage in the New River and Elk Fork Creek areas, and exposures in the Hickory Creek area near the Pine Mountain fault have been subjected to faulting and folding. The farthest southeast exposure of the Lee group is along the Cumberland escarpment, where there are few coal prospects and where the formations rise at an increasing rate to the southeast. Owing to lack of information on the occurrence of coal in the Lee group, no reserves were estimated for this group.

The Kanawha group is immediately above the Lee and contains all minable beds in the county. Reserve estimates were made for 15 coal beds, as follows: Rock Spring, Petree, Pewee, Walnut Mountain, Red Ash, Big Mary, Windrock, Upper Pioneer, Jordan, Joyner, Jellico, Blue Gem, Coal Creek, Poplar Creek, and Rex. Enough information was not available to make estimates for the Wild Cat, Cold Gap, Grassy Spring, Split Seam, Sharp, Beech Grove, and Lower Pioneer beds.

Stratigraphically, the lowest bed that has been mined in the Kanawha group is the Rex, which occurs at an elevation of 1,000 to 1,300 feet in the Hickory Creek area, except along the Cumberland escarpment, where it rises along the northwest limb of an anticline. The Coal Creek bed, although higher stratigraphically than the Rex, is topographically the lowest coal known in the county. This bed has been mined at an elevation of 950 feet in the New River area where the Rex bed is not known to be present. The Wild Cat bed is the highest in the county and occurs at an elevation of about 3,200 feet. The coal beds and geology of the region are described more fully in other publications.[7] [8]

Rock Spring Bed

(See fig. 4 and table 1)

The Rock Spring bed is the youngest coal that has been mined commercially in Campbell County. It underlies only 2 percent of the area of the county and is found near the tops of the mountains, a few feet above the Pilot Knob sandstone, which is the base of the Anderson formation. (See fig. 3.) All of the known reserves are in the northern part of the New River area and are found at elevations ranging from 2,700 feet (west of Block) to 2,900 feet (west of Caryville).

All mines that were operated in this bed have been abandoned. A sample of the coal taken for analysis from a prospect was 70 inches thick. This bed section and another, also in the area of recoverable reserves, follow:

New River Area

Material	Inches
COAL	19
Bone and shale	11
COAL	20
Shale	1
COAL	19
Thickness	70

Material	Inches
COAL	44
Thickness	44

7/ Glenn, L. C., The Northern Tennessee Coal Field: Tennessee Div. Geol., Bull. 33A, 1925, 478 pp.

8/ Wanless, Harold R., Pennsylvanian Geology of a Part of the Southern Appalachian Coal Field: Geol. Soc. America, Mem. 13, 1946, 155 pp.

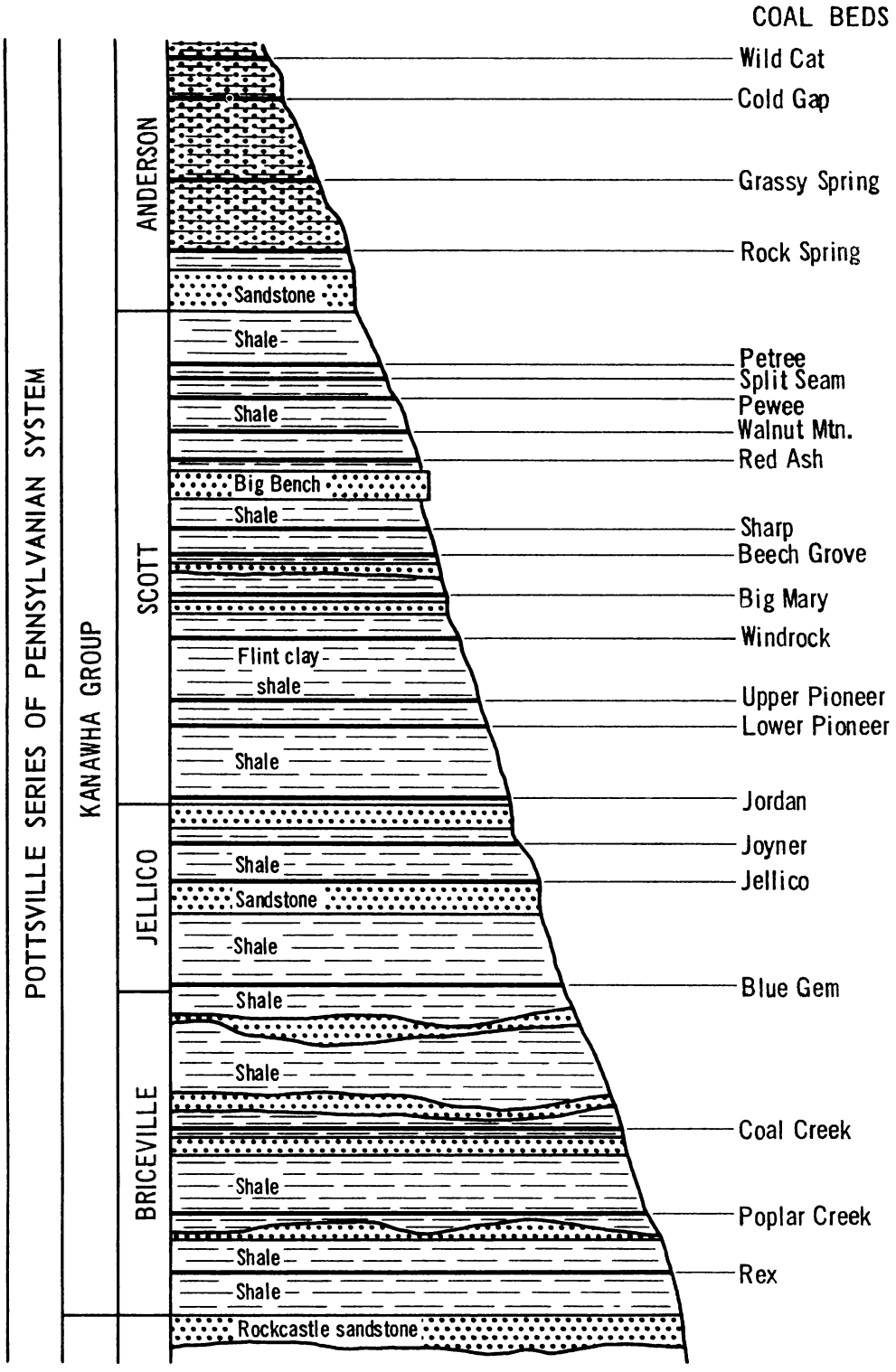

Figure 3. - Composite section of coal measures in Campbell County, Tenn.

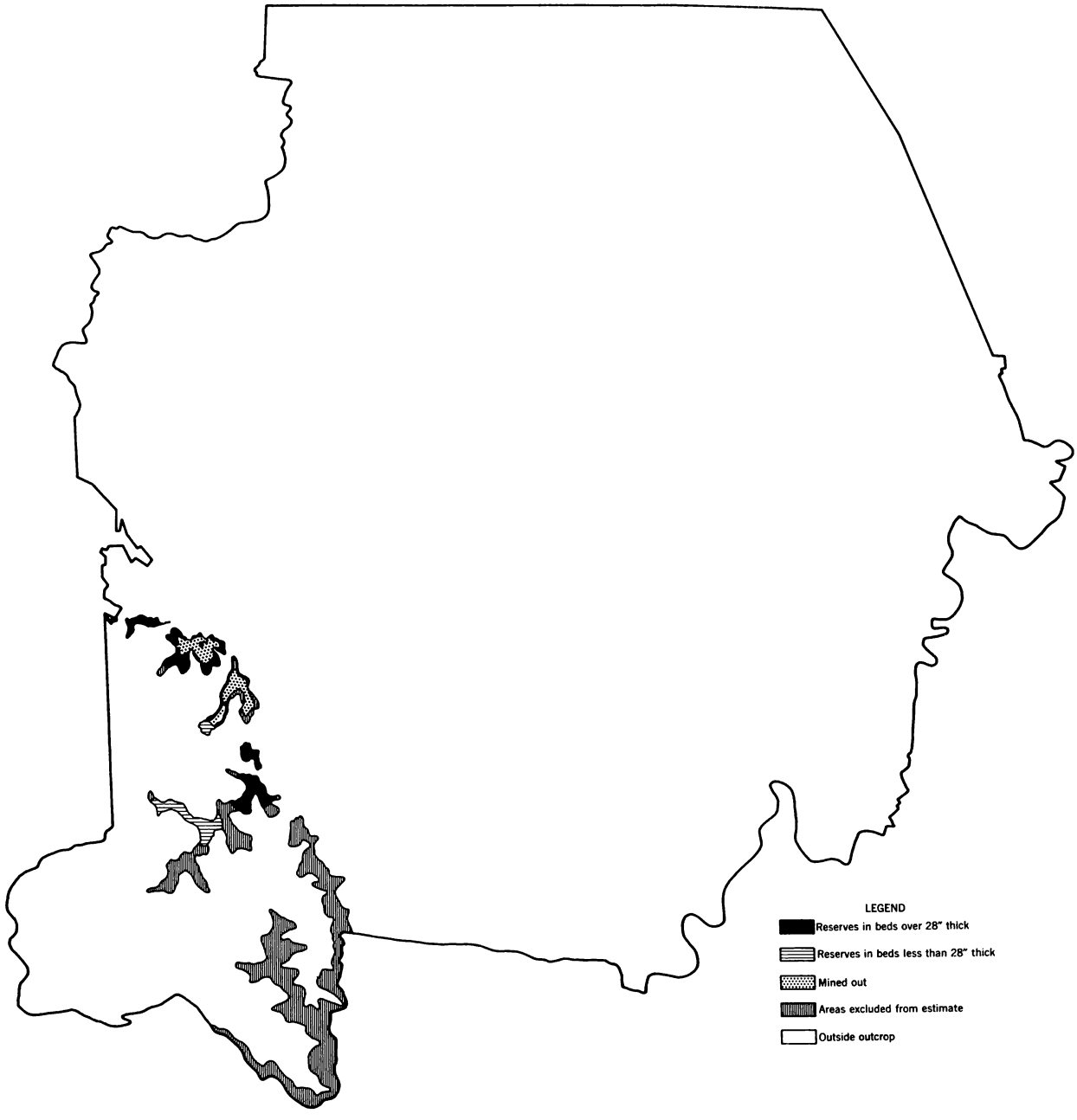

Figure 4. - Rock Spring bed, Campbell County, Tenn., January 1, 1953.

Petree Bed

(See fig. 5 and table 2)

The Petree bed is about 80 feet below the Rock Spring and is near the top of the Scott formation. It is limited in extent to mountaintops and is found only in the New River area. From an elevation of 2,800 feet in the vicinity of Caryville, the bed dips northwestward, falling to 2,600 feet in the area northwest of Pioneer. The coal is hard, splinty, and usually less than 28 inches thick. The only mine in the bed in this county was abandoned owing to water and soft clay bottom.

A 17-inch sample was taken from the Turley Petree strip for coal-preparation studies in this report. This bed section and another in the area of recoverable reserves follow:

New River Area

Material	Inches
COAL	17
Thickness	17

Material	Inches
COAL	31-1/2
Thickness	31-1/2

Pewee Bed

(See fig. 6 and table 3)

The Pewee bed (also referred to as the Peewee, Pee Wee, Merwin, and "X") occurs from 100 to 200 feet below the Petree bed in the Scott formation and underlies about 4 percent of the county. It is fairly regular in thickness in the southern part of the New River area, where virtually all of the mining has been done. In the northern part of the county, where the bed has been found in the tops of mountains, it is thin. Elevations of the Pewee horizon range from 2,600 feet southwest of Caryville to 2,400 feet northwest of Pioneer.

A thin bed of coal, known as the "Split seam" or "Rider," occurs 8 to 30 feet above the Pewee bed; and, when the interval between the beds is small, the Pewee bed becomes difficult to mine.

A sample taken from the Clinchmore mine for preparation studies was 41-3/4 inches thick. Another from the Sun Pewee strip, taken for the same purpose, was 67-1/2 inches thick. These bed sections and others in areas of recoverable reserves follow:

New River Area

Material	Inches
Coal and shale rash	2
COAL	39-3/4
Thickness	41-3/4
COAL	40
Thickness	40

Material	Inches
Rash coal and shale	3-1/4
COAL	42-1/2
Soft shale binder	2-1/2
COAL	1
Shale binder	4
COAL	14-1/4
Thickness	67-1/2

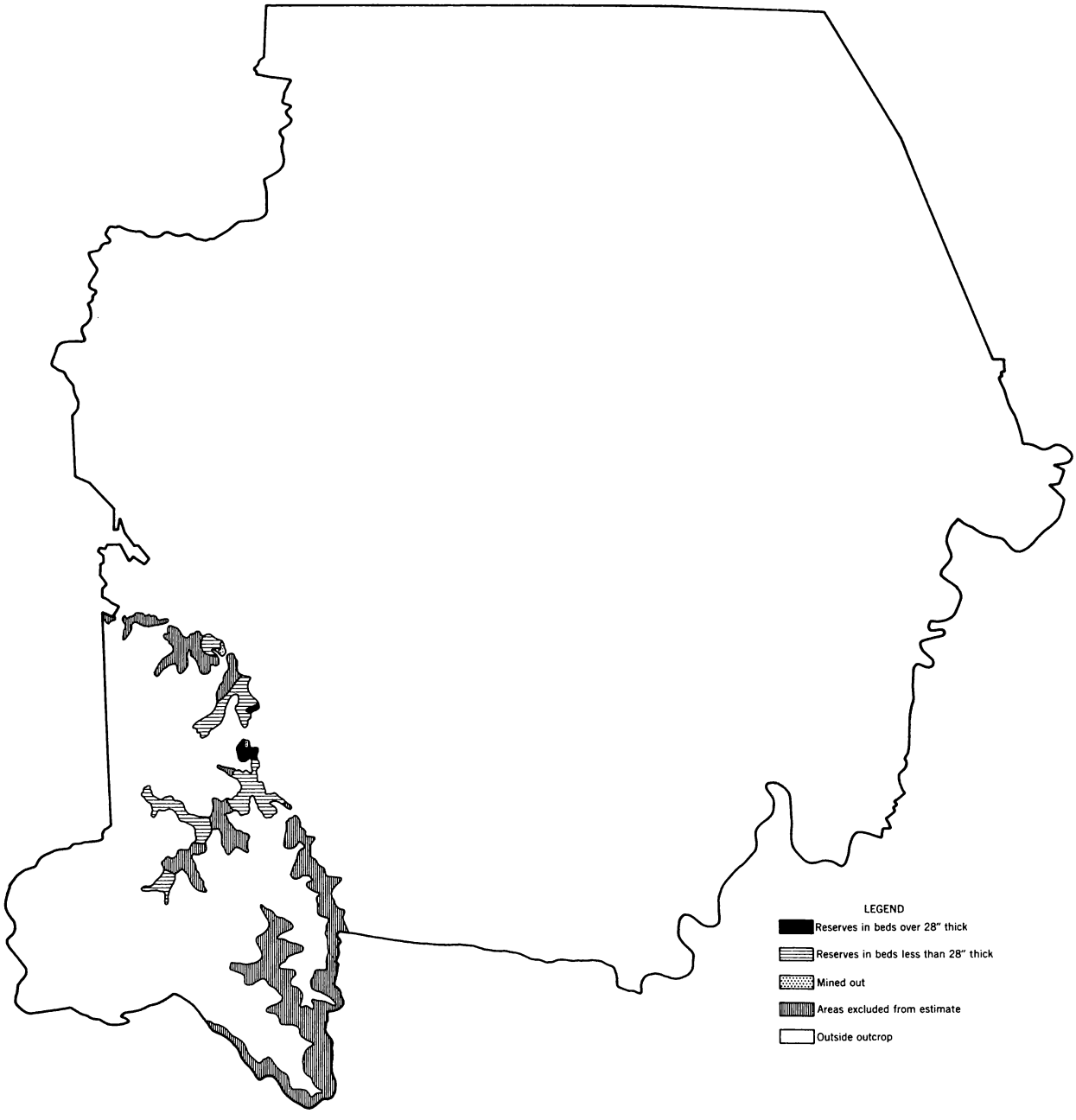

Figure 5. - Petree bed, Campbell County, Tenn., January 1, 1953.

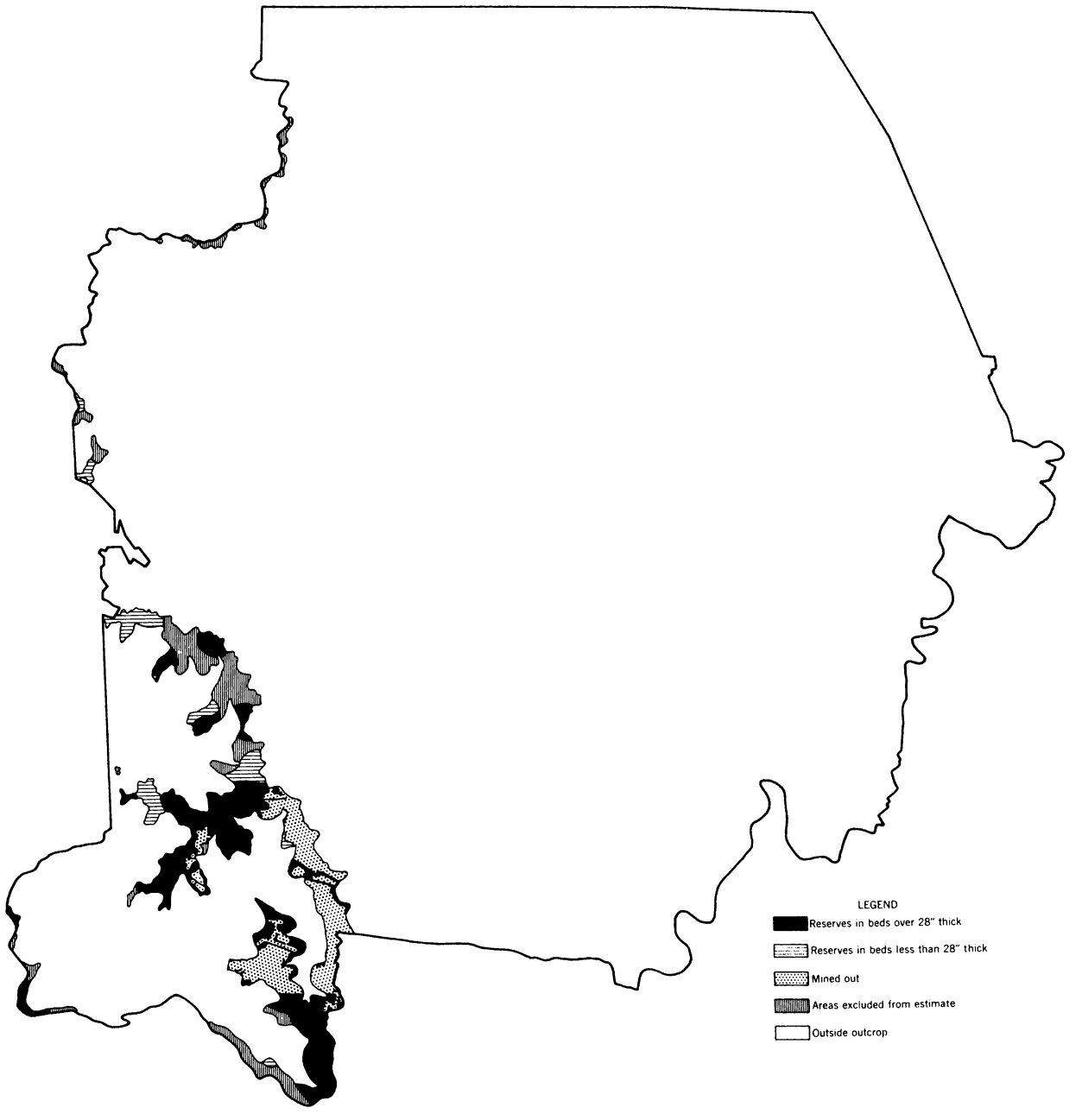

Figure 6. - Pewee bed, Campbell County, Tenn., January 1, 1953.

Material	Inches
COAL	30
Thickness	30
COAL	36
Thickness	36

Material	Inches
COAL	44
Rash	3
COAL	9
Thickness	56

Walnut Mountain Bed

(See fig. 7 and table 4)

The Walnut Mountain bed is in the Scott formation about 60 feet below the Pewee and at an average elevation of 2,500 feet. The bed varies considerably in thickness and continuity. An entry and aircourse west of Caryville were started in 32 inches of coal, and at 700 feet they were stopped when the bed thickness decreased to 6 inches. The bed averages about 30 inches in thickness in an outcrop stripping in the same area. Little is known of the bed in the Elk Fork Creek and Hickory Creek areas.

Coal reserves are in the New River area, where a sample taken from the Sun Ray Coal Co. strip mine for coal-preparation studies was 37-1/2 inches thick. This bed section and another in that area follow:

New River Area

Material	Inches
Shale and coal rash	3-1/4
COAL	14-1/4
Bone coal	3/4
COAL	19-1/4
Thickness	37-1/2

Material	Inches
COAL	35
Thickness	35

Red Ash Bed

(See fig. 8 and table 5)

Along the eastern side of the New River area the Red Ash bed in the Scott formation easily is recognized by the Big Bench sandstone that lies a few feet below the coal bed.

This bed underlies about 6 percent of the county. In the Elk Fork Creek area Red Ash coal is found only in a few mountaintops. In the Hickory Creek area it was prospected and mined in one isolated spot at an elevation of 2,760 feet, where it was 48 inches thick.

The largest reserves are in the New River area, where extensive mining has been carried on in the northern part. Toward the southern part of the area the bed splits, and little or no mining has been done there.

A sample of Red Ash coal 47-1/2 inches thick was taken from the Phillips Red Ash strip mine for preparation studies of this report. Another preparation sample 59-1/2 inches thick was taken from the High Point No. 2 mine. Samples 59-1/2 inches thick were taken from the Diamond No. 3 mine for coal preparation and carbonization studies.

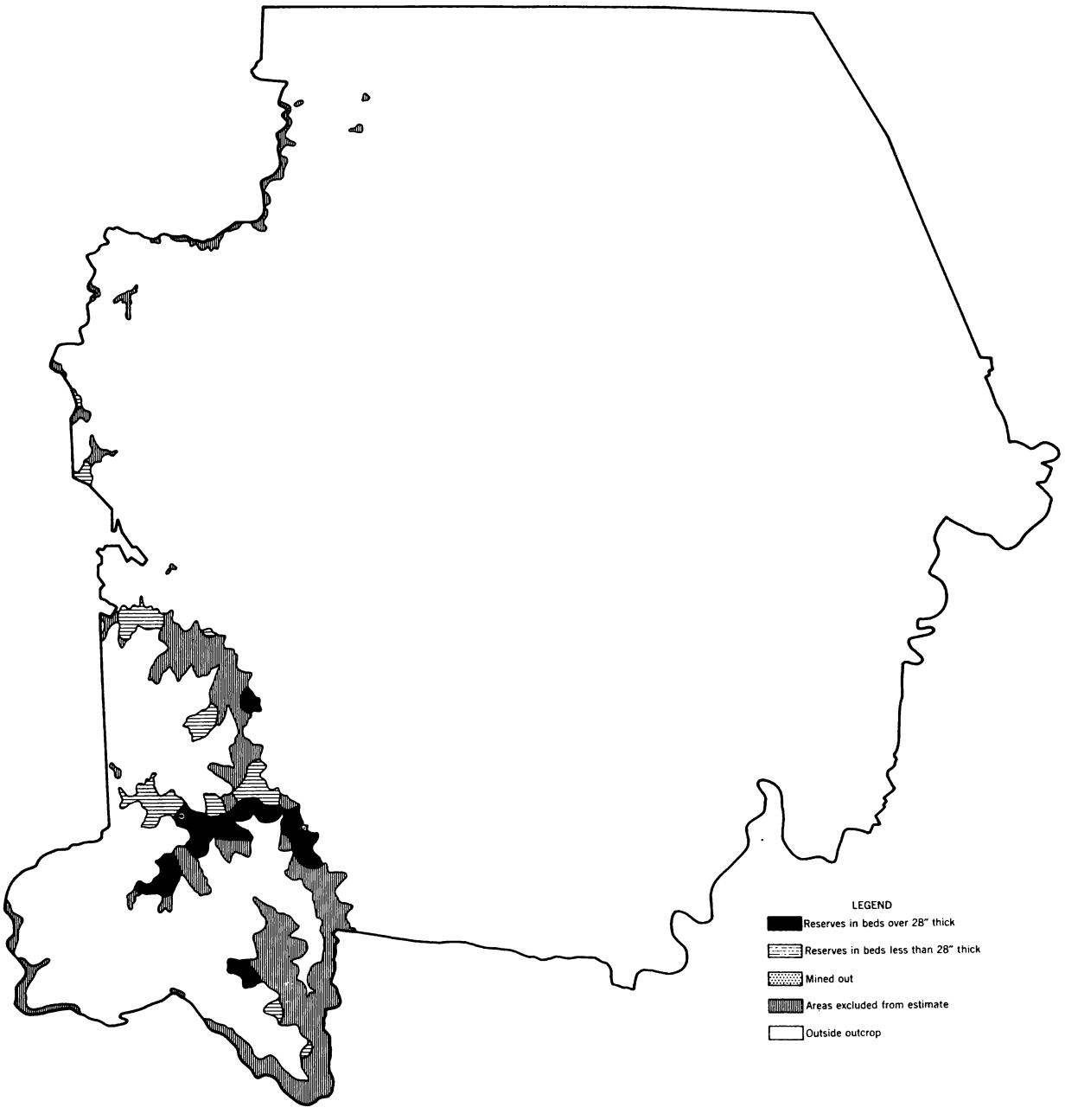

Figure 7. - Walnut Mountain bed, Campbell County, Tenn., January 1, 1953.

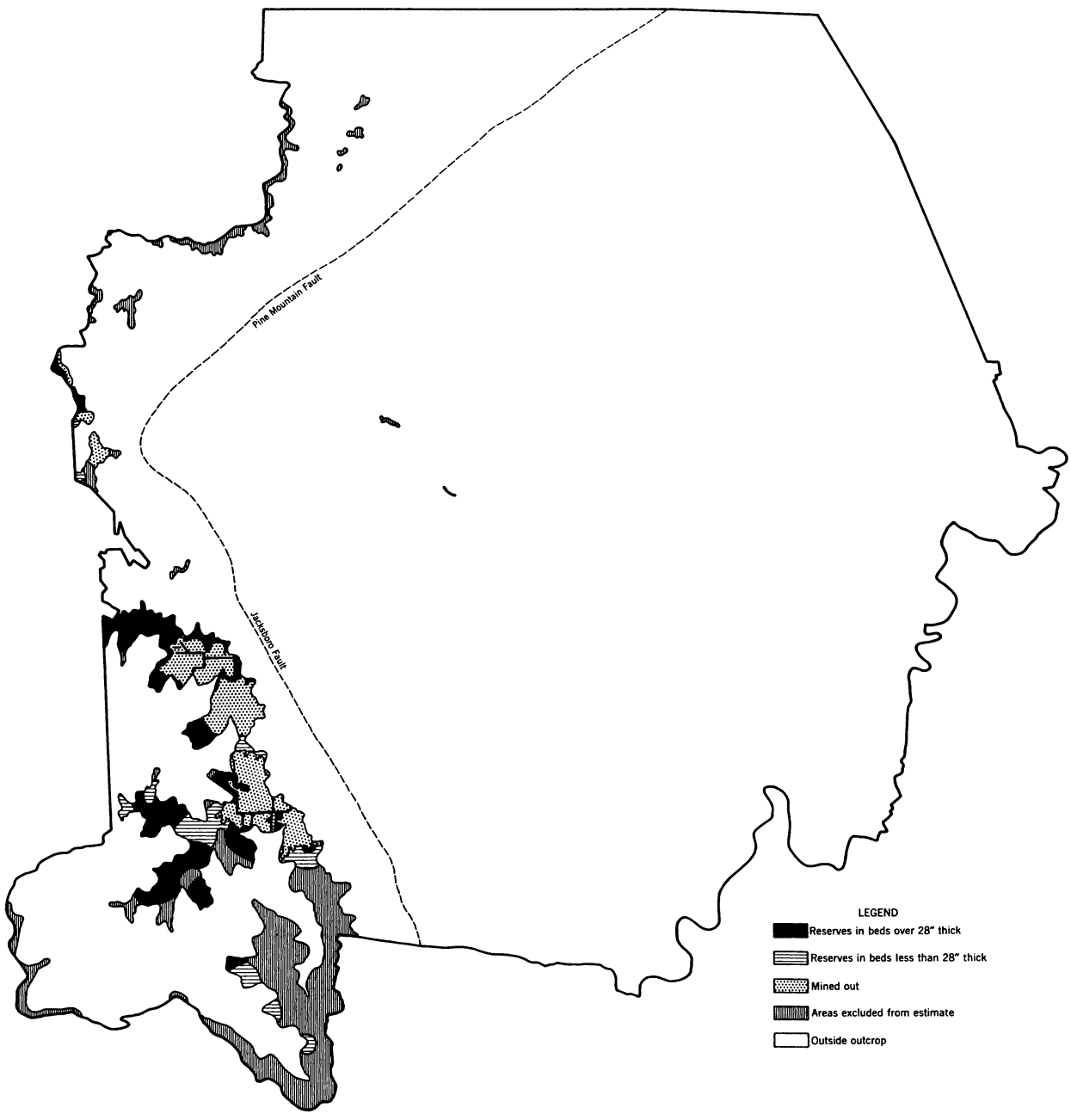

Figure 8. - Red Ash bed, Campbell County, Tenn., January 1, 1953.

Sections of the bed at these mines and other sections of the bed in the area of reserves follow:

New River Area

Material	Inches
COAL	10-3/4
Fusain	1/2
COAL	3
Shale	5-1/2
COAL	1-3/4
Bone	6
COAL	20
Thickness	47-1/2
COAL	24
Parting	6
COAL	12
Thickness	42
COAL	7-1/2
Fusain	1/2
Coal with bony streaks	28-1/4
Thickness	36-1/4

Material	Inches
Draw shale	3
Shale and coal	4
Shale	3-1/2
COAL	15-1/2
Bone	1/2
COAL	1-1/4
Fusain	1/4
COAL	28
Shale	1-3/4
COAL	1-3/4
Thickness	59-1/2
Shale	2
COAL	20
Parting	7
COAL	10
Thickness	39

Big Mary Bed

(See fig. 9 and table 6)

The Big Mary bed is in the Scott formation and often is called the "Upper Dean." It lies about 250 feet below the Big Bench; is immediately below a shale containing marine fossils; and covers about 9 percent of the area of the county. Elevations of this bed in the New River and Elk Fork Creek areas range from 2,250 feet in the Duncan Flats quadrangle to 1,850 feet in the West Jellico quadrangle, showing a general dip toward the north. In the Hickory Creek area the horizon of the bed should be at an elevation of about 2,500 feet, but nothing is known concerning the bed in this area.

Several attempts were made to mine the bed in the New River area; but high percentages of sulfur and ash in the coal, together with bad top consisting of thin-bedded shale, caused abandonment of all mines. Coal data indicate areas of thin coal in the center of the New River area with reserves to the north and south.

A sample of coal 55 inches thick was taken from the Campbell County workings of the Straight Fork mine in Scott County for coal-preparation studies. This bed section and others in areas of recoverable reserves follow:

Northern Part of New River Area

Material	Inches
Draw shale and sulfur	5
COAL	50
Thickness	55

Material	Inches
COAL	2
Shale	3
COAL	26
Rash	7
COAL	
Thickness	43

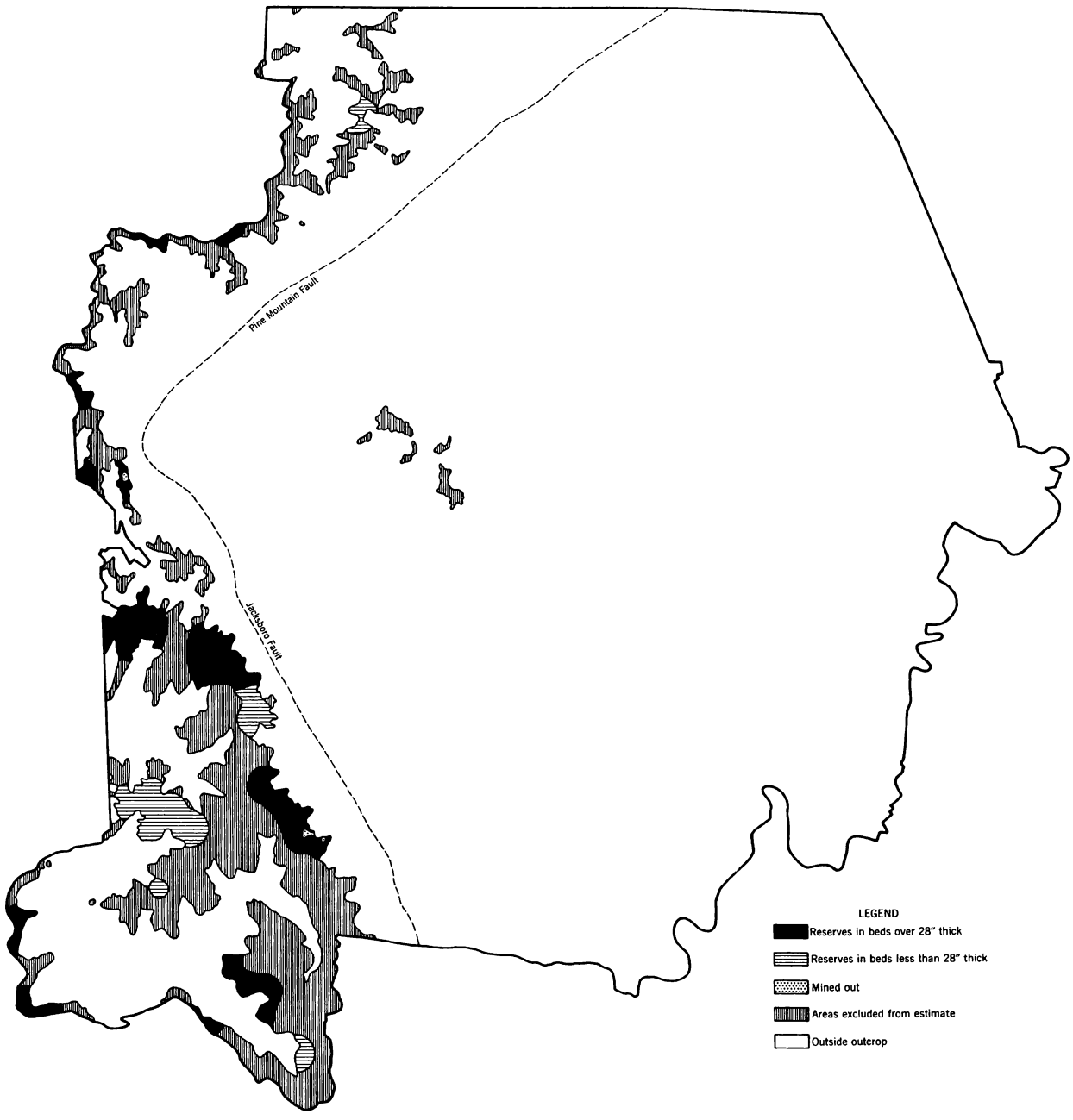

Figure 9. - Big Mary bed, Campbell County, Tenn., January 1, 1953.

Southern Part of New River Area

Material	Inches	Material	Inches
COAL	4	COAL	4
Bone	1	Bone	1
COAL	26	COAL	24
Thickness	31	Thickness	29

Windrock Bed

(See fig. 10 and table 7)

The Windrock bed usually is identified by a flint clay immediately below it. The coal occurs about 40 feet below the Big Mary and extends under about 10 percent of the county. In the New River and Elk Fork Creek areas the Windrock generally dips toward the north from an elevation of about 2,200 feet in the Lake City quadrangle to about 1,800 feet in the Jellico West quadrangle. In the Hickory Creek area the bed was found at an elevation of 2,450 feet. Continuity is lacking throughout. Thick partings and thin coal discouraged mining in many places. The bed has been mined in only two places: (1) The northern part of the Elk Fork Creek area, where coal reserves are limited; and (2) the southern part of the New River area, where mine workings of a mine with a portal in Anderson County extend into Campbell County. The largest coal reserves are in this area. Bed sections in areas of recoverable reserves follow:

Northern Part of Elk Fork Creek Area

Material	Inches
COAL	26
Clay	4
COAL	12
Thickness	42

Southern Part of New River Area

Material	Inches	Material	Inches
COAL	26	COAL	35
Bone	2	Thickness	35
COAL	18		
Thickness	46		

Upper Pioneer Bed

(See fig. 11 and table 8)

The Upper Pioneer bed is in the Scott formation and occurs about 100 feet below the Windrock. Elevations of the Upper Pioneer range from 1,800 feet west of Elk Valley to 2,000 feet southwest of Caryville. Owing to lack of continuity little is known of the bed except west of Elk Valley and west of Pioneer. Mining, which was confined to these areas, has been abandoned.

The sample taken from the Baird strip mine for coal-preparation study was 33-3/4 inches thick. This bed section and others in areas of recoverable reserves follow:

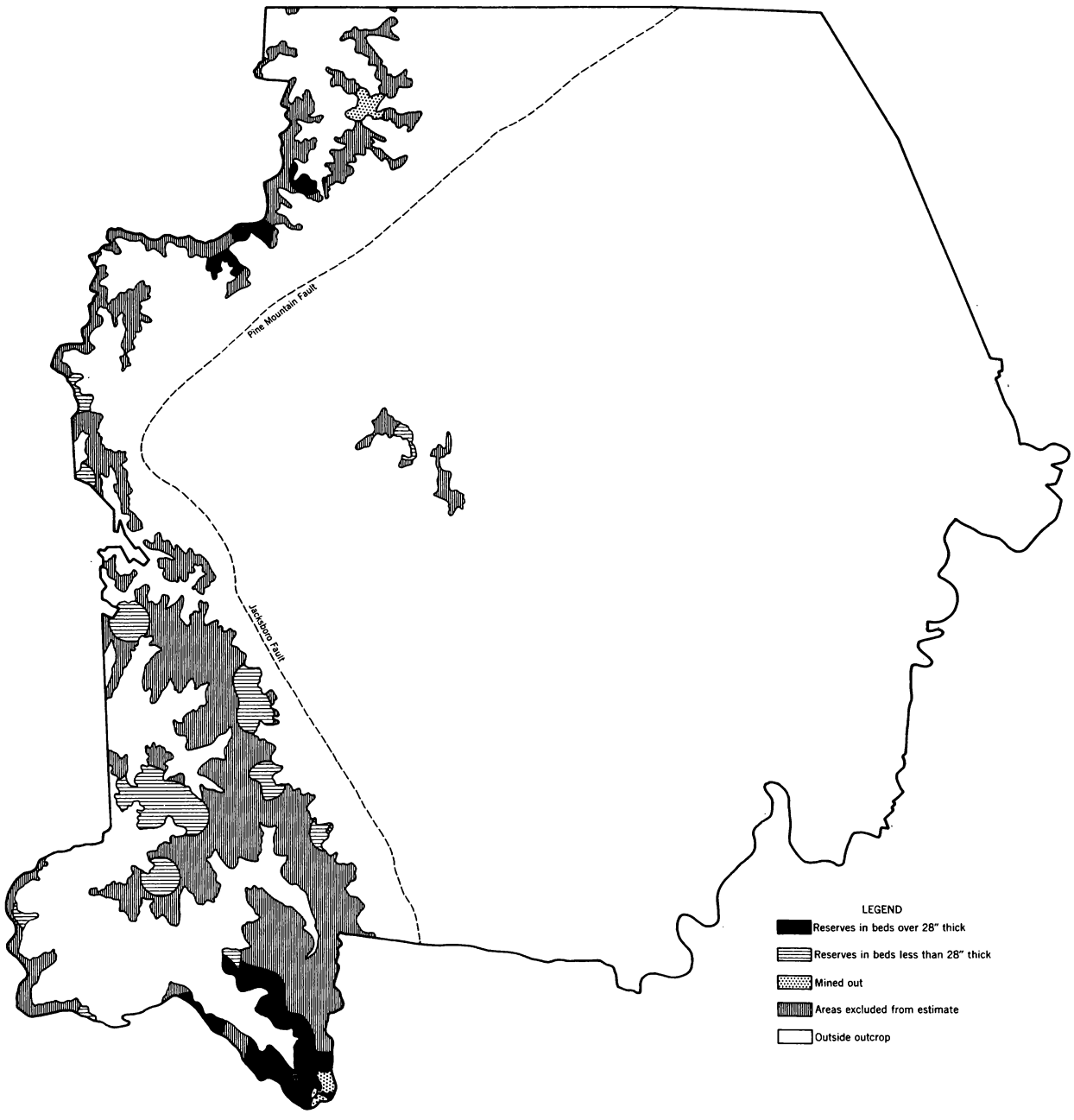

Figure 10. - Windrock bed, Campbell County, Tenn., January 1, 1953.

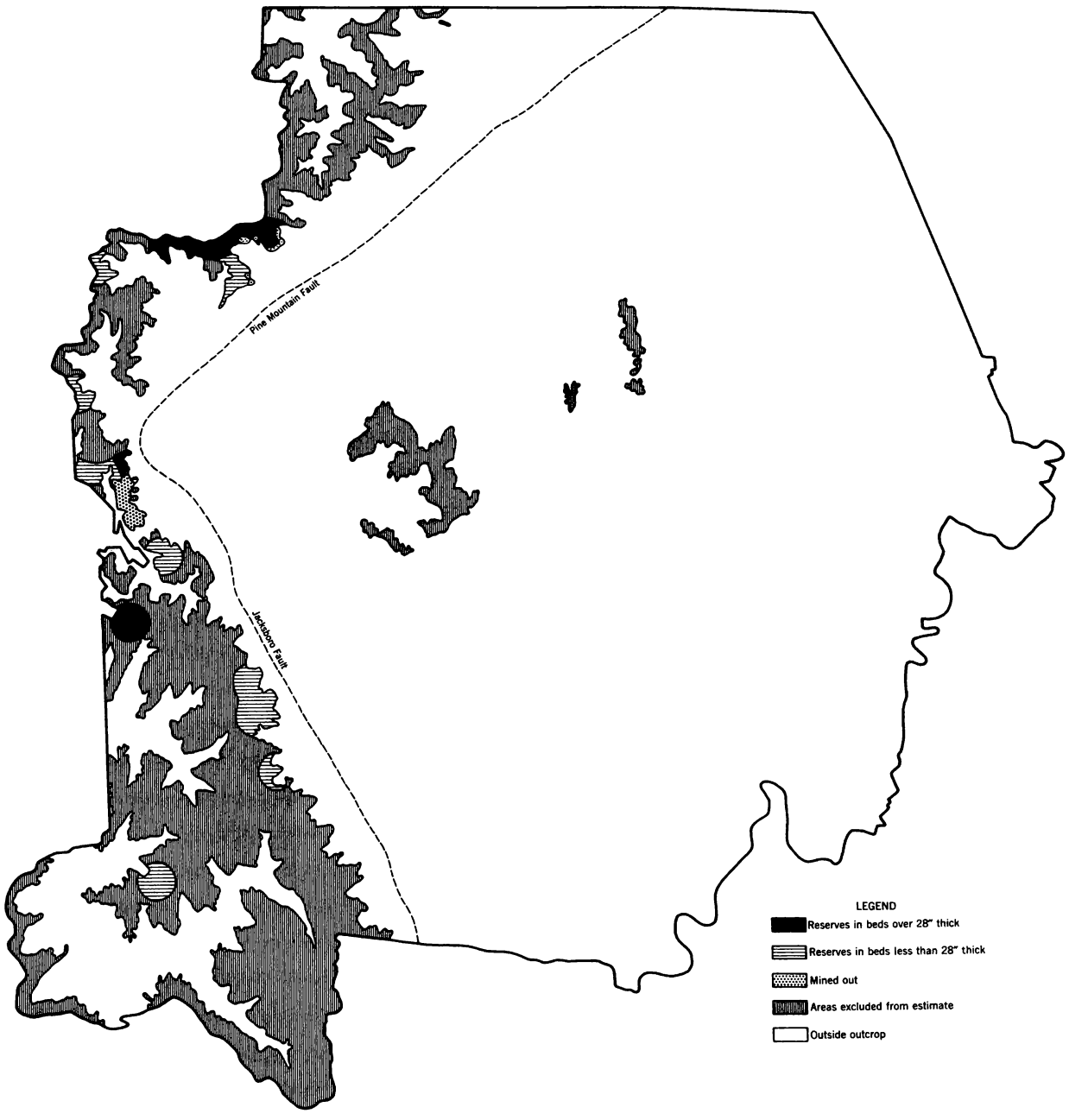

Figure 11. - Upper Pioneer bed, Campbell County, Tenn., January 1, 1953.

Central Part of Elk Fork Creek Area

Material	Inches
COAL	14-1/2
Shale binder	1
COAL	18-1/4
Thickness	33-3/4

Material	Inches
COAL	32
Thickness	32

Northern Part of New River Area

Material	Inches
COAL	32
Thickness	32

Jordan Bed

(See fig. 12 and table 9)

The Jordan bed occurs at the base of the Scott formation, just above the prominent Pioneer sandstone and about 150 feet below the Upper Pioneer coal. Within the Elk Fork Creek and New River areas the elevation of the bed ranges from 1,600 feet in the Jellico West quadrangle to 1,850 feet in the Block quadrangle. The average elevation is about 1,950 feet in the Hickory Creek area. Little is known of the bed owing to lack of continuity.

The Jordan coal was mined most extensively in the Hickory Creek area, and reserves in this area are negligible. One attempt was made to mine the bed in the New River area, but the mine was abandoned because of the unexpected occurrence of thin coal. Small truck mines are the only source of production at present.

A sample of Jordan coal taken from the James mine for coal-preparation study was 39-1/4 inches thick. This bed section and another one in the area follow:

Hickory Creek Area

Material	Inches
Coal with pyrite and bony bands	39-1/4
Thickness	39-1/4

Material	Inches
COAL	49
Thickness	49

Joyner Bed

(See fig. 13 and table 10)

The Joyner coal is below the Pioneer sandstone in the Jellico formation and occurs about 150 feet below the Jordan bed. Elevations range from 1,500 and 1,600 feet in the Elk Fork Creek area to 1,700 feet in the New River area. The horizon of the bed in the Hickory Creek area has an average elevation of about 2,050 feet. Indicated recoverable coal reserves are in the southwestern part of the New River area and are based on bed sections given by Glenn.[9/] The locations of the bed sections given by Glenn were visited, but the measurements could not be verified because the coal bed was covered.

9/ Glenn, L. C., The Northern Tennessee Coal Field: Tennessee Div. Geol., Bull. 33B, 1925, p. 159.

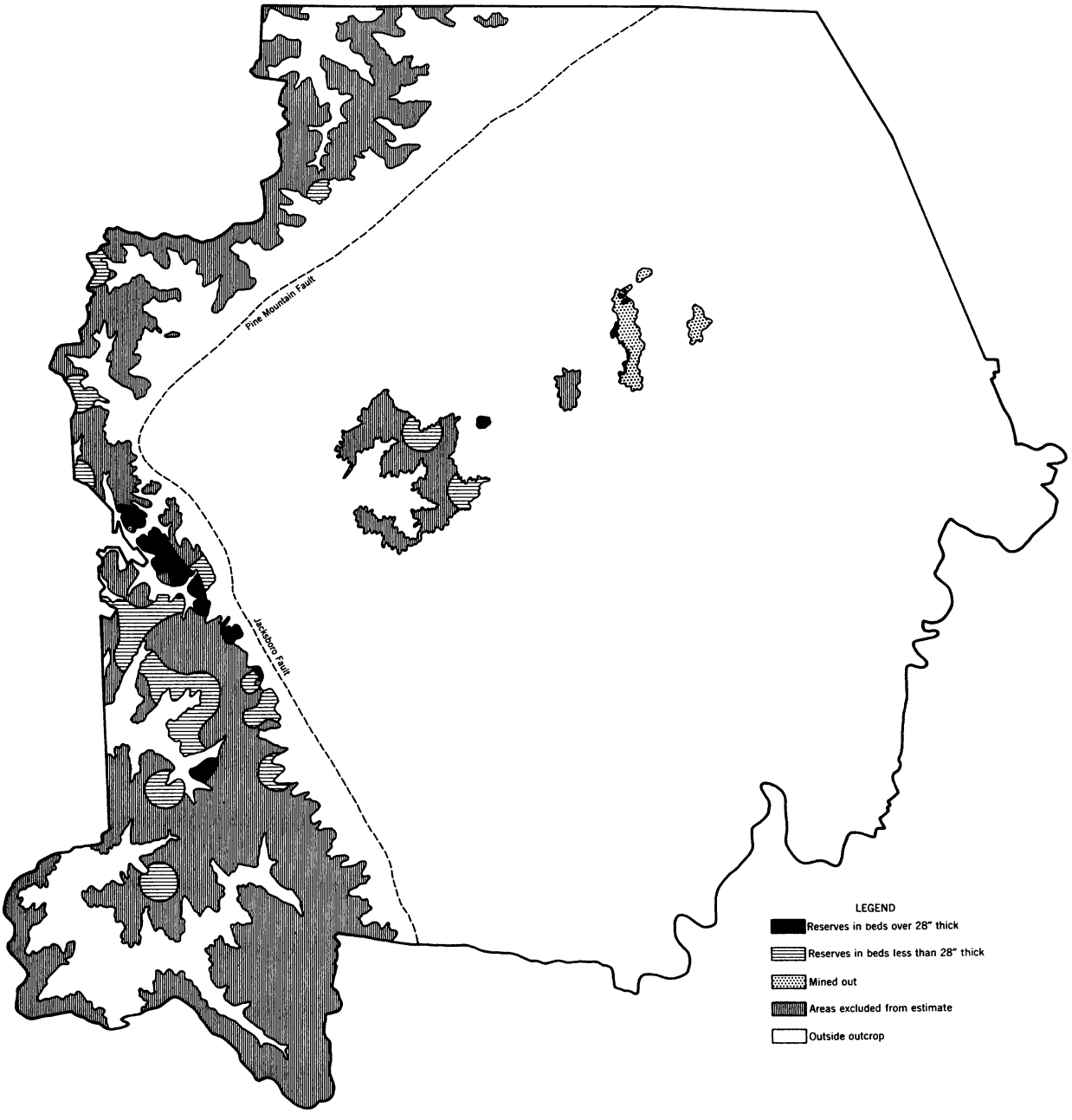

Figure 12. - Jordan bed, Campbell County, Tenn., January 1, 1953.

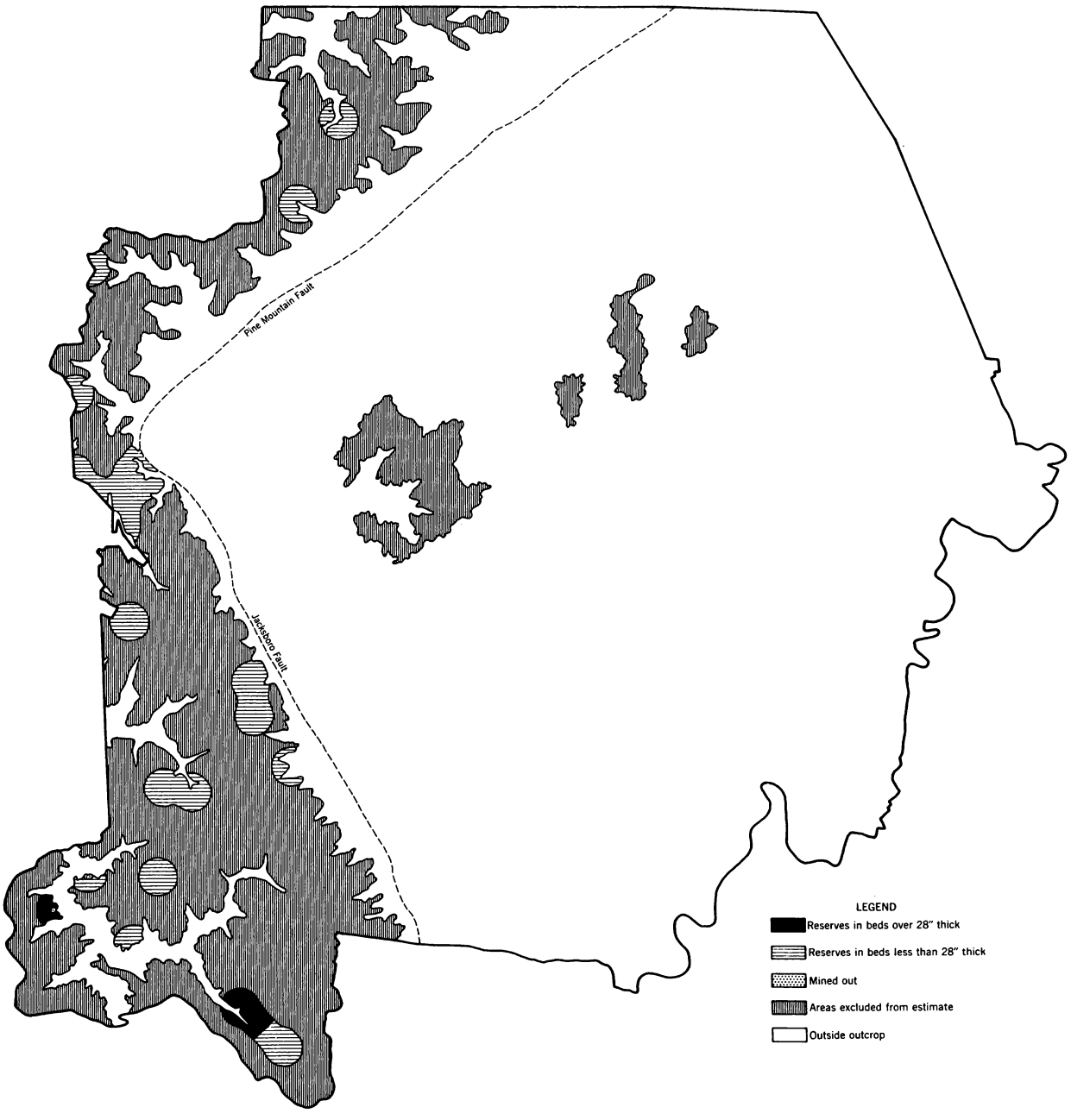

Figure 13. - Joyner bed, Campbell County, Tenn., January 1, 1953.

Jellico Bed

(See fig. 14 and table 11)

The Jellico bed occurs 100 feet below the Joyner and is a member of the Jellico formation. Although the Elk Fork Creek area has been the important production area, there are coal reserves in all three areas.

Originally the name Jellico was applied to a coal bed in the Elk Fork Creek area near the Kentucky line, where the average elevation is 1,400 feet. Farther south in the New River area, where the average bed elevation is about 1,600 feet, it is often referred to as the "Brushy Mountain" or "State" seam. In the Hickory Creek area the name "Jellico" is attached to an older bed that outcrops at an average elevation of 1,400 feet. Because of the Pine Mountain fault the true Jellico in the Hickory Creek area is found at an average elevation of about 1,900 feet; but its identity is lost, as it is better known as the "Log Mountain," "Pruden," "Mingo," or "Mason."

Two samples of Jellico coal were taken for coal-preparation studies. The one from the Mooney Coal Co. mine was 29-1/4 inches thick, and the one from the Brooks Graham mine was 45-1/2 inches thick. These bed sections and others in areas of recoverable reserves follow:

Elk Fork Creek Area

Material	Inches
COAL	27
Fusain	1/4
Coal with pyrite and fusain streaks	2
Thickness	29-1/4

Material	Inches
COAL	33
Thickness	33

Hickory Creek Area

Material	Inches
Coal with bony bands and sulfur balls	45-1/2
Thickness	45-1/2

Material	Inches
COAL	36
Thickness	36

New River Area

Material	Inches
COAL	2-1/2
Rashy coal	2-1/2
COAL	3-1/4
Parting	1/2
COAL	3-1/4
COAL	7-1/2
Rash	2
COAL	8
Thickness	29-1/2

Material	Inches
COAL	42
Thickness	42

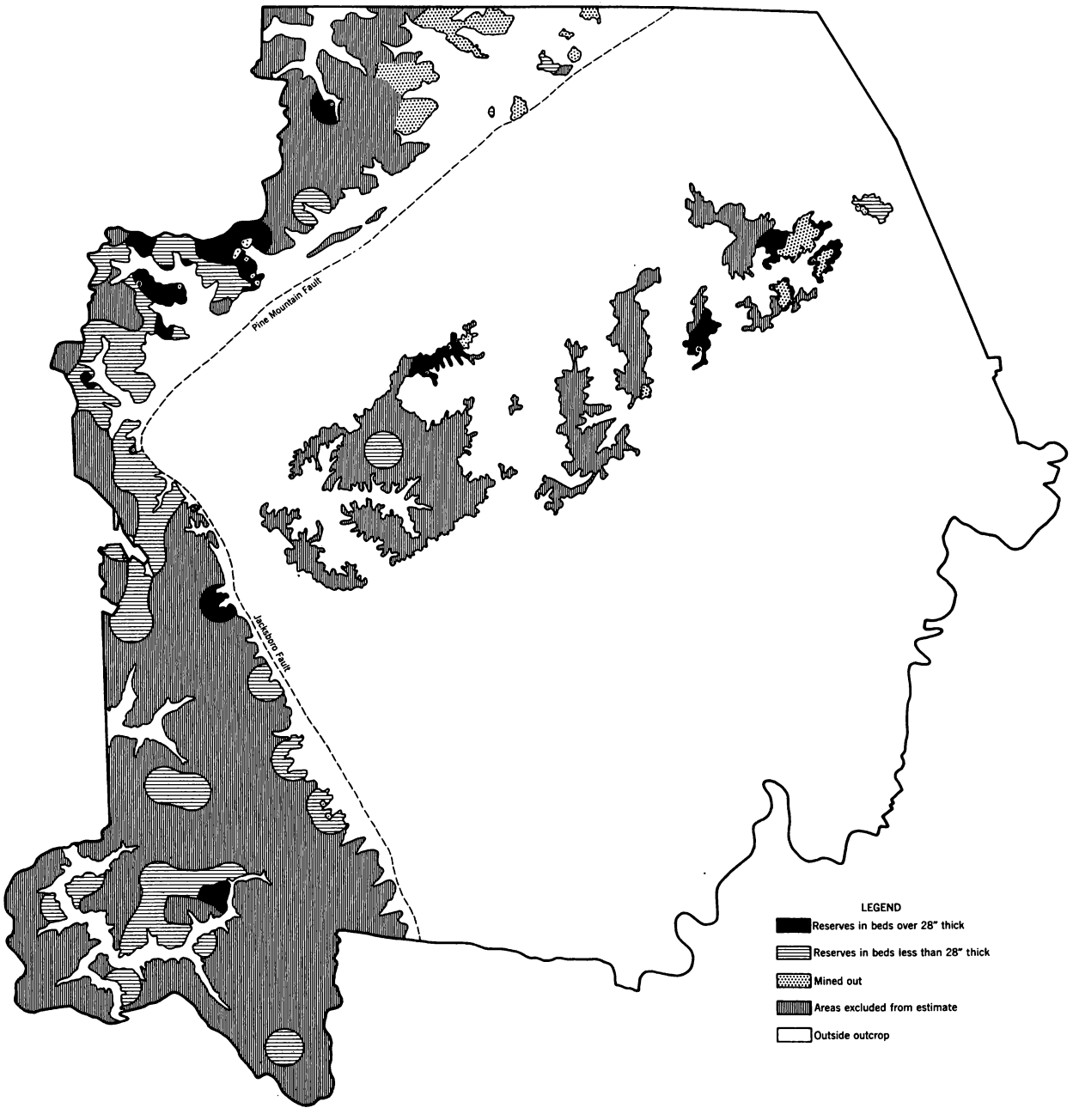

Figure 14. - Jellico bed, Campbell County, Tenn., January 1, 1953.

Blue Gem Bed

(See fig. 15 and table 12)

The Blue Gem bed occurs at the base of the Jellico formation about 150 feet below the Jellico bed. In the New River and Elk Fork Creek areas, the elevation ranges from 1,450 feet in the Duncan Flats quadrangle to 1,200 feet in the Jellico West quadrangle. In the Hickory Creek area, the bed is better known as the Rich Mountain, but locally it is called "Billy Goat." Here the bed dips toward the northeast and ranges in elevation from 1,540 feet to 1,900 feet.

The most extensive mining was in the northern part of the county, where the bed is above drainage and easily accessible. Data from prospects and drill holes indicate that most of the known remaining coal in the New River and Elk Fork Creek areas is less than 28 inches thick. Nearly all of the recoverable reserves are in the northeastern part of the Hickory Creek area, and bed sections in that area follow:

Northeastern Part of Hickory Creek Area

Material	Inches	Material	Inches
COAL	32	COAL	30
Thickness	32	Thickness	30

Coal Creek Bed

(See fig. 16 and table 13)

The Coal Creek bed is a member of the Briceville formation and lies 200 to 400 feet below the Blue Gem bed.

In the Elk Fork Creek area it also is known as the "Dixie" and generally is below drainage at elevations ranging from 1,050 to 1,200 feet. Meager data on this area show that the reserves are less than 28 inches thick.

The bed in the New River area is below drainage, except in the extreme eastern part, where some mining was done. The elevation of the bed in this area ranges from 950 to 1,200 feet.

In the Hickory Creek area the Coal Creek coal has been called Kent, Bennett Fork, and Jellico. The confusion with Jellico was caused by the fact that the Coal Creek bed east of the Pine Mountain fault has approximately the same elevation as the Jellico bed west of the fault. Most mining in the Coal Creek bed in Campbell County has been done in the Hickory Creek area, which also contains the largest reserves. The bed elevation ranges from 1,300 to 1,700 feet and dips toward the northeast.

Two samples were taken for coal-preparation studies. One from the Anthras Slope mine was 37 inches thick, and one from the Blue Rose mine was 57-1/2 inches thick. These bed sections and others in areas of recoverable reserves follow:

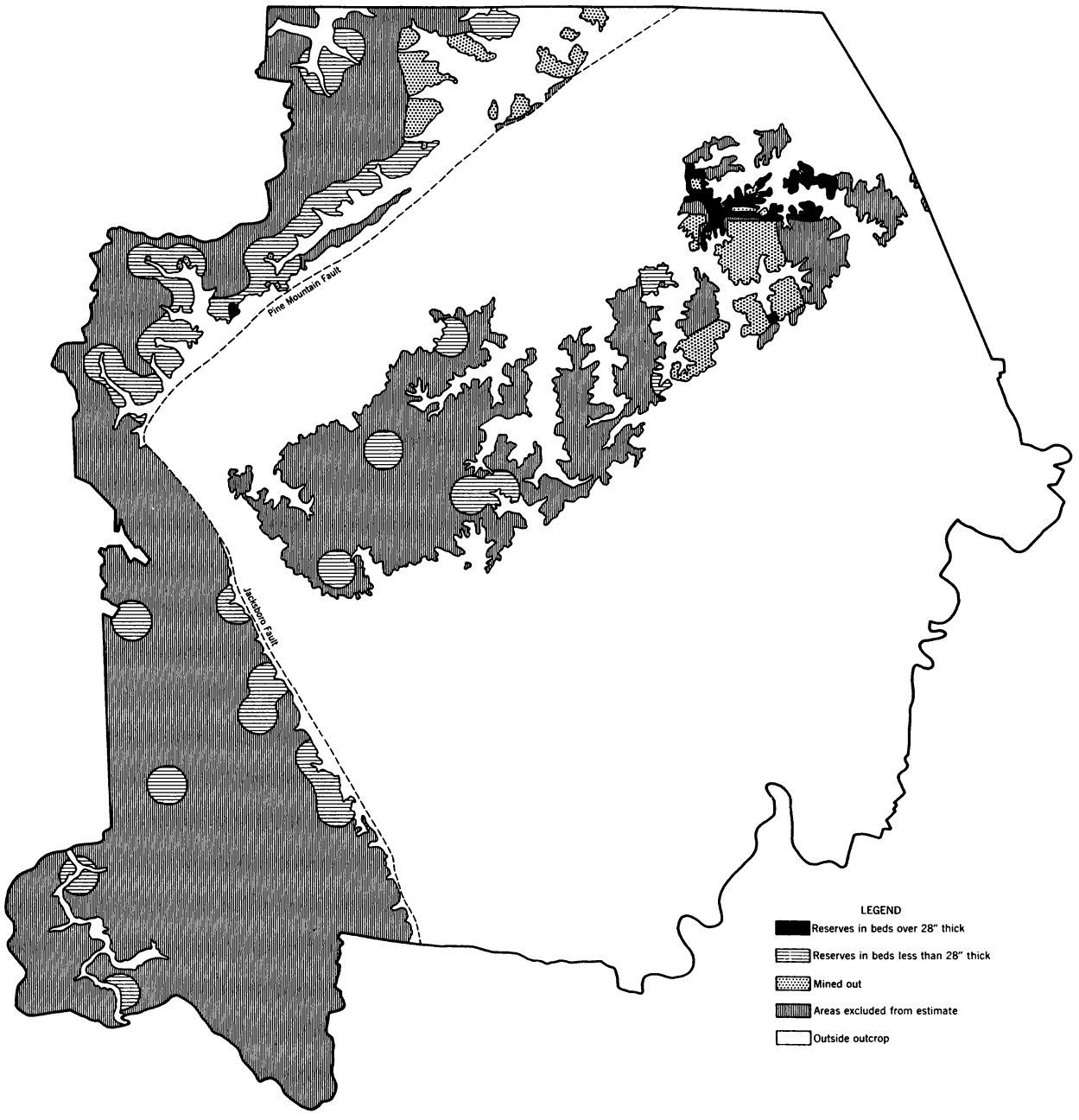

Figure 15. - Blue Gem bed, Campbell County, Tenn., January 1, 1953.

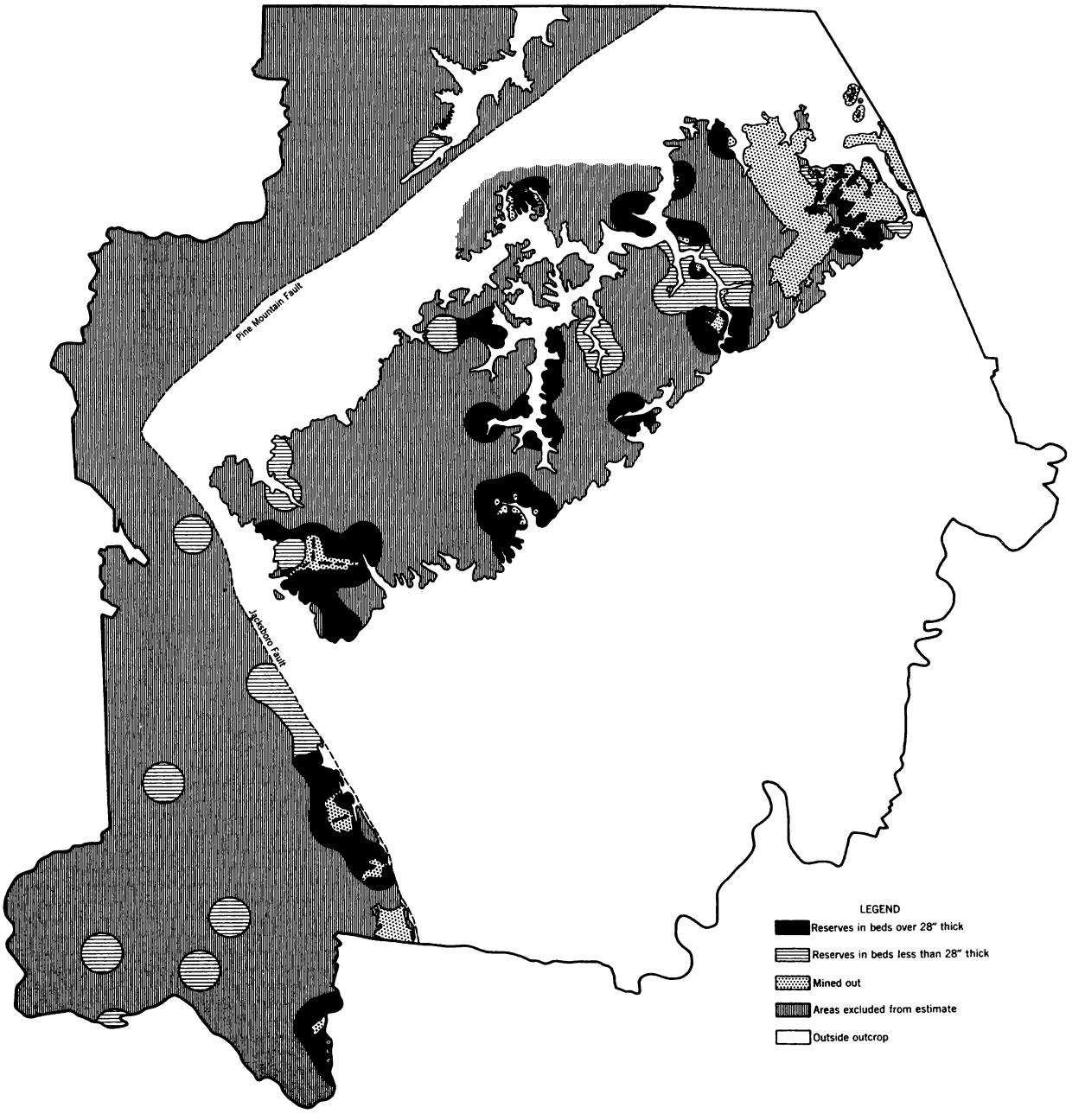

Figure 16. - Coal Creek bed, Campbell County, Tenn., January 1, 1953.

Southern Part of New River Area

Material	Inches
Coal with pyrite streaks	9-1/2
Bone coal	1-1/2
COAL	26
Thickness	37

Material	Inches
COAL	4
Rash	4
COAL	32
Thickness	40

Hickory Creek Area

Material	Inches
COAL	19-1/2
Pyrite	1/4
Coal with pyrite streaks	37-3/4
Thickness	57-1/2
COAL	6
Shale	4-1/2
COAL	20
Thickness	30-1/2

Material	Inches
COAL	20
Parting	12
COAL	15
Thickness	47
COAL	23
Bone	1
COAL	16
Thickness	40

Poplar Creek Bed

(See fig. 17 and table 14)

The Poplar Creek bed occurs about 200 feet below the Coal Creek bed in the Briceville formation.

In the northern part of the Elk Fork Creek area a bed, known as "Swamp Angel" locally, has been correlated as the Poplar Creek by the Tennessee Division of Geology. This same bed in the Hickory Creek area locally is called the "Murray." Although the bed in the Elk Fork Creek area is below drainage, it has been opened by slopes. Some strip mining has been done where the bed cropped in the stream bottoms.

Records of 2 diamond-drill holes in the southern part of the New River area show the coal to be less than 28 inches thick and at elevations of 900 and 1,037 feet.

In the Hickory Creek area the bed crops in the lowest streams but generally is below drainage. Some underground mining has been done in the area of reserves.

A sample of coal 29-1/2 inches thick was taken from the Whistle Creek strip for coal-preparation studies. A sample taken from the Stansbury No. 4 mine for both coal preparation and carbonization studies was 40 inches thick. These bed sections and others in areas of recoverable reserves follow:

Northern Part of Elk Fork Creek Area

Material	Inches
Laminated coal and bone	11-3/4
COAL	17-3/4
Thickness	29-1/2

Material	Inches
COAL	28
Thickness	28

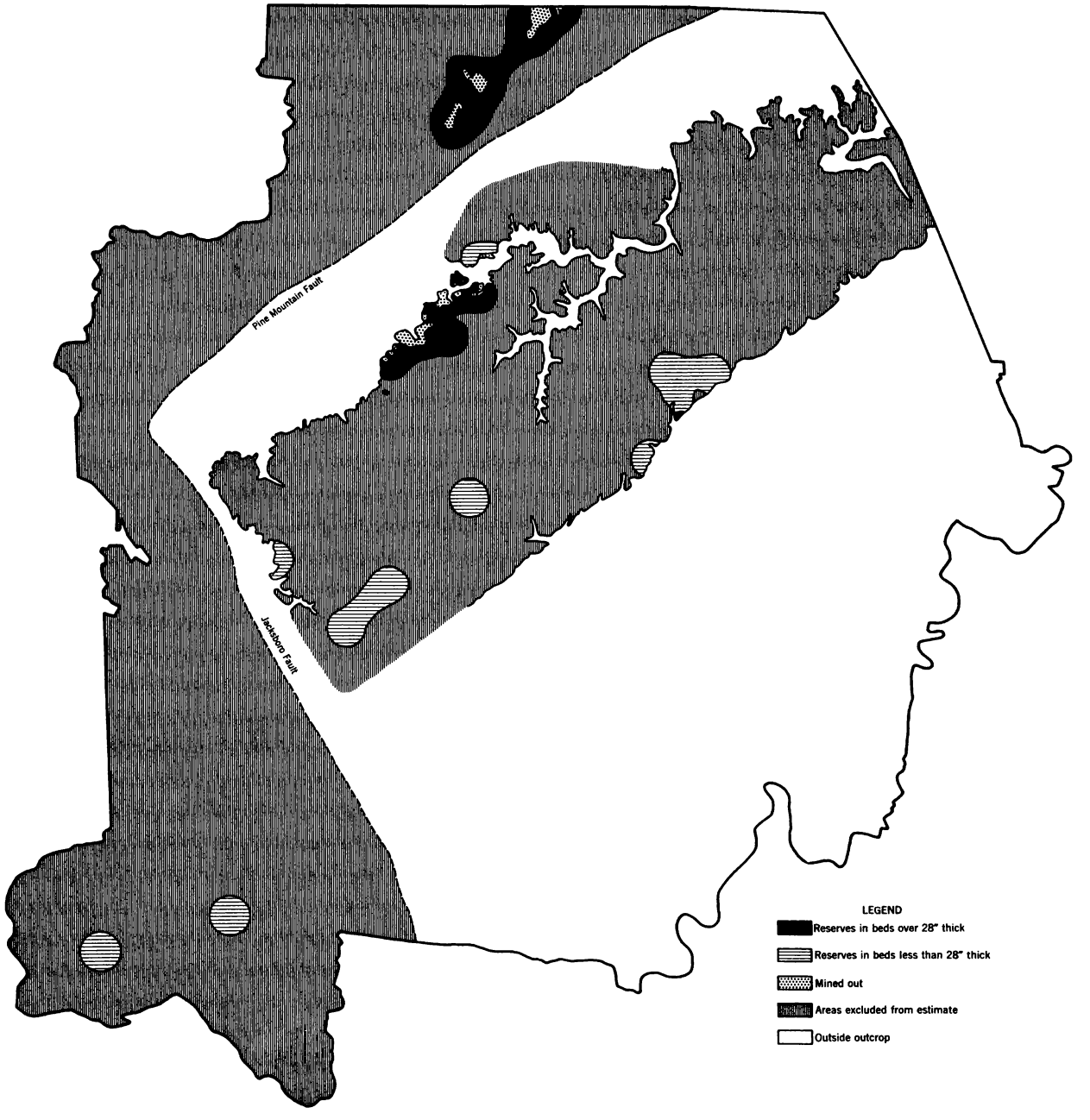

Figure 17. - Poplar Creek bed, Campbell County, Tenn., January 1, 1953.

Northwestern Part of Hickory Creek Area

Material	Inches
COAL	40
Thickness	40
COAL	23
Bone	1/2
COAL	10
Thickness	33-1/2

Material	Inches
COAL	5
Rash	1-1/2
COAL	15
Rash	1
COAL	15
Thickness	37-1/2

Rex Bed

(See fig. 18 and table 15)

The Rex bed is in the Briceville formation and lies about 100 feet below the Poplar Creek. It is the lowest bed in the county in which coal has been mined commercially. This mining was confined to the Hickory Creek area, where the coal lies 200 to 500 feet below surface.

A sample of Rex coal taken for analysis from a prospect along Titus Creek was 38-1/2 inches thick. This bed section and another from reserves in the southern part of the Hickory Creek area follow:

Southern Part of Hickory Creek Area

Material	Inches
COAL	36
Clay	1
COAL	1-1/2
Thickness	38-1/2

Material	Inches
COAL	24
Rock	6
COAL	6
Thickness	36

Coal Reserves

Detailed estimates of known measured and indicated reserves of coal in Campbell County as of January 1, 1953, are given in tables 1 to 15, inclusive. Table 16 is a recapitulation of reserves in 15 beds. The location and extent of coal reserves, by beds, are shown in figures 4 through 18. Reserves of coal 14 inches and more thick are estimated at 397, 523,000 tons, as of January 1, 1953; of this total, 266,693,000 tons is in beds 28 inches and more thick.

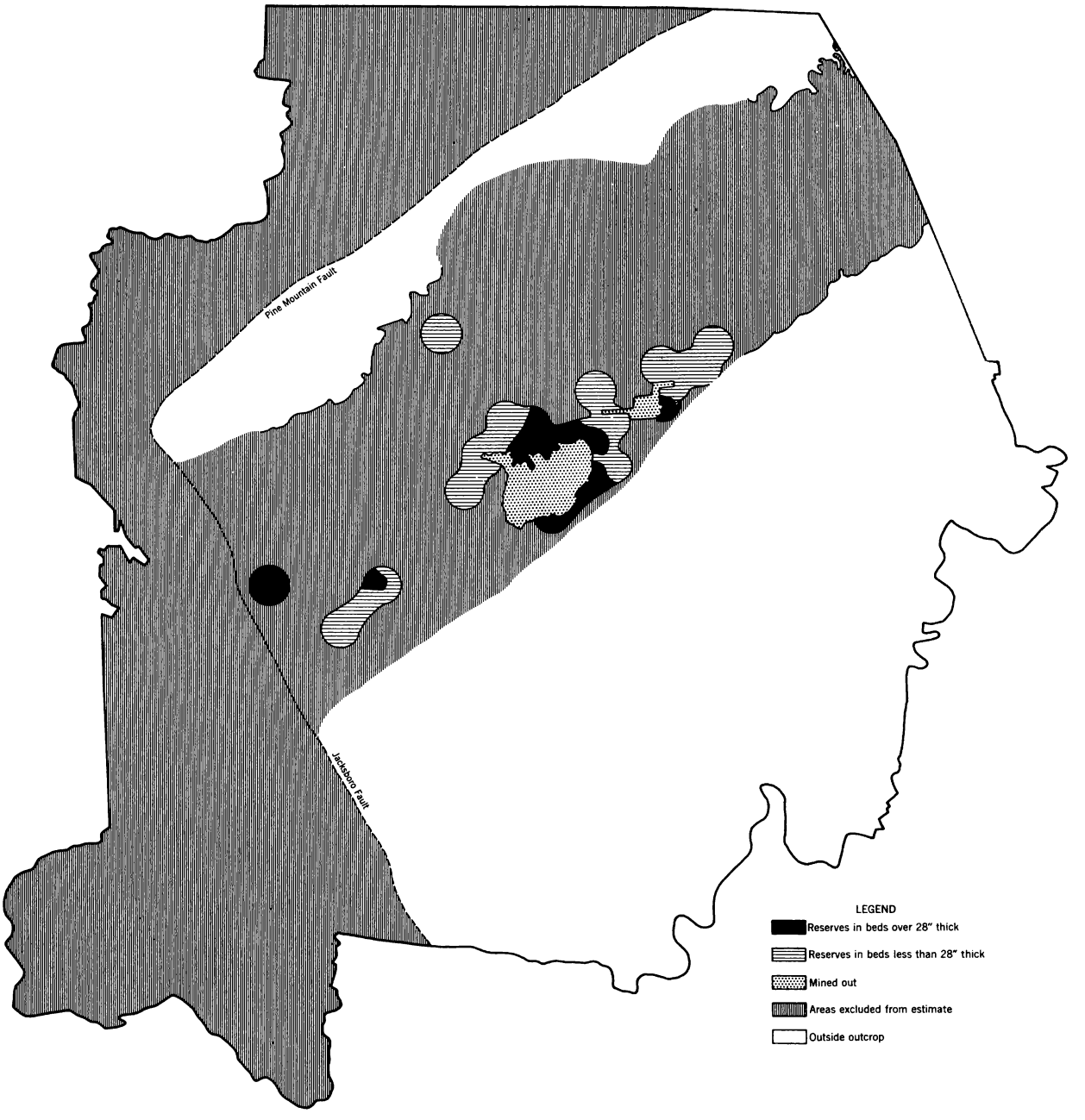

Figure 18. - Rex bed, Campbell County, Tenn., January 1, 1953.

CAMPBELL COUNTY

TABLE 1. - RESERVES IN ROCK SPRING BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	1,017	51,857	55	2,001	620	1,381	Measured	233	629	10	57	642	4,893	885	5,579	652	4,950		3,371
								Indicated	136	367	157	719	203	1,443	496	2,529	360	2,162		1,472
								Total	369	996	167	776	845	6,336	1,381	8,108	1,012	7,112	68.1	4,843
Remaining quadrangles	261,468	3,888	257,580	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	233	629	10	57	642	4,893	885	5,579	652	4,950		3,371
								Indicated	136	367	157	719	203	1,443	496	2,529	360	2,162		1,472
Total	316,398	4,905	309,437	55	2,001	620	1,381	Total	369	996	167	776	845	6,336	1,381	8,108	1,012	7,112	68.1	4,843

TABLE 2. - RESERVES IN PETREE BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	1,723	51,076	632	1,499	8	1,491	Measured	879	2,910	125	664	25	173	1,029	3,747	150	837		419
								Indicated	462	1,382	-	-	-	-	462	1,382	-	-		-
								Total	1,341	4,292	125	664	25	173	1,491	5,129	150	837	2/50.0	419
Remaining quadrangles	261,468	4,310	257,158	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	879	2,910	125	664	25	173	1,029	3,747	150	837		419
								Indicated	462	1,382	-	-	-	-	462	1,382	-	-		-
Total	316,398	6,033	308,234	632	1,499	8	1,491	Total	1,341	4,292	125	664	25	173	1,491	5,129	150	837	2/50.0	419

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 3. - RESERVES IN PEWEE BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
									Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.					
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
128 Huntsville	54,930	1,801	48,327	513	4,289	444	3,845	Measured	450	1,492	1,735	9,037	-	-	2,185	10,529	1,735	9,037		4,482
								Indicated	309	884	1,084	5,559	267	1,722	1,660	8,165	1,351	7,281		3,611
								Total	759	2,376	2,819	14,596	267	1,722	3,845	18,694	3,086	16,318	49.6	8,093
129 Oliver Springs	12,530	559	10,623	-	1,348	794	554	Measured	-	-	294	1,686	85	614	379	2,300	379	2,300		1,380
								Indicated	38	154	16	101	121	828	175	1,083	137	929		557
								Total	38	154	310	1,787	206	1,442	554	3,383	516	3,229	60.0	1,937
136 LaFollette	149,920	-	148,675	-	1,245	1,086	159	Measured	2	7	151	883	-	-	153	890	151	883		737
								Indicated	6	24	-	-	-	-	6	24	-	-		-
								Total	8	31	151	883	-	-	159	914	151	883	83.5	737
137 Norris Dam	9,000	117	6,603	-	2,280	740	1,540	Measured	5	18	217	1,254	177	1,168	399	2,440	394	2,422		1,920
								Indicated	-	-	553	3,195	588	3,979	1,141	7,174	1,141	7,174		5,689
								Total	5	18	770	4,449	765	5,147	1,540	9,614	1,535	9,596	79.3	7,609
Remaining quadrangles	90,018	231	89,787	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	2,708	304,015	513	9,162	3,064	6,098	Measured	457	1,517	2,397	12,860	262	1,782	3,116	16,159	2,659	14,642		8,519
								Indicated	353	1,062	1,653	8,855	976	6,529	2,982	16,446	2,629	15,384		9,857
								Total	810	2,579	4,050	21,715	1,238	8,311	6,098	32,605	5,288	30,026	61.2	18,376

TABLE 4. - RESERVES IN WALNUT MOUNTAIN BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
									Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.					
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
128 Huntsville	54,930	4,086	46,856	1,008	2,980	-	2,980	Measured	307	847	376	1,960	-	-	683	2,807	376	1,960		980
								Indicated	875	2,622	1,422	7,229	-	-	2,297	9,851	1,422	7,229		3,614
								Total	1,182	3,469	1,798	9,189	-	-	2,980	12,658	1,798	9,189	2/50.0	4,594
129 Oliver Springs	12,530	2,014	10,170	-	346	-	346	Measured	31	107	42	221	35	247	108	575	77	468		234
								Indicated	80	276	117	632	41	261	238	1,169	158	893		447
								Total	111	383	159	853	76	508	346	1,744	235	1,361	2/50.0	681
136 LaFollette	149,920	851	148,561	-	508	6	502	Measured	-	-	155	755	-	-	155	755	155	755		378
								Indicated	-	-	347	1,710	-	-	347	1,710	347	1,710		855
								Total	-	-	502	2,465	-	-	502	2,465	502	2,465	2/50.0	1,233
Remaining quadrangles	99,018	3,114	95,850	54	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	10,065	301,437	1,062	3,834	6	3,828	Measured	338	954	573	2,936	35	247	946	4,137	608	3,183		1,592
								Indicated	955	2,898	1,886	9,571	41	261	2,882	12,730	1,927	9,832		4,916
								Total	1,293	3,852	2,459	12,507	76	508	3,828	16,867	2,535	13,015	2/50.0	6,508

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 5. - RESERVES IN RED ASH BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
									Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.					
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick		Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	1,239	45,834	41	7,816	3,272	4,544	Measured	630	1,834	2,199	11,267	259	1,669	3,088	14,770	2,458	12,936		7,063
								Indicated	198	563	1,140	5,914	118	814	1,456	7,291	1,258	6,728		3,674
								Total	828	2,397	3,339	17,181	377	2,483	4,544	22,061	3,716	19,664	54.6	10,737
129 Oliver Springs	12,530	2,207	9,953	-	370	-	370	Measured	95	228	-	-	-	-	95	228	-	-		-
								Indicated	205	492	70	347	-	-	275	839	70	347		174
								Total	300	720	70	347	-	-	370	1,067	70	347	2/50.0	174
136 LaFollette	149,920	950	148,444	-	526	260	266	Measured	99	343	33	163	-	-	132	506	33	163		81
								Indicated	121	436	-	-	13	94	134	530	13	94		47
								Total	220	779	33	163	13	94	266	1,036	46	257	2/50.0	128
Remaining quadrangles	99,018	3,412	95,525	81	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	824	2,405	2,232	11,430	259	1,669	3,315	15,504	2,491	13,099		7,144
								Indicated	524	1,491	1,210	6,261	131	908	1,865	8,660	1,341	7,169		3,895
Total	316,398	7,808	299,756	122	8,712	3,532	5,180	Total	1,348	3,896	3,442	17,691	390	2,577	5,180	24,164	3,832	20,268	54.5	11,039

TABLE 6. - RESERVES IN BIG MARY BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
									Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.					
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick		Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	10,438	38,919	1,684	3,889	18	3,871	Measured	-	-	281	1,453	330	2,574	611	4,027	611	4,027		1,812
								Indicated	519	1,627	2,039	10,157	702	5,265	3,260	17,049	2,741	15,422		6,940
								Total	519	1,627	2,320	11,610	1,032	7,839	3,871	21,076	3,352	19,449	45.0	8,752
129 Oliver Springs	12,530	2,424	8,905	-	1,201	-	1,201	Measured	-	-	235	1,118	157	1,248	392	2,366	392	2,366		1,183
								Indicated	-	-	587	2,829	222	1,644	809	4,473	809	4,473		2,236
								Total	-	-	822	3,947	379	2,892	1,201	6,839	1,201	6,839	2/50.0	3,419
136 LaFollette	149,920	1,937	147,422	-	561	9	552	Measured	-	-	218	1,006	-	-	218	1,006	218	1,006		503
								Indicated	-	-	334	1,653	-	-	334	1,653	334	1,653		827
								Total	-	-	552	2,659	-	-	552	2,659	552	2,659	2/50.0	1,330
Stearns	2,908	997	1,684	-	227	-	227	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	120	720	107	835	227	1,555	227	1,555		778
								Total	-	-	120	720	107	835	227	1,555	227	1,555	2/50.0	778
Saxton	55,595	2,145	53,238	-	212	-	212	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	212	477	-	-	-	-	212	477	-	-		-
								Total	212	477	-	-	-	-	212	477	-	-	-	-
Remaining quadrangles	40,515	3,144	37,142	229	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	-	-	734	3,577	487	3,822	1,221	7,399	1,221	7,399		3,498
								Indicated	731	2,104	3,080	15,359	1,031	7,744	4,842	25,207	4,111	23,103		10,781
Total	316,398	21,085	287,310	1,913	6,090	27	6,063	Total	731	2,104	3,814	18,936	1,518	11,566	6,063	32,606	5,332	30,502	46.8	14,279

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 7. - RESERVES IN WINDROCK BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	13,496	37,282	1,957	2,195	-	2,195	Measured	254	551	-	-	-	-	254	551	-	-		-
								Indicated	1,745	3,572	196	911	-	-	1,941	4,483	196	911		456
								Total	1,999	4,123	196	911	-	-	2,195	5,034	196	911	2/50.0	456
129 Oliver Springs	12,530	2,281	8,544	51	1,654	-	1,654	Measured	4	16	226	1,310	268	1,828	498	3,154	494	3,138		1,569
								Indicated	126	478	336	1,915	694	4,628	1,156	7,021	1,030	6,543		3,271
								Total	130	494	562	3,225	962	6,456	1,654	10,175	1,524	9,681	2/50.0	4,840
136 LaFollette	149,920	2,597	147,026	-	297	2	295	Measured	67	201	-	-	-	-	67	201	-	-		-
								Indicated	228	662	-	-	-	-	228	662	-	-		-
								Total	295	863	-	-	-	-	295	863	-	-	-	-
137 Norris Dam	9,000	2,305	5,525	-	1,170	164	1,006	Measured	-	-	16	91	227	1,464	243	1,555	243	1,555		777
								Indicated	-	-	207	1,237	556	3,753	763	4,990	763	4,990		2,495
								Total	-	-	223	1,328	783	5,217	1,006	6,545	1,006	6,545	2/50.0	3,272
Stearns	2,908	1,131	1,526	-	251	-	251	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	251	963	-	-	251	963	251	963		482
								Total	-	-	251	963	-	-	251	963	251	963	2/50.0	482
Saxton	55,595	2,511	52,564	-	520	312	208	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	208	1,186	-	-	208	1,186	208	1,186		593
								Total	-	-	208	1,186	-	-	208	1,186	208	1,186	2/50.0	593
Remaining quadrangles	31,515	-	31,515	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	24,321	283,982	2,008	6,087	478	5,609	Measured	325	768	242	1,401	495	3,292	1,062	5,461	737	4,693		2,346
								Indicated	2,099	4,712	1,198	6,212	1,250	8,381	4,547	19,305	2,448	14,593		7,297
								Total	2,424	5,480	1,440	7,613	1,745	11,673	5,609	24,766	3,185	19,286	2/50.0	9,643

TABLE 8. - RESERVES IN UPPER PIONEER BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	17,607	33,381	1,687	2,255	378	1,877	Measured	189	724	47	226	-	-	236	950	47	226		113
								Indicated	1,042	3,639	599	3,207	-	-	1,641	6,846	599	3,207		1,604
								Total	1,231	4,363	646	3,433	-	-	1,877	7,796	646	3,433	2/50.0	1,717
Stearns	2,908	1,000	1,008	-	900	26	874	Measured	-	-	304	1,459	-	-	304	1,459	304	1,459		730
								Indicated	13	45	557	2,605	-	-	570	2,650	557	2,605		1,302
								Total	13	45	861	4,064	-	-	874	4,109	861	4,064	2/50.0	2,032
Remaining quadrangles	258,560	18,971	239,589	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	37,578	273,978	1,687	3,155	404	2,751	Measured	189	724	351	1,685	-	-	540	2,409	351	1,685		843
								Indicated	1,055	3,684	1,156	5,812	-	-	2,211	9,496	1,156	5,812		2,906
								Total	1,244	4,408	1,507	7,497	-	-	2,751	11,905	1,507	7,497	2/50.0	3,749

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 9. - RESERVES IN JORDAN BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	19,177	29,395	2,302	4,056	2	4,054	Measured	212	558	211	1,080	-	-	423	1,638	211	1,080		540
								Indicated	2,477	7,262	1,154	5,802	-	-	3,631	13,064	1,154	5,802		2,901
								Total	2,689	7,820	1,365	6,882	-	-	4,054	14,702	1,365	6,882	2/50.0	3,441
136 LaFollette	149,920	6,177	141,962	346	1,435	939	496	Measured	-	-	89	516	-	-	89	516	89	516		258
								Indicated	380	1,254	27	154	-	-	407	1,408	27	154		77
								Total	380	1,254	116	670	-	-	496	1,924	116	670	2/50.0	335
Stearns	2,908	2,188	704	-	16	-	16	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	16	50	-	-	-	-	16	50	-	-		-
								Total	16	50	-	-	-	-	16	50	-	-	-	-
Remaining quadrangles	108,640	15,640	92,834	166	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	43,182	264,895	2,814	5,507	941	4,566	Measured	212	558	300	1,596	-	-	512	2,154	300	1,596		798
								Indicated	2,873	8,566	1,181	5,956	-	-	4,054	14,522	1,181	5,956		2,978
								Total	3,085	9,124	1,481	7,552	-	-	4,566	16,676	1,481	7,552	2/50.0	3,776

TABLE 10. - RESERVES IN JOYNER BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	27,218	22,507	4,207	998	3	995	Measured	58	183	-	-	-	-	58	183	-	-		-
								Indicated	783	2,091	154	832	-	-	937	2,923	154	832		416
								Total	841	2,274	154	832	-	-	995	3,106	154	832	2/50.0	416
129 Oliver Springs	12,530	7,997	3,263	-	1,270	-	1,270	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	635	2,032	635	3,118	-	-	1,270	5,150	635	3,118		1,559
								Total	635	2,032	635	3,118	-	-	1,270	5,150	635	3,118	2/50.0	1,559
137 Norris Dam	9,000	3,853	4,995	-	152	-	152	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	152	502	-	-	-	-	152	502	-	-		-
								Total	152	502	-	-	-	-	152	502	-	-	-	-
Saxton	55,595	7,410	47,431	400	354	-	354	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	354	850	-	-	-	-	354	850	-	-		-
								Total	354	850	-	-	-	-	354	850	-	-	-	-
Stearns	2,908	2,360	469	16	63	-	63	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	63	151	-	-	-	-	63	151	-	-		-
								Total	63	151	-	-	-	-	63	151	-	-	-	-
Remaining quadrangles	181,435	9,835	171,528	72	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
Total	316,398	58,673	250,193	4,695	2,837	3	2,834	Measured	58	183	-	-	-	-	58	183	-	-		-
								Indicated	1,987	5,626	789	3,950	-	-	2,776	9,576	789	3,950		1,975
								Total	2,045	5,809	789	3,950	-	-	2,834	9,759	789	3,950	2/50.0	1,975

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 11. - RESERVES IN JELLICO BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	24,265	19,499	3,918	7,248	47	7,201	Measured	718	2,618	562	2,445	-	-	1,280	5,063	562	2,445		1,222
								Indicated	4,941	16,343	980	4,687	-	-	5,921	21,030	980	4,687		2,344
								Total	5,659	18,961	1,542	7,132	-	-	7,201	26,093	1,542	7,132	2/50.0	3,566
128 Oliver Springs	12,530	8,976	1,960	491	1,103	-	1,103	Measured	176	581	-	-	-	-	176	581	-	-		-
								Indicated	927	3,050	-	-	-	-	927	3,050	-	-		-
								Total	1,103	3,631	-	-	-	-	1,103	3,631	-	-	-	-
136 LaFollette	149,920	14,985	132,602	979	1,354	398	956	Measured	11	36	109	637	195	1,280	315	1,953	304	1,917		959
								Indicated	62	205	361	1,637	218	1,429	641	3,271	579	3,066		1,533
								Total	73	241	470	2,274	413	2,709	956	5,224	883	4,983	2/50.0	2,492
Stearns	2,908	1,438	305	-	1,165	31	1,134	Measured	59	215	248	1,166	-	-	307	1,381	248	1,166		583
								Indicated	324	981	503	2,294	-	-	827	3,275	503	2,294		1,147
								Total	383	1,196	751	3,460	-	-	1,134	4,656	751	3,460	2/50.0	1,730
Saxton	55,595	8,229	43,765	-	3,601	2,543	1,058	Measured	-	-	243	1,197	71	457	314	1,654	314	1,654		827
								Indicated	495	1,803	244	1,129	5	32	744	2,964	249	1,161		580
								Total	495	1,803	487	2,326	76	489	1,058	4,618	563	2,815	2/50.0	1,407
144 Log Mountain	4,365	-	4,118	-	247	7	240	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	240	720	-	-	-	-	240	720	-	-		-
								Total	240	720	-	-	-	-	240	720	-	-	-	-
Remaining quadrangles	36,150	3,941	32,069	140	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	964	3,450	1,162	5,445	266	1,737	2,392	10,632	1,428	7,182		3,591
								Indicated	6,989	23,102	2,088	9,747	223	1,461	9,300	34,310	2,311	11,208		5,604
Total	316,398	61,834	234,318	5,528	14,718	3,026	11,692	Total	7,953	26,552	3,250	15,192	489	3,198	11,692	44,942	3,739	18,390	2/50.0	9,195

TABLE 12. - RESERVES IN BLUE GEM BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	34,603	14,058	3,022	3,247	29	3,218	Measured	986	3,029	35	158	-	-	1,021	3,187	35	158		79
								Indicated	2,183	5,956	14	63	-	-	2,197	6,019	14	63		31
								Total	3,169	8,985	49	221	-	-	3,218	9,206	49	221	2/50.0	110
136 LaFollette	149,920	25,810	118,507	1,408	4,195	1,952	2,243	Measured	168	479	38	199	-	-	206	678	38	199		100
								Indicated	2,037	6,565	-	-	-	-	2,037	6,565	-	-		-
								Total	2,205	7,044	38	199	-	-	2,243	7,243	38	199	2/50.0	100
Stearns	2,908	2,275	95	-	538	-	538	Measured	61	191	-	-	-	-	61	191	-	-		-
								Indicated	477	1,417	-	-	-	-	477	1,417	-	-		-
								Total	538	1,608	-	-	-	-	538	1,608	-	-	-	-
Saxton	55,595	9,388	38,694	-	7,513	3,337	4,176	Measured	828	2,496	943	4,680	-	-	1,771	7,176	943	4,680		2,340
								Indicated	1,905	5,459	500	2,366	-	-	2,405	7,825	500	2,366		1,183
								Total	2,733	7,955	1,443	7,046	-	-	4,176	15,001	1,443	7,046	2/50.0	3,523
Remaining quadrangles	53,045	16,498	36,274	273	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	2,043	6,195	1,016	5,037	-	-	3,059	11,232	1,016	5,037		2,519
								Indicated	6,602	19,397	514	2,429	-	-	7,116	21,826	514	2,429		1,214
Total	316,398	88,574	207,628	4,703	15,493	5,318	10,175	Total	8,645	25,592	1,530	7,466	-	-	10,175	33,058	1,530	7,466	2/50.0	3,733

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 13. - RESERVES IN COAL CREEK BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	42,428	9,786	1,876	840	-	840	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	616	1,977	224	1,198	-	-	840	3,175	224	1,198		599
								Total	616	1,977	224	1,198	-	-	840	3,175	224	1,198	2/50.0	599
129 Oliver Springs	12,530	11,092	-	731	707	-	707	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	707	1,715	-	-	-	-	707	1,715	-	-		-
								Total	707	1,715	-	-	-	-	707	1,715	-	-	-	-
136 LaFollette	149,920	31,879	103,742	535	13,764	1,716	12,048	Measured	471	1,852	2,639	13,853	277	1,660	3,387	17,365	2,916	15,513		11,309
								Indicated	2,561	9,715	4,391	22,540	1,709	10,640	8,661	42,895	6,100	33,180		24,188
								Total	3,032	11,567	7,030	36,393	1,986	12,300	12,048	60,260	9,016	48,693	72.9	35,497
137 Norris Dam	9,000	3,004	4,814	-	1,182	346	836	Measured	-	-	317	1,759	42	252	359	2,011	359	2,011		1,005
								Indicated	-	-	449	2,486	28	168	477	2,654	477	2,654		1,327
								Total	-	-	766	4,245	70	420	836	4,665	836	4,665	2/50.0	2,332
144 Log Mountain	4,365	71	1,912	14	2,368	1,571	797	Measured	60	219	375	1,970	145	970	580	3,159	520	2,940		1,470
								Indicated	76	308	88	409	53	334	217	1,051	141	743		372
								Total	136	527	463	2,379	198	1,304	797	4,210	661	3,683	2/50.0	1,842
Saxton	55,595	26,391	23,622	-	5,582	3,004	2,578	Measured	166	616	374	1,871	-	-	540	2,487	374	1,871		936
								Indicated	324	898	1,663	7,349	51	337	2,038	8,584	1,714	7,686		3,843
								Total	490	1,514	2,037	9,220	51	337	2,578	11,071	2,088	9,557	2/50.0	4,779
Remaining quadrangles	30,058	2,908	27,150	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	697	2,687	3,705	19,453	464	2,882	4,866	25,022	4,169	22,335		14,720
								Indicated	4,284	14,613	6,815	33,982	1,841	11,479	12,940	60,074	8,656	45,461		30,329
Total	316,398	117,773	171,026	3,156	24,443	6,637	17,806	Total	4,981	17,300	10,520	53,435	2,305	14,361	17,806	85,096	12,825	67,796	66.4	45,049

TABLE 14. - RESERVES IN POPLAR CREEK BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
129 Oliver Springs	12,530	11,869	-	188	473	-	473	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	473	1,135	-	-	-	-	473	1,135	-	-		-
								Total	473	1,135	-	-	-	-	473	1,135	-	-	-	-
136 LaFollette	149,920	50,344	94,239	2,948	2,389	320	2,069	Measured	50	196	665	3,394	-	-	715	3,590	665	3,394		1,697
								Indicated	397	1,543	957	4,822	-	-	1,354	6,365	957	4,822		2,411
								Total	447	1,739	1,622	8,216	-	-	2,069	9,955	1,622	8,216	2/50.0	4,108
Saxton	55,595	35,197	16,966	-	3,432	416	3,016	Measured	32	127	1,232	5,422	-	-	1,264	5,549	1,232	5,422		2,711
								Indicated	138	548	1,614	7,111	-	-	1,752	7,659	1,614	7,111		3,556
								Total	170	675	2,846	12,533	-	-	3,016	13,208	2,846	12,533	2/50.0	6,267
Remaining quadrangles	98,353	56,266	41,619	468	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	82	323	1,897	8,816	-	-	1,979	9,139	1,897	8,816		4,408
								Indicated	1,008	3,226	2,571	11,933	-	-	3,579	15,159	2,571	11,933		5,967
Total	316,398	153,676	152,824	3,604	6,294	736	5,558	Total	1,090	3,549	4,468	20,749	-	-	5,558	24,298	4,468	20,749	2/50.0	10,375

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

CAMPBELL COUNTY

TABLE 15. - RESERVES IN REX BED, January 1, 1953

15' Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
128 Huntsville	54,930	49,345	5,111	-	474	-	474	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	474	2,702	-	-	474	2,702	474	2,702		1,351
								Total	-	-	474	2,702	-	-	474	2,702	474	2,702	2/50.0	1,351
136 LaFollette	149,920	51,479	88,002	1,185	9,254	2,558	6,696	Measured	1,000	3,586	875	4,431	50	330	1,925	8,347	925	4,761		2,381
								Indicated	3,781	11,617	990	4,784	-	-	4,771	16,401	990	4,784		2,392
								Total	4,781	15,203	1,865	9,215	50	330	6,696	24,748	1,915	9,545	2/50.0	4,773
Saxton	55,595	42,760	12,809	-	26	-	26	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	26	94	-	-	-	-	26	94	-	-		-
								Total	26	94	-	-	-	-	26	94	-	-	-	-
Remaining quadrangles	55,953	24,019	31,934	-	-	-	-	Measured	-	-	-	-	-	-	-	-	-	-		-
								Indicated	-	-	-	-	-	-	-	-	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured	1,000	3,586	875	4,431	50	330	1,925	8,347	925	4,761		2,381
								Indicated	3,807	11,711	1,464	7,486	-	-	5,271	19,197	1,464	7,486		3,743
Total	316,398	167,603	137,856	1,185	9,754	2,558	7,196	Total	4,807	15,297	2,339	11,917	50	330	7,196	27,544	2,389	12,247	2/50.0	6,124

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

TABLE 16. - Recapitulation of reserves, Campbell County, Tenn., January 1, 1953

Bed	Thousands of tons		Recoverable 1/	
	In beds 14 inches and more thick	In beds 28 inches and more thick	Percentage	Thousands of tons
Rock Spring	8,108	7,112	68.1	4,843
Petree	5,129	837	2/ 50.0	419
Pewee	32,605	30,026	61.2	18,376
Walnut Mountain	16,867	13,015	2/ 50.0	6,508
Red Ash	24,164	20,268	54.5	11,039
Big Mary	32,606	30,502	46.8	14,279
Windrock	24,766	19,286	2/ 50.0	9,643
Upper Pioneer	11,905	7,497	2/ 50.0	3,749
Jordan	16,676	7,552	2/ 50.0	3,776
Joyner	9,759	3,950	2/ 50.0	1,975
Jellico	44,942	18,390	2/ 50.0	9,195
Blue Gem	33,058	7,466	2/ 50.0	3,733
Coal Creek	85,096	67,796	2/ 66.4	45,049
Poplar Creek	24,298	20,749	2/ 50.0	10,375
Rex	27,544	12,247	2/ 50.0	6,124
Total	397,523	266,693	55.9	149,083

1/ Based on reserves in beds 28 inches and more thick.
2/ Estimated.

The weighted average percentage of recovery for each bed as used in this report is shown in column 19 of tables 1 to 15, inclusive. The highest average percentage of recovery is 68.1 for the unimportant Rock Spring bed; however, the Coal Creek bed, with the largest recoverable reserves, shows a recovery of 66.4 percent. The lowest recovery is 46.8 percent for the Big Mary bed. The weighted average recovery, including all mining losses for all beds in the county, is 55.9 percent. Based on this recovery, the known recoverable reserves 28 inches and more thick are estimated at 149,083,000 short tons as of January 1, 1953.

Campbell County is one of the major coal-producing counties in Tennessee. Coal production during 1953 was 849,972 tons,[10] or 15.6 percent of Tennessee coal production. Campbell County ranked second of the 18 counties producing coal in that year. This is a decrease in the annual production rate under that of the preceding 4 years. Campbell County produced about 71,288,000 tons of coal between 1852 and January 1, 1953, according to Annual Reports of the Tennessee Division of Mines, Bureau of Mines Mineral Market Summaries, and some unpublished records. This is about 20.3 percent of the total coal produced in Tennessee and ranks the county first in total production of coal.

The Coal Creek bed contains 45 million tons of recoverable coal reserves, the largest for any bed in the county. This bed also has the largest mined-out area (6,637 acres), which represents only 5 percent of the total bed area. Eighty-one percent of the Coal Creek-bed horizon was excluded from the estimate for lack of data. The Pewee bed provided the most comprehensive data. Only 22 percent of the bed horizon was excluded from the estimate for lack of data, and 25 percent of the bed area was mined out. The Red Ash shows 47 percent excluded and 21 percent mined out.

10/ Bureau of Mines, Bituminous Coal and Lignite in 1953: Mineral Market Summary 2339, December 1954, p. 120.

Analyses of Campbell County Coals

The chemical analyses of tipple and mine samples are arranged in table 17 in the stratigraphic order of the coal beds. The sample of Windrock coal came from the Tennco strip mine in Anderson County but is used here because it is the closest place to the Windrock reserves in this county where a sample could be taken. The results of this analysis have been published.11/ All other samples with analyses listed in table 17 were taken for this study, and the results of the analyses are published here for the first time.

The coals of Campbell County are all high-volatile A bituminous in rank. Analyses of the samples of Pewee and Upper Pioneer coal from the Sun Pewee and the Baird strip mines, respectively, show the coals to rank as high-volatile B bituminous, but neither sample is truly representative of unweathered coal of the bed from which the sample was taken.

PART II. - PREPARATION CHARACTERISTICS OF CAMPBELL COUNTY, TENN., COAL

by

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Test Procedure

To determine the washability of Campbell County coal, 15 face samples and 2 mine-run tipple samples were collected in 11 deep mines and 6 strip pits working the Petree, Pewee, Walnut Mountain, Red Ash, Big Mary, Upper Pioneer, Jordan, Jellico, Blue Gem, Coal Creek, and Poplar Creek beds. Only one sample each could be obtained from the Petree, Walnut Mountain, Big Mary, Upper Pioneer, Jordan, and Blue Gem beds. The remaining beds provided 2 samples each, except the Red Ash bed, from which 3 face samples were taken. Where more than one sample was taken in a single bed, the sampling locations were selected to cover a wide area of the bed and thereby reflect possible variations in bed quality in different parts of the county. The location of mines from which washability samples were collected is shown in figure 1.

The tipple samples taken from the Big Mary and Poplar Creek beds were obtained by collecting numerous increments of mine-run coal as loaded during a shift of operation. Each large gross sample was crushed in the field to pass a 1-1/2-inch round-hole screen and reduced in volume, and a test lot of several hundred pounds of 1-1/2-inch by 0 for each coal was sent to the laboratory for float-and-sink testing.

The face samples were collected in the conventional manner, except that binders and partings in the mined section of the bed usually were included in the sample, even though the extraneous matter normally would be removed on the picking table.

11/ Williams, Lloyd, James, Curtis, Gandrud, B. W., and Reynolds, D. A., Estimate of Known Recoverable Reserves and the Preparation and Carbonizing Properties of Coking Coal in Anderson County, Tenn.: Bureau of Mines Rept. of Investigations 5185, 1955, 52 pp.

TABLE 17. - Analyses of Campbell County coals

Town and mine	Bed	Rank[1/]	Kind of sample[2/]	As-received, moist.	Dry basis				
					Vol.	F.c.	Ash	Sul.	B.t.u.
1	2	3	4	5	6	7	8	9	10
Turley									
Turley Petree	Petree	Hvab	M	2.8	38.1	49.8	12.1	0.6	13,010
Caryville									
Sun Pewee	Pewee	Hvbb	M	5.7	32.0	49.3	18.7	.7	11,890
Clinchmore									
Clinchmore	do.	Hvab	M	3.1	38.3	55.8	5.9	.7	14,090
Caryville									
Sun Ray Coal Co.	Walnut Mountain	do.	M	3.6	37.3	53.7	9.0	1.8	13,390
Pioneer									
Phillips Red Ash	Red Ash	do.	M	4.2	33.1	43.8	23.1	.9	11,160
Caryville									
High Point No. 2	do.	do.	M	2.8	37.3	52.8	9.9	1.3	13,290
Hickey									
Diamond Mine No. 3	do.	do.	M	2.6	38.9	54.6	6.5	1.5	13,920
Dean									
Straight Fork	Big Mary	do.	T	1.4	34.8	47.4	17.8	4.4	12,010
Briceville									
Tennco	Windrock	do.	T	4.2	37.6	53.8	8.6	.6	13,510
Elk Valley									
Baird	Upper Pioneer	Hvbb	M	8.2	36.4	52.0	11.6	2.0	12,630
LaFollette									
James	Jordan	Hvab	M	3.6	38.0	59.1	2.9	.9	14,310
Elk Valley									
Mooney Coal Co.	Jellico	do.	M	2.7	38.7	56.2	5.1	2.5	14,120
Morley									
Brooks Graham	do.	do.	M	2.6	39.5	56.8	3.7	.9	14,520
Morley									
Blue Rose	Coal Creek	do.	M	2.3	39.9	55.8	4.3	1.4	14,470
Vasper									
Anthras Slope	do.	do.	M	1.8	37.0	57.4	5.6	.8	14,290
Newcomb									
Whistle Creek	Poplar Creek	do.	M	4.0	38.7	54.1	7.2	2.0	13,680
Pioneer									
Stansbury No. 4	do.	do.	M	2.4	41.6	52.3	6.1	2.8	13,940
Titus									
Prospect	Rex	do.	M	2.6	40.3	54.5	5.2	1.1	14,300

1/ Hvab = high-volatile A bituminous; Hvbb = high-volatile B bituminous.
2/ M = mine sample; T = tipple sample.
3/ Portal in Scott County; sample from Campbell County near boundary.
4/ Sample from Anderson County - 1-1/2 miles from Campbell County line.

The tipple sample, crushed to 1-1/2-inch top size in the field, and the face samples, crushed to 1-1/2-inch top size in the laboratory, were prepared for float-and-sink testing by a similar procedure. After crushing to 1-1/2-inch top size a riffled portion of the 1-1/2-inch by 0 sample was screened at 100-mesh. The 1-1/2-inch by 100-mesh coal was float-and-sink tested. To determine the effect of crushing upon the release of impurities, the remainder of the 1-1/2-inch by 0 sample was crushed to 3/8-inch top size and riffled. One half of the 3/8-inch by 0 crushing was dedusted over a 100-mesh sieve, and the 3/8-inch by 100-mesh coal was float-and-sink tested. The duplicate portion of the 3/8-inch by 0 test lot was crushed to 14-mesh top size and dedusted to remove the 100-mesh by 0 dust, and the 14- by 100-mesh sample was tested. The flowsheet (fig. 19) shows the steps taken in preparing samples for the float-and-sink test. Since the difficulty of cleaning coal usually increases with a decrease in particle size, crushing to finer than 1-1/2-inch top size was confined to those samples that failed to yield a coarse-coal float product that would be chemically suitable for metallurgical use. Likewise, when examination of the float-and-sink data after crushing the sample to 1-1/2-inch top size indicated little likelihood of the washed coal being chemically satisfactory for metallurgical use, the sample preparation procedure sometimes was altered to eliminate the 3/8-inch crushing.

All samples were tested on specific gravities of 1.30, 1.35, 1.40, 1.45, 1.50, 1.55, and 1.60. Tests were made with carbon tetrachloride mixed with white gasoline or bromoform, depending upon the desired specific gravity.

The float-and-sink test for determining the washing characteristics of coal has been used for many years, and descriptions of the procedure have appeared frequently in literature. Coe[12/] has explained carefully the compilation and interpretation of washability data. In examining the float-and-sink data on face samples it must be emphasized that these data are not to be construed as representative of the quality of product loaded at the operation where the sample was taken, but rather as an indication of bed quality in the general geographical area. In some instances the face sample represents full seam recovery. At some mines certain inferior portions of the bed are left in place to improve the quality of output, especially where a band of inferior coal occurs between the shale roof and the top of the better coal.

To expedite the float-and-sink test, the 100-mesh by 0 dust was removed from all samples before separation into specific-gravity fractions. It would be uneconomical to discard this dust and to include the material in the washed coal would increase somewhat the ash and sulfur percentages shown in the washability data for the dedusted coal. Usually, the quantity of fine dust produced during crushing does not become a serious problem unless the coal is crushed finer than 1-1/2-inch top size.

In interpreting washability characteristics of coal from float-and-sink data, it must be remembered that these data are based on precise specific-gravity separations, which are approached but not equaled in commercial practice. Washing efficiency usually decreases with decreased particle size of the washery feed. During washing, even in an efficient, modern preparation plant, it is to be expected that some refuse will be misplaced in the clean coal and that some clean coal will be rejected with the refuse.

12/ Coe, G. D., An Explanation of Washability Curves for the Interpretation of Float-and-Sink Data on Coal: Bureau of Mines Inf. Circ. 7045, 1938, 10 pp.

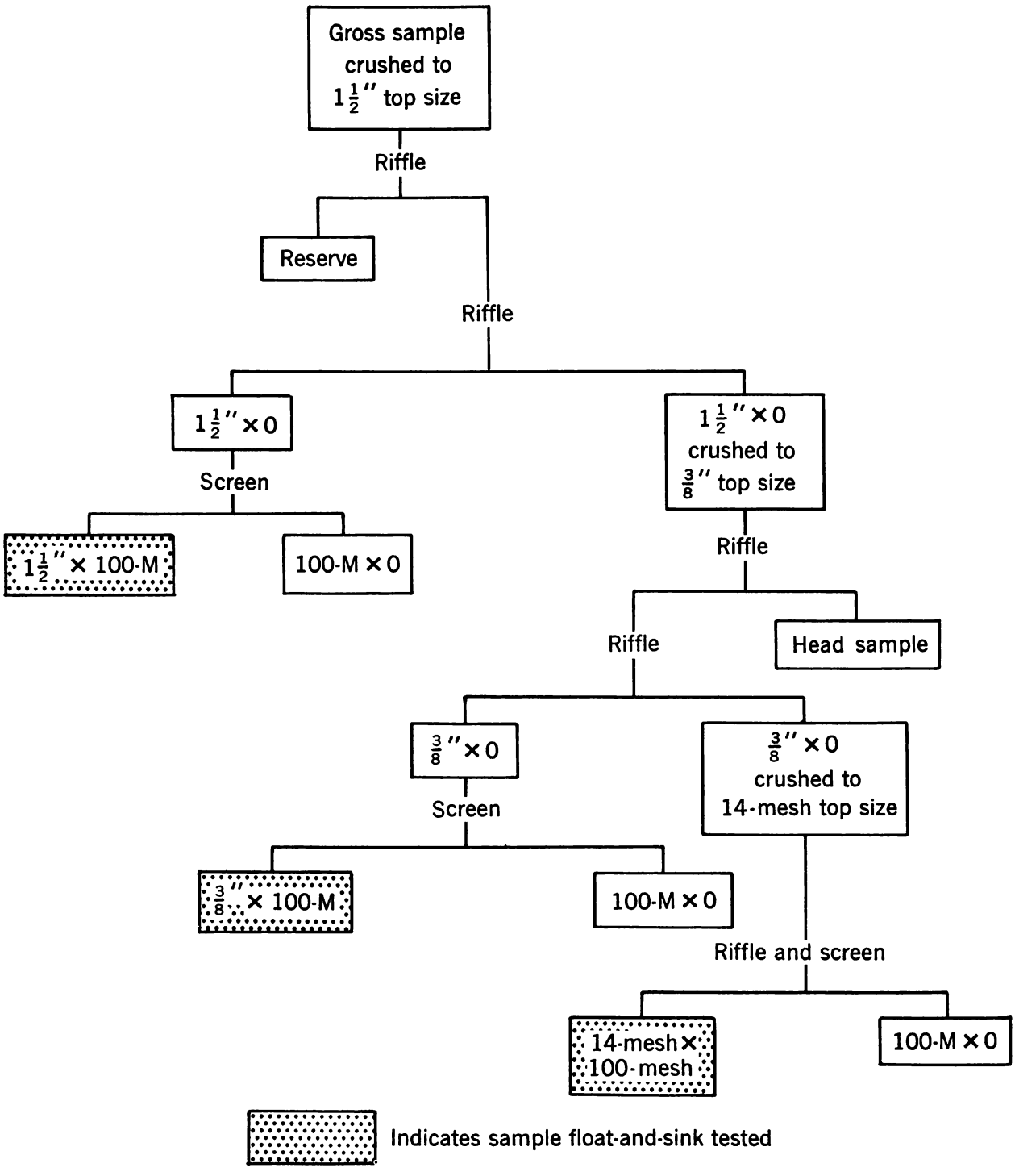

Figure 19. - Flow diagram showing preparation of samples.

Experimental Results

Petree Bed

The Petree bed is one of the less important beds in Campbell County, Tenn. The bed is present in the southwest part of the county, but usually it is thin and occurs in local pockets from which it is removed by strip mining.

A large face sample of Petree coal was taken in the Turley Petree strip pit, Turley Coal Co., 1 mile southwest of Turley, Tenn. Here the bed is only 17 inches thick and contains no visible impurities. Table 18 reports the float-and-sink data on the face sample after crushing to 1-1/2-inch top size and removing the 100-mesh by 0 dust. These data show that separating the coal at 1.60 specific gravity would yield a float coal containing 9.3 percent ash, with a recovery of 93.8 percent of the raw coal as float material. Sulfur determinations were not made on the individual float fractions, because the sulfur in the raw coal analyzed only 0.6 percent. To investigate the possibility of further ash reduction by fine crushing, the sample was crushed to 3/8-inch top size, the minus 100-mesh material removed, and the 3/8-inch by 100-mesh size float-and-sink tested. These data are given in table 19. The results show that separating the sample at 1.60 specific gravity would yield a clean coal containing 8.8 percent ash, a product very similar in quality to that obtained when washing the coarser size coal. The slight reduction in ash content, approximately 0.5 percent, would not compensate for the increased difficulty of handling the finer-sized material in the preparation plant. Once the heavy sink material is removed from the sample, further ash reduction can be achieved only by an uneconomic rejection of combustible material.

Although the washed Petree-bed coal cannot be termed a low-ash product, the ash content is not high enough to eliminate the deposit from consideration as a potential source of metallurgical fuel.

TABLE 18. - Washing characteristics of face sample, Turley Petree strip mine, Petree bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.5 percent of sample)	Under - 1.30	25.2	25.2	3.3	3.3
	1.30 to 1.35	46.8	72.0	9.1	7.1
	1.35 to 1.40	16.3	88.3	14.0	8.3
	1.40 to 1.45	2.5	90.8	19.2	8.6
	1.45 to 1.50	1.5	92.3	24.7	8.9
	1.50 to 1.55	1.1	93.4	30.2	9.2
	1.55 to 1.60	.4	93.8	32.2	9.3
	Over - 1.60	6.2	100.0	56.6	12.2
100-mesh by 0 (1.5 percent of sample				18.2	

TABLE 19. - Washing characteristics of face sample, Turley Petree strip mine, Petree bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (90.1 percent of sample	Under - 1.30	32.1	32.1	3.5	3.5
	1.30 to 1.35	43.5	75.6	9.3	6.8
	1.35 to 1.40	11.6	87.2	13.9	7.8
	1.40 to 1.45	2.8	90.0	19.2	8.1
	1.45 to 1.50	1.7	91.7	24.7	8.4
	1.50 to 1.55	1.1	92.8	29.6	8.7
	1.55 to 1.60	.4	93.2	34.1	8.8
	Over - 1.60	6.8	100.0	54.8	11.9
100-mesh by 0 (9.9 percent of sample)				14.3	

Pewee Bed

The Pewee bed is of major importance in Campbell County from the standpoint of production and known recoverable reserves. The bed is subject to wide variations in thickness within a narrow geographical area and frequently contains one or more shale partings several inches thick. Sulfur in the raw coal usually is less than 1 percent.

Table 20 shows the float-and-sink data for a large face sample collected at the Clinchmore mine, Stoney Fork Coal Corp., Clinchmore, Tenn., a drift mine in the extreme southern part of Campbell County near the Campbell-Anderson County line. The face sample was crushed to 1-1/2-inch top size, and the 100-mesh by 0 dust was removed. At the point of sampling the bed was 3 feet 5-3/4 inches thick, including several inches of laminated coal and shale between the top of the coal bed and the shale roof. This inferior portion of the bed was included in the washability sample. Separating the 1-1/2-inch by 100-mesh coal at 1.60 specific gravity yields a float coal containing 3.5 percent ash. The raw-coal sample analyzed 0.7 percent sulfur, so sulfur determinations were not made on the individual float fractions.

TABLE 20. - Washing characteristics of face sample, Clinchmore mine, Pewee bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.5 percent of sample)	Under - 1.30	78.1	78.1	2.6	2.6
	1.30 to 1.35	13.5	91.6	4.5	2.9
	1.35 to 1.40	2.9	94.5	9.2	3.1
	1.40 to 1.45	1.1	95.6	17.0	3.2
	1.45 to 1.50	.5	96.1	21.8	3.3
	1.50 to 1.55	.3	96.4	25.9	3.4
	1.55 to 1.60	.2	96.6	29.4	3.5
	Over - 1.60	3.4	100.0	62.2	5.5
100-mesh by 0 (1.5 percent of sample)				9.1	

Another sample of Pewee-bed coal was taken at the Sun Pewee strip mine, Cove Lake Coal Co., 3 miles southwest of Caryville, Tenn., and about 6 miles northeast from the Clinchmore mine. At the Sun Pewee strip pit the Pewee bed thickens to 5 feet 7-1/2 inches, but the bed section contains 2 thick shale partings separated by about 1 inch of coal and approximately 14 inches from the bottom of the bed. The total thickness of the 2 partings is 6-1/2 inches. These partings were included in the washability sample. Similar to the bed at the Clinchmore-mine location, the Pewee bed at the Sun Pewee strip contains several inches of laminated coal and shale at the top of the bed. This portion of the bed at the Sun Pewee strip was excluded from the washability sample. Table 21 shows the float-and-sink data for the strip-pit sample of Pewee coal after crushing to 1-1/2-inch top size and dedusting to remove the fine dust. Separating the coal at 1.60 specific gravity yields a float coal containing 3.9 percent ash, with a recovery of 80.9 percent of the sample as a float coal. The two shale partings included in the washability sample are largely responsible for the high percentage of 1.60-specific gravity sink material. The raw-coal sample contained only 0.7 percent sulfur, so the individual float fractions were not analyzed for sulfur.

TABLE 21. - Washing characteristics of face sample, Sun Pewee strip mine, Pewee bed. Sample, crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.2 percent of sample)	Under - 1.30	56.7	56.7	2.6	2.6
	1.30 to 1.35	15.5	72.2	3.9	2.9
	1.35 to 1.40	5.5	77.7	8.8	3.3
	1.40 to 1.45	1.8	79.5	13.9	3.5
	1.45 to 1.50	.7	80.2	18.7	3.7
	1.50 to 1.55	.5	80.7	24.7	3.8
	1.55 to 1.60	.2	80.9	29.1	3.9
	Over - 1.60	19.1	100.0	80.2	18.4
100-mesh by 0 (1.8 percent of sample)				32.4	

The washability tests show that the washed Pewee-bed coal is very similar in quality at the two test locations and is chemically well suited for metallurgical use. A low-sulfur, low-ash float coal can be obtained by an easy cleaning operation that can be achieved by a wide variety of preparation methods.

Walnut Mountain Bed

The Walnut Mountain bed in Campbell County, Tenn., is a deposit of rather limited commercial importance. A face sample was collected at the Sun Ray strip pit, Sun Ray Coal Co., 2 miles southwest of Caryville, Tenn. Here the bed is slightly more than 3 feet thick and contains several inches of laminated coal and shale at the top of the bed. The entire bed section was included in the washability sample. Table 22 shows the float-and-sink data on the face sample after crushing to 1-1/2-inch top size and dedusting to remove the 100-mesh by 0 dust. Separating the sample at 1.60 specific gravity yields a float product containing 3.8 percent ash and 1.18 percent sulfur, with a 90.3-percent recovery of float coal.

TABLE 22. - Washing characteristics of face sample, Sun Ray strip mine, Walnut Mountain bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.8 percent of sample	Under - 1.30	68.4	68.4	2.5	2.5	0.89	0.89
	1.30 to 1.35	13.6	82.0	5.0	2.9	1.35	.97
	1.35 to 1.40	3.7	85.7	7.3	3.1	2.12	1.02
	1.40 to 1.45	2.0	87.7	13.0	3.3	3.50	1.07
	1.45 to 1.50	1.1	88.8	16.6	3.5	4.30	1.11
	1.50 to 1.55	.9	89.7	22.0	3.7	5.01	1.15
	1.55 to 1.60	.6	90.3	25.6	3.8	5.37	1.18
	Over - 1.60	9.7	100.0	51.9	8.5	6.39	1.69
100-mesh by 0 (1.2 percent of sample)				22.7		2.21	

Although it would be improper to predict the washing characteristics of a coal bed on the basis of test data from one sample, this sample of the Walnut Mountain bed shows that an easy washing operation will prepare a clean coal that is chemically well suited to metallurgical use.

Red Ash Bed

The Red Ash bed is one of the important coal deposits in Campbell County from the standpoint of reserves and production. The bed is usually 3 to 4 feet thick and sometimes contains 1 or more shale partings. Three face samples were collected at 2 drift mines and 1 strip pit to study the washability of the Red Ash bed.

One face sample was taken at the Phillips Red Ash strip mine, Phillips Brothers Coal Co., 3 miles northwest of Pioneer, Tenn., in the extreme western part of Campbell County near the Campbell-Scott County line. Here the bed is about 4 feet thick and contains a 5-1/2-inch shale binder that was included in the washability sample. Float-and-sink data on the sample after crushing to 1-1/2-inch top size and removing the 100-mesh by 0 dust are given in table 23. These data show that separating the coal at 1.60 specific gravity would yield a float coal containing 7.1 percent ash, with a recovery of 71.5 percent of the sample as float coal. Including the thick shale parting in the washability sample causes the large percentage of 1.60-specific gravity sink material. The raw-coal sample analyzed less than 1 percent sulfur, so sulfur determinations were not made on the individual float fractions.

Another sample of the Red Ash bed was taken at the High Point No. 2 mine, Tennessee Fuel Co., 4 miles west of Caryville, Tenn., in the southwestern part of the county. The High Point No. 2 mine is a drift opening. Here the bed is more than 4 feet thick and is overlain by about 1 foot of draw slate. The draw slate was not included in the washability sample. Table 24 shows the results of the float-and-sink tests made on the sample after crushing to 1-1/2-inch top size. Separating this coal at 1.60 specific gravity yields a float coal containing 4.0 percent ash and 1.08 percent sulfur.

TABLE 23. - Washing characteristics of face sample, Phillips Red Ash strip mine, Red Ash bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.1 percent of sample)	Under - 1.30	28.4	28.4	3.9	3.9
	1.30 to 1.35	29.7	58.1	5.6	4.8
	1.35 to 1.40	7.0	65.1	10.8	5.4
	1.40 to 1.45	2.0	67.1	16.7	5.8
	1.45 to 1.50	1.6	68.7	22.3	6.1
	1.50 to 1.55	2.0	70.7	28.4	6.8
	1.55 to 1.60	.8	71.5	31.9	7.1
	Over - 1.60	28.5	100.0	63.4	23.1
100-mesh by 0 (1.9 percent of sample)				40.2	

TABLE 24. - Washing characteristics of face sample, High Point No. 2 mine, Red Ash bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.5 percent of sample)	Under - 1.30	59.7	59.7	2.3	2.3	0.84	0.84
	1.30 to 1.35	24.8	84.5	5.2	3.2	1.25	0.96
	1.35 to 1.40	4.5	89.0	10.2	3.5	2.55	1.04
	1.40 to 1.45	.9	89.9	14.9	3.6	2.93	1.06
	1.45 to 1.50	.7	90.6	20.8	3.8	2.30	1.07
	1.50 to 1.55	.7	91.3	26.8	3.9	1.71	1.07
	1.55 to 1.60	.3	91.6	30.3	4.0	2.35	1.08
	Over - 1.60	8.4	100.0	69.6	9.5	3.42	1.28
100-mesh by 0 (1.5 percent of sample)				22.8		1.06	

The third sample of Red Ash-bed coal was taken at the Diamond No. 3 mine, a drift opening operated by Walter Bledsoe and Co., 3/4 mile southwest of Hickey, Tenn. In this area the Red Ash bed thins to about 3 feet, but the deposit is relatively free of visible high-ash impurities. Table 25 shows the float-and-sink data on the face sample crushed to 1-1/2-inch top size. Separating the sample at 1.60 specific gravity produces a float coal containing 3.5 percent ash and 1.22 percent sulfur with a 95.9-percent recovery of raw feed as float coal. Similar to the other samples of Red Ash coal, the Diamond No. 3 mine sample contains relatively little material of intermediate density. Significant reduction in impurities, therefore, cannot be readily achieved by separating the sample at a lower specific gravity.

These tests show that although the raw coal may fluctuate in quality, especially with respect to ash content, an easy washing operation will prepare a clean coal that is chemically suitable for metallurgical use.

TABLE 25. - Washing characteristics of face sample, Diamond No. 3 mine, Red Ash bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.6 percent of sample)	Under - 1.30	71.9	71.9	2.2	2.2	1.10	1.10
	1.30 to 1.35	17.2	89.1	4.9	2.7	1.43	1.16
	1.35 to 1.40	4.0	93.1	10.3	3.0	1.62	1.18
	1.40 to 1.45	1.5	94.6	14.2	3.2	2.05	1.20
	1.45 to 1.50	.7	95.3	19.6	3.3	2.63	1.21
	1.50 to 1.55	.4	95.7	23.2	3.4	3.61	1.22
	1.55 to 1.60	.2	95.9	29.4	3.5	2.74	1.22
	Over - 1.60	4.1	100.0	68.2	6.1	4.62	1.36
100-mesh by 0 (1.4 percent of sample)				10.2		2.23	

Big Mary Bed

Even though significant reserves of coal are present in the Big Mary bed in Campbell County, Tenn., the bed has been opened at only a few places. To determine the washability characteristics of the Big Mary bed, a mine-run tipple sample was taken at the Straight Fork mine, Straight Fork Coal Co., 1 mile east of Dean, Tenn. This mine usually is considered to be a Scott County operation; the mine workings extend across the county line into Campbell County. The tipple sample was collected during a period when coal from the Campbell County workings was being processed in the tipple. Float-and-sink data on the sample after crushing to 1-1/2-inch top size are given in table 26. Separating the sample at 1.60 specific gravity produces a float coal containing 8.6 percent ash and 3.08 percent sulfur. Further examination of the float-and-sink data reveals the impracticability of upgrading the coal to meet present metallurgical standards. A clean coal containing 2 percent sulfur or less cannot be obtained within the specific-gravity range employed.

TABLE 26. - Washing characteristics of mine-run tipple sample, Straight Fork mine, Big Mary bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.1 percent of sample)	Under - 1.30	32.2	32.2	3.3	3.3	2.33	2.33
	1.30 to 1.35	22.6	54.8	6.5	4.6	2.90	2.57
	1.35 to 1.40	11.3	66.1	12.0	5.9	3.54	2.73
	1.40 to 1.45	5.9	72.0	16.0	6.7	4.30	2.86
	1.45 to 1.50	4.4	76.4	20.5	7.5	4.45	2.95
	1.50 to 1.55	2.9	79.3	24.2	8.1	4.96	3.03
	1.55 to 1.60	1.8	81.1	28.0	8.6	5.46	3.08
	Over - 1.60	18.9	100.0	54.4	17.2	11.25	4.62
100-mesh by 0 (1.9 percent of sample)				21.8		4.58	

Float-and-sink data shown in tables 27 and 28 reveal the washing characteristics of the mine-run tipple sample after crushing to 3/8-inch and 14-mesh top size, respectively. Crushing the sample to 3/8-inch top size and separating at 1.60 specific gravity yields a float coal containing 8.1 percent ash and 2.97 percent sulfur. This coal is quite comparable in quality to the 1.60 specific gravity float product of the 1-1/2-inch crushing. Even crushing the mine-run tipple sample to flotation size will not result in significant reduction in ash and sulfur. Separating the 14- and 100-mesh coal at 1.60 specific gravity produces a float coal containing 7.6 percent ash and 2.65 percent sulfur.

Only one sample of Big Mary coal from Campbell County was tested, and the float-and-sink data are very similar to results obtained when testing Big Mary-bed samples collected in counties contiguous to Campbell. It is evident, therefore, that the Big Mary bed is a high-sulfur deposit over a wide area. The coal from this bed in Campbell County is a satisfactory general purpose fuel but cannot be considered a potential source of metallurgical coal owing to its high sulfur content.

TABLE 27. - Washing characteristics of mine-run tipple sample, Straight Fork mine, Big Mary bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (95.3 percent of sample)	Under - 1.30	35.6	35.6	3.0	3.0	2.30	2.30
	1.30 to 1.35	19.7	55.3	6.4	4.2	2.77	2.47
	1.35 to 1.40	10.0	65.3	11.7	5.4	3.57	2.64
	1.40 to 1.45	5.9	71.2	15.9	6.2	4.05	2.75
	1.45 to 1.50	4.3	75.5	19.7	7.0	4.44	2.85
	1.50 to 1.55	3.0	78.5	23.8	7.6	4.86	2.93
	1.55 to 1.60	1.8	80.3	28.0	8.1	4.89	2.97
	Over - 1.60	19.7	100.0	55.9	17.5	11.39	4.63
100-mesh by 0 (4.7 percent of sample)				19.8		4.23	

TABLE 28. - Washing characteristics of mine-run tipple sample, Straight Fork mine, Big Mary bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh (83.4 percent of sample)	Under - 1.30	40.5	40.5	2.9	2.9	2.11	2.11
	1.30 to 1.35	14.2	54.7	6.2	3.8	2.55	2.22
	1.35 to 1.40	9.9	64.6	10.6	4.8	3.10	2.36
	1.40 to 1.45	6.3	70.9	15.3	5.7	3.54	2.46
	1.45 to 1.50	4.2	75.1	19.6	6.5	3.87	2.54
	1.50 to 1.55	3.3	78.4	23.2	7.2	4.23	2.61
	1.55 to 1.60	1.6	80.0	27.0	7.6	4.53	2.65
	Over - 1.60	20.0	100.0	53.5	16.8	11.34	4.39
100-mesh by 0 (16.6 percent of sample)				18.4		4.24	

Upper Pioneer Bed

The Upper Pioneer bed in Campbell County has little commercial importance at present, and limited known reserves probably will prevent the bed from becoming an important producer of coal in the future. A large face sample was taken in the Baird strip pit, T.A.C.E. Co., Inc., 4-1/2 miles northwest of Elk Valley, Tenn., in the northwest portion of the county. The bed is less than 3 feet thick and it is divided into two benches by a 1-inch thick shale parting occurring in the middle of the bed. The shale parting was included in the washability sample. The sample was crushed to 1-1/2-inch top size and dedusted to remove the 100-mesh by 0 size. Table 29 shows the float-and-sink tests on the 1-1/2-inch by 100-mesh coal. Separating the sample at 1.60 specific gravity yields a float coal containing 6.3 percent ash and 1.65 percent sulfur. To obtain a float product containing 1.25 percent sulfur would require a precise separation at a 1.37 specific gravity. This would be a most difficult washing task in commercial practice.

TABLE 29. - Washing characteristics of face sample, Baird strip mine, Upper Pioneer bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (99.2 percent of sample)	Under - 1.30	15.6	15.6	2.5	2.5	1.00	1.00
	1.30 to 1.35	37.8	53.4	4.5	3.9	1.20	1.14
	1.35 to 1.40	23.9	77.3	7.3	5.0	2.09	1.43
	1.40 to 1.45	9.1	86.4	11.2	5.6	2.57	1.55
	1.45 to 1.50	3.4	89.8	15.1	6.0	3.03	1.61
	1.50 to 1.55	1.7	91.5	20.0	6.2	3.15	1.64
	1.55 to 1.60	.6	92.1	22.2	6.3	3.92	1.65
	Over - 1.60	7.9	100.0	59.4	10.5	5.51	1.96
100-mesh by 0 (0.8 percent of sample)				25.5		1.85	

Table 30 shows the float-and-sink data of the coal sample crushed to 3/8-inch top size with the 100-mesh by 0 dust removed. Examination of the data clearly reveals that fine crushing has no effect upon the release of impurities. The preparation of a low-sulfur clean coal from the Baird sample after crushing to 3/8-inch top size probably would be even more difficult than obtaining a float coal of comparable quality from a coarser size. Even crushing to flotation size would not ease the washing problem. Table 31 shows float-and-sink data after crushing the face sample to 14-mesh top size. Separating the 14- by 100-mesh coal at 1.60 specific gravity yields a float product containing 5.5 percent ash and 1.69 percent sulfur. These data show the negligible effect of crushing upon the release of impurities.

The washing test on Upper Pioneer-bed coal shows that, when properly prepared, the coal becomes a useful general-purpose fuel but is unsuited for coke making because of the high percentage of sulfur in the clean coal.

Jordan Bed

The Jordan bed is not an important bed in Campbell County, and it has been opened only in a few places. At the time of the field investigation only one small mine was found where a sample of the Jordan bed coal could be collected.

TABLE 30. - Washing characteristics of face sample, Baird strip mine, Upper Pioneer bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (94.1 percent of sample)	Under - 1.30	24.0	24.0	2.7	2.7	1.10	1.10
	1.30 to 1.35	33.4	57.4	4.8	3.9	1.47	1.32
	1.35 to 1.40	20.9	78.3	7.4	4.9	2.19	1.55
	1.40 to 1.45	7.2	85.5	11.3	5.4	2.55	1.63
	1.45 to 1.50	3.6	89.1	15.3	5.8	2.90	1.68
	1.50 to 1.55	1.7	90.8	19.4	6.0	3.55	1.72
	1.55 to 1.60	.7	91.5	23.3	6.2	3.66	1.73
	Over - 1.60	8.5	100.0	55.9	10.4	5.33	2.04
100-mesh by 0 (5.9 percent of sample)				22.4		2.06	

TABLE 31. - Washing characteristics of face sample, Baird strip mine, Upper Pioneer bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh (86.3 percent of sample)	Under - 1.30	27.7	27.7	2.5	2.5	1.15	1.15
	1.30 to 1.35	26.9	54.6	4.0	3.2	1.47	1.31
	1.35 to 1.40	20.1	74.7	6.1	4.0	1.99	1.49
	1.40 to 1.45	8.2	82.9	10.0	4.6	2.47	1.59
	1.45 to 1.50	3.9	86.8	14.5	5.0	2.86	1.65
	1.50 to 1.55	2.0	88.8	18.5	5.3	3.04	1.68
	1.55 to 1.60	.8	89.6	20.8	5.5	3.25	1.69
	Over - 1.60	10.4	100.0	55.0	10.6	4.69	2.00
100-mesh by 0 (13.7 percent of sample)				17.1		2.27	

A face sample of the Jordan bed was taken at this small mine operated by the James Bros. Coal. Co. 8-1/2 miles north of LaFollette, Tenn., in the northern part of Campbell County, where much of the original Jordan bed has been depleted. Here a 39-1/4-inch coal bed is being mined. Table 32 shows the float-and-sink data of the face sample crushed to 1-1/2-inch top size, with the 100-mesh by 0 dust removed. Separating the sample at 1.60 specific gravity yields a float coal containing 2.4 percent ash, with a 99.0-percent recovery of raw feed as float coal. The raw-coal sample analyzed only 0.9 percent sulfur, so sulfur determinations were not made on the individual float fractions.

These data clearly reveal that Jordan-bed coal is chemically suitable for metallurgical use. A satisfactory product probably could be obtained without resorting to mechanical cleaning.

TABLE 32. - Washing characteristics of face sample, James mine, Jordan bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.6 percent of sample)	Under - 1.30	74.0	74.0	1.7	1.7
	1.30 to 1.35	20.7	94.7	3.3	2.0
	1.35 to 1.40	2.8	97.5	8.3	2.2
	1.40 to 1.45	.9	98.4	12.3	2.3
	1.45 to 1.50	.3	98.7	16.0	2.4
	1.50 to 1.55	.2	98.9	18.3	2.4
	1.55 to 1.60	.1	99.0	20.5	2.4
	Over - 1.60	1.0	100.0	45.4	2.8
100-mesh by 0 (1.4 percent of sample)				7.6	

Jellico Bed

The Jellico bed is an important coal deposit in Campbell County. The bed usually is less than 4 feet thick and overlain with several inches of draw slate. To determine the washing characteristics of the Jellico bed, face samples were collected in a small drift mine operated by Brooks Graham, 5 miles southeast of Morley Tenn., and in an abandoned mine formerly operated by the Mooney Coal Co., about 3 miles west of Elk Valley, Tenn. Both sampling locations are in the northern half of Campbell County with the Brooks Graham site in the eastern part of the county near the Campbell-Claiborne County line, and the Mooney mine in western Campbell County near the Campbell-Scott County line.

Table 33 shows the float-and-sink data of the Brooks Graham sample after crushing to 1-1/2-inch top size. Separating the sample at 1.60 specific gravity yields a float coal containing 1.6 percent ash. The raw coal from the Brooks Graham mine analyzed only 0.9 percent sulfur.

TABLE 33. - Washing characteristics of face sample, Brooks Graham mine, Jellico bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.6 percent of sample)	Under - 1.30	87.3	87.3	1.3	1.3
	1.30 to 1.35	9.2	96.5	3.6	1.5
	1.35 to 1.40	.5	97.0	7.8	1.6
	1.40 to 1.45	.2	97.2	11.9	1.6
	1.45 to 1.50	.1	97.3	16.1	1.6
	1.50 to 1.55	.1	97.4	22.0	1.6
	1.55 to 1.60	.1	97.5	20.3	1.6
	Over - 1.60	2.5	100.0	64.7	3.2
100-mesh by 0 (1.4 percent of sample)				13.7	

The bed at the Mooney Coal Co. mine was less than 30 inches thick. Analysis of the raw coal showed 5.1 percent ash and 2.5 percent sulfur. Table 34 shows the float-and-sink data of the face sample after crushing to 1-1/2-inch top size and removing the fine dust. Separating this coal sample at 1.60 specific gravity yields a float product containing 4.0 percent ash and 2.38 percent sulfur. This is a highly satisfactory product for many industrial uses but totally unsuited for coke making because of the high percentage of sulfur. Examination of the float product on the lighter specific gravities shows that only the 1.30-specific gravity float coal contains less than 2 percent sulfur.

TABLE 34. - Washing characteristics of face sample, Mooney mine, Jellico bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (99.0 percent of sample)	Under - 1.30	53.9	53.9	2.7	2.7	1.82	1.82
	1.30 to 1.35	35.4	89.3	4.4	3.4	2.74	2.18
	1.35 to 1.40	5.6	94.9	8.1	3.7	4.07	2.30
	1.40 to 1.45	1.6	96.5	10.9	3.8	4.35	2.33
	1.45 to 1.50	.9	97.4	13.3	3.9	5.72	2.36
	1.50 to 1.55	.5	97.9	15.7	3.9	5.09	2.38
	1.55 to 1.60	.2	98.1	19.8	4.0	5.51	2.38
	Over - 1.60	1.9	100.0	42.9	4.7	7.58	2.48
100-mesh by 0 (1.0 percent of sample)				10.0		2.98	

Float-and-sink data shown in table 35 reveal the effect of finer crushing upon the release of impurities. In this series of tests the face sample was crushed to 3/8-inch size and then float-and-sink tested. Comparison of these data with those of table 34 shows that some reduction in sulfur can be achieved by finer crushing. The reduction is not enough to upgrade the coal to metallurgical quality. Separating the coal at a specific gravity that might be attempted in an efficient washing plant would yield a clean coal containing sulfur in excess of 2 percent. Table 36 shows the float-and-sink results of the face sample crushed to 14-mesh top size and the 14- by 100-mesh coal separated into specific-gravity fractions. These data show that crushing to flotation size will not yield a satisfactory metallurgical product. Although crushing to a finer size will improve the quality of the 1.60 specific gravity float coals, somewhat, the crushing operation produces a significant amount of fine dust, which is removed from the sample to expedite the float-and-sink procedure. The dust contains almost 3 percent sulfur, so it cannot be added to the float coal without increasing the percentage of sulfur in the clean coal.

Assuming that the float-and-sink tests conducted on the two samples taken in the Jellico bed accurately portray the washing characteristics of the Jellico bed in Campbell County, it would seem that the deposit in the eastern part of Campbell County adjoining Claiborne County is chemically well suited to special purpose use, while the coal in the western part of the county is a high-sulfur deposit that could not be upgraded to metallurgical use.

TABLE 35. - Washing characteristics of face sample, Mooney mine, Jellico bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (90.8 percent of sample)	Under - 1.30	56.8	56.8	2.6	2.6	1.62	1.62
	1.30 to 1.35	29.6	86.4	4.4	3.2	2.54	1.94
	1.35 to 1.40	6.0	92.4	7.9	3.5	4.07	2.07
	1.40 to 1.45	2.4	94.8	11.0	3.7	4.99	2.15
	1.45 to 1.50	1.2	96.0	12.9	3.8	6.19	2.20
	1.50 to 1.55	.8	96.8	15.3	3.9	6.69	2.24
	1.55 to 1.60	.3	97.1	15.3	4.0	6.69	2.25
	Over - 1.60	2.9	100.0	38.4	5.0	10.94	2.50
100-mesh by 0 (9.3 percent of sample)				6.8		2.87	

TABLE 36. - Washing characteristics of face sample, Mooney mine, Jellico bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh (84.3 percent of sample)	Under - 1.30	61.0	61.0	2.4	2.4	1.54	1.54
	1.30 to 1.35	22.1	83.1	4.2	2.9	2.15	1.70
	1.35 to 1.40	7.2	90.3	6.9	3.2	3.14	1.82
	1.40 to 1.45	3.1	93.4	10.3	3.4	4.30	1.90
	1.45 to 1.50	1.8	95.2	12.4	3.6	5.50	1.97
	1.50 to 1.55	1.0	96.2	15.3	3.7	7.19	2.02
	1.55 to 1.60	.3	96.5	15.3	3.8	7.19	2.04
	Over - 1.60	3.5	100.0	35.5	4.9	12.64	2.41
100-mesh by 0 (15.7 percent of sample)				6.2		2.82	

Blue Gem Bed

The Blue Gem bed in Campbell County is a deposit of minor importance from the standpoint of production and known reserves. Much of the thicker coal has been depleted; and, although some areas in the northeast portion of the county contain coal thick enough to mine, it is most doubtful that the bed will ever become a significant source of coal.

At the time of the field investigation only one small mine could be found where it was possible to obtain a test sample of Blue Gem coal. A face sample was collected in the Carl Duncan No. 1 mine, operated by Carl Duncan, 3 miles northeast of Habersham, Tenn. Table 37 shows the float-and-sink data of the face sample after crushing to 1-1/2-inch top size. Separating the coal at 1.60 specific gravity yields a float product containing 3.3 percent ash and 1.74 percent sulfur. With the 1-1/2-inch by 100-mesh size, separation at 1.38 specific gravity would have to be made to obtain a washed coal containing 1.25 percent sulfur. In addition to the obvious technical difficulties of operating a commercial washing plant at this gravity, the separation would result in rejection of about 15 percent of the raw feed as a refuse material. Table 38 shows the washability data on the face sample

after crushing to 3/8-inch top size. To obtain a clean coal containing 1.25 percent sulfur when washing the 3/8-inch by 100-mesh size would require a separation at a 1.44 specific gravity. At this gravity about 90 percent of the raw feed becomes float coal. Although not an easy separation, coal of the desired quality probably could be obtained by careful control of the washing process. Using the 3/8-inch crushed size, a washed product containing about 1.4 percent sulfur could be prepared without difficulty. Table 39 shows float-and-sink data on the face sample after crushing to 14-mesh top size and screening to remove the minus-100-mesh dust. Examination of these data shows that metallurgical-grade coal might be prepared by froth flotation, but the operation would impose the inherent difficulty of handling and drying a very fine coal.

Assuming that the one sample of Blue Gem coal is representative of the deposit throughout Campbell County, it would appear that, although it is possible to prepare a chemically satisfactory metallurgical fuel from this deposit, fine crushing of the feed and precise control over the washing operation would be necessary.

TABLE 37. - Washing characteristics of face sample Carl Duncan No.1 mine, Blue Gem bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.7 percent of sample)	Under - 1.30	75.2	75.2	1.4	1.4	0.84	0.84
	1.30 to 1.35	6.7	81.9	6.2	1.8	3.53	1.06
	1.35 to 1.40	5.4	87.3	10.2	2.3	5.83	1.36
	1.40 to 1.45	2.8	90.1	13.2	2.7	6.54	1.52
	1.45 to 1.50	2.6	92.7	17.1	3.1	6.92	1.67
	1.50 to 1.55	.9	93.6	19.8	3.2	7.00	1.72
	1.55 to 1.60	.3	93.9	22.2	3.3	8.42	1.74
	Over - 1.60	6.1	100.0	57.6	6.6	9.27	2.20
100-mesh by 0 (1.3 percent of sample)				14.7		2.00	

TABLE 38. - Washing characteristics of face sample, Carl Duncan No. 1 mine, Blue Gem bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (96.5 percent of sample)	Under - 1.30	74.5	74.5	1.4	1.4	0.90	0.90
	1.30 to 1.35	9.7	84.2	3.8	1.7	1.93	1.02
	1.35 to 1.40	3.9	88.1	8.3	2.0	4.36	1.17
	1.40 to 1.45	2.4	90.5	10.9	2.2	4.92	1.27
	1.45 to 1.50	1.4	91.9	13.9	2.4	5.63	1.33
	1.50 to 1.55	.9	92.8	16.3	2.5	5.80	1.38
	1.55 to 1.60	.4	93.2	16.3	2.6	5.80	1.39
	Over - 1.60	6.8	100.0	49.3	5.8	11.33	2.07
100-mesh by 0 (3.5 percent of sample)				13.7		2.05	

TABLE 39. - Washing characteristics of face sample, Carl Duncan No. 1 mine, Blue Gem bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh (93.3 percent of sample)	Under - 1.30	82.2	82.2	1.6	1.6	1.01	1.01
	1.30 to 1.35	5.1	87.3	3.9	1.7	1.97	1.07
	1.35 to 1.40	3.8	91.1	6.8	1.9	3.18	1.15
	1.40 to 1.45	1.5	92.6	11.4	2.1	4.46	1.21
	1.45 to 1.50	1.0	93.6	15.4	2.2	5.16	1.25
	1.50 to 1.55	.6	94.2	19.9	2.4	5.95	1.28
	1.55 to 1.60	.2	94.4	19.9	2.4	5.95	1.29
	Over - 1.60	5.6	100.0	55.5	5.4	13.92	2.00
100-mesh by 0 (6.7 percent of sample)				9.9		2.31	

Coal Creek Bed

The Coal Creek bed in Campbell County is a very important coal deposit from both a reserve and a production standpoint. The bed in the northeastern part of the county is almost 5 feet thick but thins perceptibly as it extends to the southwest.

A large face sample was collected at the Blue Rose mine, New Jellico Coal Co., 1 mile northeast of Morley, Tenn., in the extreme northeast corner of Campbell County. Table 40 shows the float-and-sink data of the face sample after crushing to 1-1/2-inch top size and dedusting over a 100-mesh sieve. Separating the sample at 1.60 specific gravity yields a float coal containing 3.2 percent ash and 1.19 percent sulfur. Once the 1.60-specific gravity sink material is removed little improvement in quality can be achieved by separating the sample at a lighter specific gravity at least within the specific-gravity range that would be practical in commercial operation.

TABLE 40. - Washing characteristics of face sample, Blue Rose mine, Coal Creek bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.5 percent of sample)	Under - 1.30	77.5	77.5	2.0	2.0	0.92	0.92
	1.30 to 1.35	14.8	92.3	5.1	2.5	1.73	1.05
	1.35 to 1.40	3.3	95.6	9.7	2.7	2.74	1.11
	1.40 to 1.45	1.5	97.1	14.3	2.9	3.28	1.14
	1.45 to 1.50	.8	97.9	18.5	3.1	4.28	1.17
	1.50 to 1.55	.4	98.3	21.5	3.1	4.73	1.18
	1.55 to 1.60	.2	98.5	26.0	3.2	4.03	1.19
	Over - 1.60	1.5	100.0	45.6	3.8	13.89	1.38
100-mesh by 0 (1.5 percent of sample)				7.9		2.85	

To illustrate further the high quality of the Coal Creek bed another face sample was taken, this time in southern Campbell County at the Anthras Slope mine, Walter Bledsoe & Co., Vasper, Tenn. Here the bed is about 3 feet thick, and the raw coal analyzed 5.6 percent ash and 0.8 percent sulfur. This face sample was crushed to 1-1/2-inch top size, and the 1-1/2-inch by 100-mesh size was float-and-sink tested. Results are given in table 41. Separating the coal at 1.60 specific gravity yielded a float coal containing 3.3 percent ash with a 96.1-percent recovery of float coal. Similar to the Blue Rose mine sample, further ash reduction by more intensive preparation methods is not practical.

These data clearly indicate that from a chemical standpoint, the washed Coal Creek bed appears to be well suited for metallurgical use over a wide area in Campbell County.

TABLE 41. - Washing characteristics of face sample, Anthras slope mine, Coal Creek bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash	
		Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (98.7 percent of sample)	Under - 1.30	74.5	74.5	1.9	1.9
	1.30 to 1.35	14.0	88.5	5.0	2.4
	1.35 to 1.40	3.2	91.7	9.2	2.6
	1.40 to 1.45	2.1	93.8	14.4	2.9
	1.45 to 1.50	1.3	95.1	19.2	3.1
	1.50 to 1.55	.6	95.7	21.8	3.2
	1.55 to 1.60	.4	96.1	24.6	3.3
	Over - 1.60	3.9	100.0	66.5	5.8
100-mesh by 0 (1.3 percent of sample)				16.8	

Poplar Creek Bed

From the standpoint of known recoverable reserves, the Poplar Creek bed in Campbell County, Tenn., cannot be considered an important coal deposit. In the northern part of the county, where the bed reaches its maximum thickness, coal is recovered by both strip- and deep-mining methods. Elsewhere in the county the bed usually is too thin to be mined economically.

To determine the washing characteristics of the Poplar Creek bed, a mine-run tipple sample was taken at the Stansbury No. 4 mine, Black Eagle Coal Co., 5 miles southeast of Elk Valley, Tenn., and a large face sample was collected at the Whistle Creek strip mine, Maiden Coal Co., at Newcomb, Tenn. At the latter sampling place, the bed thickness was approximately 30 inches.

Table 42 shows the float-and-sink results on the mine-run tipple sample after crushing to 1-1/2-inch top size and dedusting to remove the 100-mesh by 0 dust. Separating the sample at 1.60 specific gravity produces a high-quality, general-purpose coal containing 5.4 percent ash and 2.54 percent sulfur. Further examination of the float-and-sink data reveals the impracticability of upgrading this coal to metallurgical standards. A clean coal containing 1.25 percent sulfur or less cannot be obtained within the specific-gravity range employed. Only the 1.30 float coal analyzed less than 2 percent sulfur.

TABLE 42. - Washing characteristics of mine-run tipple sample, Stansbury No. 4 mine, Poplar Creek bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh (90.2 percent of sample)	Under - 1.30	61.4	61.4	3.3	3.3	1.90	1.90
	1.30 to 1.35	23.4	84.8	6.5	4.2	2.96	2.19
	1.35 to 1.40	7.9	92.7	10.7	4.7	3.96	2.34
	1.40 to 1.45	2.6	95.3	15.0	5.0	4.83	2.41
	1.45 to 1.50	1.5	96.8	18.1	5.2	6.69	2.48
	1.50 to 1.55	.6	97.4	20.4	5.3	8.26	2.51
	1.55 to 1.60	.4	97.8	22.5	5.4	10.01	2.54
	Over - 1.60	2.2	100.0	45.2	6.3	20.12	2.93
100-mesh by 0 (9.8 percent of sample				14.9		4.76	

Float-and-sink data shown in tables 43 and 44 reveal the washing characteristics of the mine-run tipple sample after crushing to 3/8-inch and 14-mesh top size, respectively. Crushing the sample to 3/8-inch top size and separating at 1.60 specific gravity produces a float coal containing 4.9 percent ash and 2.22 percent sulfur. Some reduction in ash and sulfur as a result of fine crushing is readily apparent. Despite this product improvement, a chemically suitable metallurgical coal is not achieved. Crushing to 14-mesh top size and separating the 14- by 100-mesh coal at 1.60 specific gravity yields a float coal containing 4.7 percent ash and 2.05 percent sulfur. Ash and sulfur reduction, as a result of crushing to flotation size, must be considered insignificant.

TABLE 43. - Washing characteristics of mine-run tipple sample, Stansbury No. 4 mine, Poplar Creek bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (92.2 percent of sample)	Under - 1.30	65.1	65.1	2.8	2.8	1.53	1.53
	1.30 to 1.35	18.7	83.8	6.5	3.6	2.70	1.79
	1.35 to 1.40	7.4	91.2	10.6	4.2	3.84	1.96
	1.40 to 1.45	3.0	94.2	14.7	4.5	4.90	2.05
	1.45 to 1.50	1.7	95.9	17.1	4.7	6.29	2.13
	1.50 to 1.55	.7	96.6	19.2	4.9	8.62	2.17
	1.55 to 1.60	.6	97.2	20.4	4.9	9.16	2.22
	Over - 1.60	2.8	100.0	41.0	6.0	20.94	2.74
100-mesh by 0 (7.8 percent of sample)				8.8		3.38	

TABLE 44. - Washing characteristics of mine-run tipple sample, Stansbury No. 4 mine, Poplar Creek bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh	Under - 1.30	69.7	69.7	2.6	2.6	1.44	1.44
(88.8 percent of sample)	1.30 to 1.35	13.5	83.2	6.6	3.2	2.48	1.61
	1.35 to 1.40	6.8	90.0	10.9	3.8	3.54	1.75
	1.40 to 1.45	3.0	93.0	14.7	4.2	4.87	1.86
	1.45 to 1.50	2.0	95.0	17.1	4.4	5.94	1.94
	1.50 to 1.55	1.0	96.0	19.3	4.6	8.18	2.01
	1.55 to 1.60	.5	96.5	21.1	4.7	10.67	2.05
	Over - 1.60	3.5	100.0	39.8	5.9	20.97	2.71
100-mesh by 0 (11.2 percent of sample)				7.8		3.34	

Table 45 shows the float-and-sink results after crushing the Whistle Creek strip face sample to 1-1/2-inch top size and testing the 1-1/2-inch by 100-mesh size fraction. Separating the sample at 1.60 specific gravity yields a float product containing 5.4 percent ash and 1.66 percent sulfur. To obtain a float product containing 1.25 percent sulfur would require a precise separation at 1.37 specific gravity. The quantity of float coal at this specific gravity is substantial, but economic conditions probably would require the further separation and utilization of significant amounts of a middling product containing about 13 percent ash. Table 46 shows float-and-sink data on the Whistle Creek sample after crushing to 3/8-inch top size. A 1.60-specific gravity separation yields a float product containing 1.49 percent sulfur and 4.9 percent ash. With this size fraction, the difficulty of preparing a washed coal containing 1.25 percent sulfur is somewhat less than with the coarser 1-1/2-inch top-size coal. The yield of float coal of the desired quality is improved also. Raising the sulfur tolerance in the clean coal to 1.5 percent would increase substantially the yield of float coal and would eliminate the need for economic disposal of the middling. Table 47 shows the effect of still finer crushing on the washing characteristics of the coal sample. In this test the sample is crushed to 14-mesh top size, and the 14- by 100-mesh size is float-and-sink tested. Examination of the data shows that no measurable improvement in clean coal resulted from crushing to flotation size. Washing difficulty increases with a decrease in particle size, so it is very unlikely that the Whistle Creek coal would be crushed finer than 3/8-inch top size.

TABLE 45. - Washing characteristics of face sample, Whistle Creek strip mine, Poplar Creek bed. Sample crushed to 1-1/2-inch top size; data in percent

Size	Specific gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
1-1/2-inch by 100-mesh	Under - 1.30	50.7	50.7	2.4	2.4	0.75	0.75
(97.8 percent of sample)	1.30 to 1.35	24.3	75.0	5.6	3.4	1.87	1.11
	1.35 to 1.40	12.7	87.7	10.3	4.4	3.61	1.47
	1.40 to 1.45	4.1	91.8	13.9	4.9	3.94	1.58
	1.45 to 1.50	2.0	93.8	17.3	5.1	3.56	1.63
	1.50 to 1.55	1.1	94.9	20.4	5.3	3.61	1.65
	1.55 to 1.60	.4	95.3	23.5	5.4	3.67	1.66
	Over - 1.60	4.7	100.0	41.9	7.1	7.23	1.92
100-mesh by 0 (2.2 percent of sample)				10.0		2.79	

TABLE 46. - Washing characteristics of face sample, Whistle Creek strip mine, Poplar Creek bed. Sample crushed to 3/8-inch top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
3/8-inch by 100-mesh (92.8 percent of sample)	Under - 1.30	51.3	51.3	2.3	2.3	0.72	0.72
	1.30 to 1.35	26.6	77.9	4.9	3.2	1.63	1.03
	1.35 to 1.40	10.7	88.6	9.9	4.0	3.41	1.32
	1.40 to 1.45	3.7	92.3	13.3	4.4	3.88	1.42
	1.45 to 1.50	2.1	94.4	16.6	4.6	3.44	1.47
	1.50 to 1.55	.9	95.3	21.7	4.8	3.51	1.48
	1.55 to 1.60	.4	95.7	23.4	4.9	3.86	1.49
	Over - 1.60	4.3	100.0	41.9	6.5	9.55	1.84
100-mesh by 0 (7.2 percent of sample)				9.6		2.56	

TABLE 47. - Washing characteristics of face sample, Whistle Creek strip mine, Poplar Creek bed. Sample crushed to 14-mesh top size; data in percent

Size	Specific-gravity fraction	Weight		Ash		Sulfur	
		Direct	Cumulative	Direct	Cumulative	Direct	Cumulative
14- by 100-mesh (85.4 percent of sample)	Under - 1.30	57.8	57.8	2.3	2.3	0.81	0.81
	1.30 to 1.35	20.6	78.4	5.3	3.1	1.65	1.03
	1.35 to 1.40	9.5	87.9	10.0	3.8	3.29	1.27
	1.40 to 1.45	3.7	91.6	13.5	4.2	3.97	1.38
	1.45 to 1.50	2.1	93.7	16.8	4.5	3.82	1.44
	1.50 to 1.55	1.2	94.9	20.6	4.7	3.81	1.47
	1.55 to 1.60	.5	95.4	22.4	4.8	3.82	1.48
	Over - 1.60	4.6	100.0	40.6	6.5	8.83	1.82
100-mesh by 0 (14.6 percent of sample)				8.7		2.49	

Tests on the two samples of Poplar Creek coal indicate that this coal is not converted easily into a satisfactory metallurgical fuel by mechanical cleaning. There is some indication that sulfur in the coal decreases as the bed extends to the north, unless the sulfur differences in the two samples tested result from local variations. Where the sulfur in the raw coal does not exceed 2 percent, it may be possible to prepare a satisfactory metallurgical fuel from a chemical standpoint by crushing the coal to about 3/8-inch top size and subjecting the product to precise washing.

PART III. - CARBONIZING PROPERTIES OF COALS FROM CAMPBELL COUNTY, TENN.

by

D. A. Reynolds

This report gives the carbonizing properties of the five coals in Campbell County, Tenn., having the largest reserves. The experimental data were obtained from tests on six samples representing the Pewee, Windrock, Coal Creek (two samples), Poplar Creek, and Red Ash beds. Channel samples representing the full thickness of minable coal in each bed were taken in operating mines under supervision

of Bureau of Mines engineers. Each weighed about 600 pounds. They were transported to the Bureau of Mines Central Experiment Station, Pittsburgh, Pa., in steel drums, where they were prepared for carbonization by crushing in the hammermill. The source of samples is shown in table 48.

TABLE 48. - Source of coal samples

Coal No.	Bed	Mine	Town	County
615	Pewee	Beech Grove	Lake City	Anderson-Campbell
617	Windrock	Tennco (strip)	Briceville	Do.
626	Coal Creek	Beech Valley	Lake City	Do.
456	Coal Creek (Jellico)	Blue Rose	Morely	Campbell
647	Poplar Creek (Murray)	Stansbury No. 4	Pioneer	Do.
749	Red Ash	Diamond No. 3	Hickey	Do.

The three samples taken in Anderson County represent beds extending into Campbell County. The Beech Grove mine (615) is partly in Campbell County, and both the Tennco and Beech Valley mines (617 and 626) are within one-half mile of the Campbell County border.

Blue Rose mine coal (456), designated as the Jellico bed in a previous publication,[13/] has since been correlated with the Kent or Coal Creek by the Tennessee Division of Geology.[14/] The Poplar Creek bed (647) also is known as the Murray bed in Campbell County.

Chemical Composition and Miscellaneous Properties of Coals

Table 49 gives proximate and ultimate analyses of the coals and their heating values, ash-softening temperatures, free-swelling indexes, agglutinating values, and expansion.

All samples ranked as high-volatile A bituminous because they contained less than 69.0 percent dry, mineral-matter-free fixed carbon and had heating values exceeding 14,000 B.t.u. per pound on the moist, mineral-matter-free basis. None ranked high in the high-volatile A classification because their contents of dry, mineral-free fixed carbon ranged from 56.4 to 61.7 percent. All contained moderate proportions of ash, and only Poplar Creek (647) contained more than 1.3 percent sulfur. The ash softening temperatures ranged from 2,080° to 2,820° F.

Free swelling indexes ranged from 4 to 7, and agglutinating values determined at a 15:1 ratio of silicon carbide to coal ranged from 4.3 to 6.4. These values are rather low compared with those for Appalachian high-volatile coals; Pittsburgh-bed coal from the Mathies mine, Washington County, Pa., for example, has a free-swelling index of 8 and an agglutinating value of 6.9.

13/ Reynolds, D. A., Davis, J. D., Birge, G. W., Brewer, R. E., Ode, W. H., and Naugle, B. W., Carbonizing Properties: Tennessee Coals From the Jellico Bed in Campbell County and the Sewanee Bed in Marion County: Bureau of Mines Bull. 523, 1953, 35 pp.

14/ Hardeman, W. D., State geologist, Tennessee Division of Geology: Communication dated June 1954.

TABLE 49. - Chemical analyses, free swelling index, agglutinating value, and expansion of coals

Coal No.	615	617	626	456	647	749
Dry, mineral-matter-free fixed carbon ..... percent	58.8	59.6	61.7	60.3	56.4	58.4
Moist, mineral-matter-free heating value ..... B.t.u./lb.	14,410	14,280	14,830	14,690	14,600	14,650
Proximate analysis of coal:						
Moisture ..... percent	3.5	4.5	2.5	2.7	2.6	2.6
Volatile matter ..... do.	37.6	35.8	36.1	37.3	40.3	37.3
Fixed carbon ..... do.	52.7	51.6	57.3	55.8	50.9	50.8
Ash ..... do.	6.2	8.1	4.1	4.2	6.2	9.3
Ultimate analysis of coal:						
Ash ..... do.	6.2	8.1	4.1	4.2	6.2	9.3
Hydrogen ..... do.	5.4	5.4	5.5	5.5	5.5	5.3
Carbon ..... do.	75.5	72.6	79.1	77.9	74.5	72.6
Nitrogen ..... do.	1.6	1.9	2.0	1.9	1.9	1.8
Oxygen						
As-carbonized ..... do.	10.6	11.4	8.5	9.5	9.1	9.7
Moisture- and ash-free . do.	7.5	7.4	6.3	7.1	6.8	7.4
Sulfur ..... do.	.7	.6	.8	1.0	2.8	1.3
Softening temperature of ash,... °F.	2,500	2,820	2,600	2,710	2,080	2,810
Free swelling index	4	5	7	5-1/2	4	5
Agglutinating value, silicon-carbide:coal ratio 15:1	4.3	5.9	5.1	5.3	6.4	6.3
Expansion, at charge density of 55.0 pounds per cubic foot and 1.0 percent moisture ..... percent	-7.4	-8.8	-6.1	-6.5	-	-

The expanding properties of Pewee, Windrock, and both Coal Creek coals were determined in the Bureau of Mines sole-heated oven, wherein a sample of about 40 pounds is heated from the bottom or sole.15/ The upward or downward movement of the weighted cover plate indicates the linear expansion or contraction at test density, which is calculated to percentage expansion at a standard bulk density of 55.0 pounds per cubic foot and 1.0 percent moisture. The four samples contracted 6.1 to 8.8 percent under these conditions and their expanding properties are considered to be normal for their rank.

15/ Auvil, H. S., Davis, J. D., and McCartney, J. T., Expansion of Coal During Coking: Bureau of Mines Rept. of Investigations 3451, 1939, 21 pp.

Carbonizing Properties

The carbonizing properties were determined by the Bureau of Mines-American Gas Association (BM-AGA) method,[16] [17] and duplicate tests were made in the standard 18-inch retort at 900° C. Yields of coke, gas, tar, light oil, ammonia, sulfur, and liquor were measured, and the properties of the coke were determined by standard methods of the American Society for Testing Materials. The results given in this report are averages of duplicate tests.

Yields of Carbonization Products

In computing the yields from BM-AGA carbonization tests U. S. gallons (231 cubic inches) and short tons (2,000 pounds) are used. Yields are based upon the coal as carbonized, which is equivalent to the as-received basis, unless otherwise stated. The yield, specific gravity, and heating values of the gas (both properties determined) are reported as stripped of light oil, saturated with water vapor at 60° F., and under a pressure equivalent to 30 inches of mercury. Coke, tar, and light oil are reported as percentages, moisture-free of coal carbonized. The term "light oil" refers to crude product stripped from the gas and does not include the portion that condenses with the tar. The yield of ammonium sulfate is given in pounds per ton of coal and includes total free and fixed ammonia. Liquor includes the fixed ammonia and dry, free ammonia absorbed by it.

Table 50 gives the yields of carbonization products on the as-received basis for these Tennessee coals and the average yields for 20 high-volatile A coals that have been carbonized commercially in blends to produce metallurgical coke. Figure 20 shows the relation of the fixed carbon content of the coals to their yields of coke and tar plus light oil on the moisture- and ash-free basis. This latter basis is used in comparing yields from coals of different moisture and ash contents; if it is not used, the comparisons lose their significance because high ash causes artificially high yields of coke, and moisture lowers the yields of all products except liquor.

Figure 20 also shows that the yields of coke were normal for the fixed-carbon content of the coals. Yields of tar plus light oil were low for Pewee (615), Windrock (617), and Red Ash (749) coals, whereas the other Campbell County coals gave normal yields of these products. The dry oxygen contents of the three coals giving the low yields were lower than those of the other three coals. In general, BM-AGA data show that the tar-plus-light oil yield varies inversely with the oxygen content for a constant value of fixed carbon.

Table 50 shows that the yields of gas were similar; the maximum difference on the volume basis was only 600 cubic feet per ton of coal carbonized. The yields of ammonium sulfate were similar and appreciably higher than the average for the 20 high-volatile A reference coals.

16/ Reynolds, D. A., and Holmes, C. R., Procedure and Apparatus for Determining Carbonizing Properties of American Coals by the Bureau of Mines-American Gas Association Method: Bureau of Mines Tech. Paper 685, 1946, 35 pp.

17/ Fieldner, A. C., and Davis, J. D., Gas-, Coke-, and Byproduct-Making Properties of American Coals and Their Determination: Bureau of Mines Mon. 5, 1934, 164 pp.

TABLE 50. - Yields of carbonization products, as-received basis

Coal No.	615	617	626	456	647	749	1/Average
Yields, percent:2/							
Coke	66.4	66.3	68.3	66.9	64.6	67.2	69.1
Gas	17.1	17.3	15.9	16.4	16.4	16.4	-
Tar	6.4	5.7	6.9	7.1	8.2	6.6	-
Light oil	1.29	1.32	1.14	1.28	1.41	1.21	-
Free ammonia	.210	.213	.312	.243	.296	.216	-
Sulfur	.18	.17	.28	.31	.79	.36	-
Liquor	7.7	8.9	6.3	6.8	6.8	7.7	-
Total	99.3	99.9	99.1	99.0	98.5	99.7	-
Yields, per ton of coal:2/							
Gas ..... cubic feet	10,800	10,700	10,550	10,700	10,400	10,200	10,350
Tar ..... gallons	13.2	11.8	14.3	14.5	16.7	13.7	13.8
Light oil .... gallons in gas	3.54	3.63	3.15	3.50	3.86	3.31	3.15
Ammonium sulfate ..... pounds	30.6	33.1	34.3	33.0	32.6	31.9	23.9

1/ Average for 20 high-volatile A coals tested previously under similar conditions and blended commercially to produce metallurgical coke.

2/ Coke, tar, ammonia, and light oil are reported moisture-free; gas is reported as stripped of light oil and saturated with water vapor at 60° F. and under a pressure equivalent to 30 inches of mercury.

Properties of Gas

The properties of gas are given in table 51. The specific gravities of all the gases were appreciably higher than the average for high-volatile A coals. Heating values reported as B.t.u. per cubic foot ranged from 586 to 620, with an average value of 605 that approximated the average of 603 for coals of similar rank. Likewise, the heating values per pound of coal averaged about the same for these coals and the high-volatile A coals tested previously. The gas from five coals contained moderate proportions of hydrogen sulfide; the gas from Poplar Creek (647), a high-sulfur coal, contained 1,080 grains of this compound.

TABLE 51. - Physical and chemical properties of gas

Coal No.	Specific gravity	Gross heating value1/		H_2S, grains per 100 cubic feet
		B.t.u. per cubic foot	B.t.u. per pound of coal	
615	0.419	586	3,160	240
617	.428	588	3,150	220
626	.401	620	3,270	380
456	.406	619	3,310	400
647	.418	616	3,200	1,080
749	.426	602	3,120	510
Average2/	.386	603	3,220	320

1/ Stripped of light oil and saturated with water vapor at 60° F. and under a pressure equivalent to 30 inches of mercury.

2/ Average for 39 high-volatile A coals tested previously and reported in Tech. Paper 693.

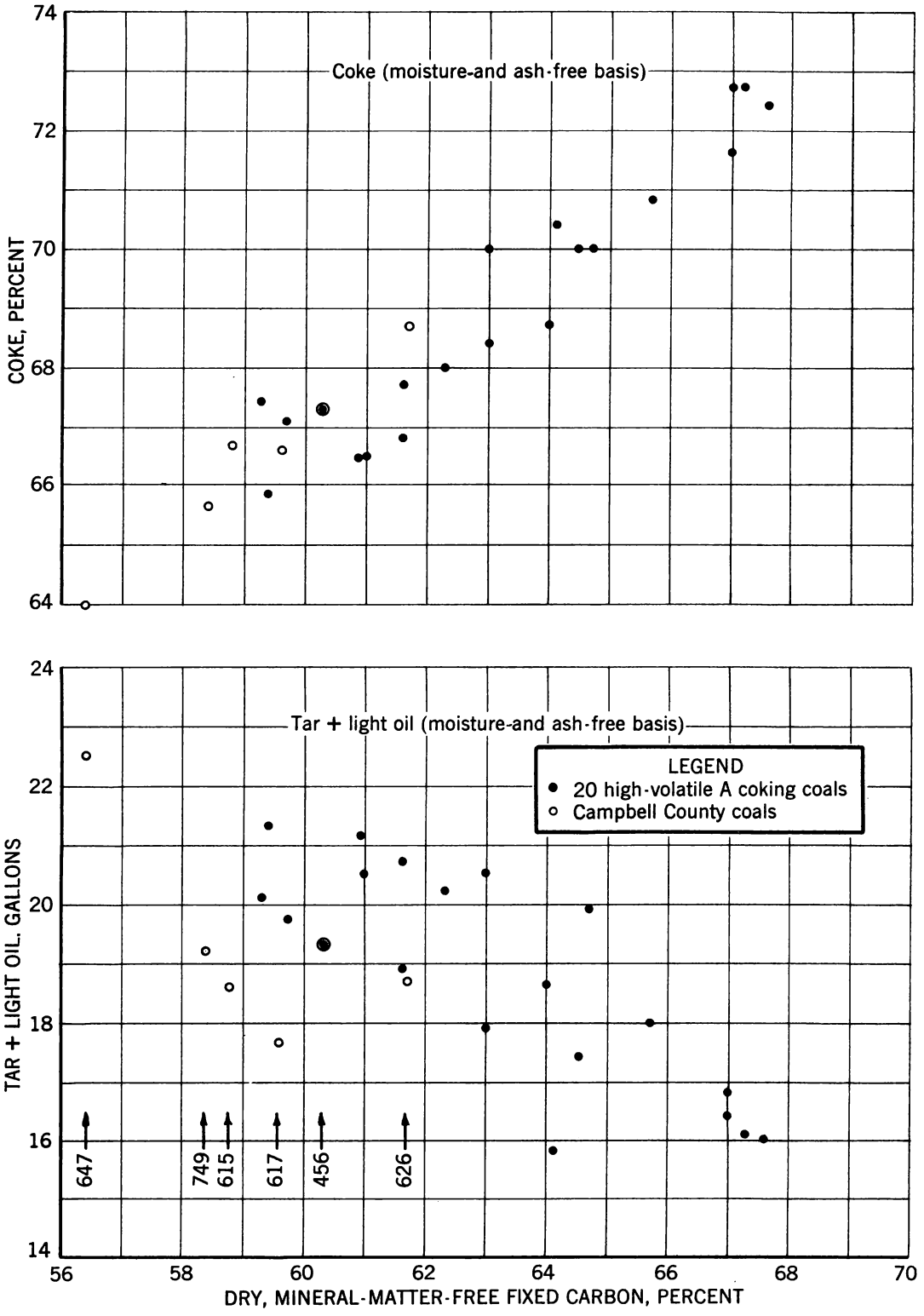

Figure 20. - Effect of dry, mineral-matter-free fixed carbon content of Campbell County and 20 high-volatile A coals coked commercially on the yields of coke and tar plus light oil on a moisture- and ash-free basis.

Properties of Coke

Chemical and physical properties of the coke are given in table 52. Sections of representative full-length pieces of coke from Pewee, Windrock, Coal Creek (Beech Valley mine), Poplar Creek, and Red Ash coals are shown in figures 21 and 22. A section of coke from Coal Creek (Jellico) coal from the Blue Rose mine was shown in a previous publication.18/ These illustrations show the cokes to be rather fingery and medium grained.

TABLE 52. - Physical and chemical properties of coke

Coal No.	Sulfur, percent	Apparent specific gravity	Cells, percent	Shatter test 1-1/2-inch screen	Tumbler test 1-inch screen	Tumbler test 1/4-inch screen
615	1.1	0.77	59.5	57	7	62
617	.6	.82	57.8	68	10	51
626	.5	.80	57.4	81	38	61
456	.7	.81	56.5	79	28	60
647	.8	.76	60.0	70	21	60
749	2.3	.81	-	59	4	56

Coke strength, as measured by the shatter and tumbler indexes, varied considerably for the individual coals. The 1-1/2-inch shatter index ranged from 57 to 81, and the ranges in the 1- and 1/4-inch tumbler indexes were 4 to 37 and 51 to 61, respectively. Figure 23 compares the physical properties of the cokes from Campbell County coals and those of cokes from 20 high-volatile A reference coals. Only Coal Creek from the Beech Valley mine (626) coked as strongly as the reference coal of similar fixed-carbon content. Pewee (615) coke had low shatter and 1-inch tumbler indexes, although its 1/4-inch tumbler index was satisfactorily high. Poplar Creek (647) coke also had low shatter and 1-inch tumbler indexes, although they were appreciably higher than those of Pewee coke. Poplar Creek (647) coke had moderately high strength indexes but was high in sulfur. Coal Creek coke from Blue Rose mine coal (456) had normal shatter and 1/4-inch tumbler indexes, but its tumbler stability was rather low. Windrock (617) and Red Ash (749) cokes were weak by all three coke-strength indexes.

These results show that Coal Creek coal from the Beech Valley mine qualifies as a metallurgical blending coal because its coke compares very favorable with those yielded by similarly ranking coals that are cokes commercially. Blue Rose mine coal from the same bed also could be used in metallurgical coking blends. Pewee, Windrock, and Red Ash probably are suitable only as minor constituents of coking blends because their cokes were weak. The high-sulfur content of Poplar Creek coal detracts from its value for metallurgical use. The other coals did not contain excessive proportions of ash and/or sulfur.

18/ Work cited in footnote 13 (p. 66).

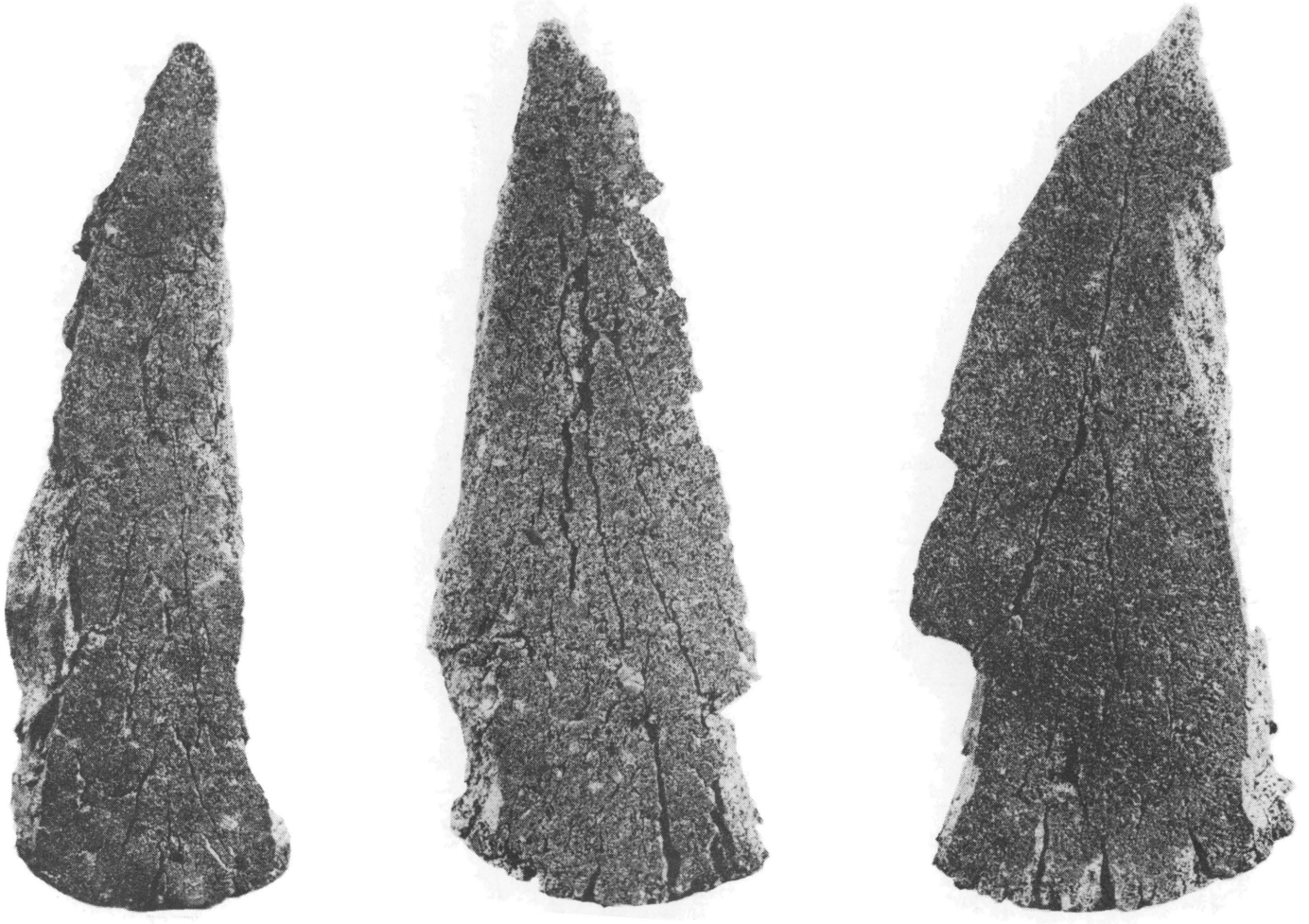

Figure 21. - Sections of 900° C. BM-AGA cokes from Campbell County, Tenn. coals: 1–Pewee bed, Beech Grove mine (615); 2–Windrock bed, Tennco mine (617); 3–Coal Creek bed, Beech Valley mine (626).

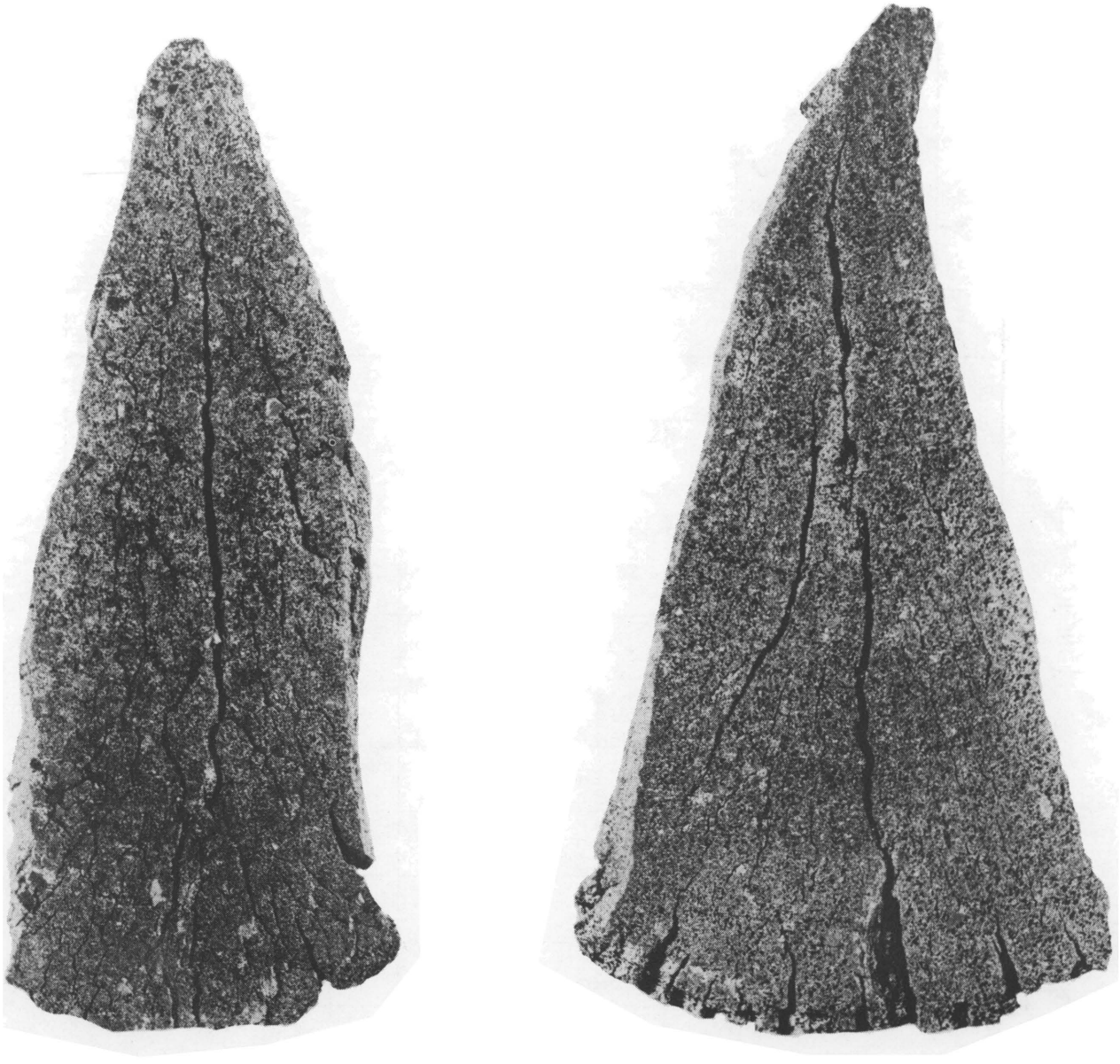

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Figure 22. - Sections of 900° C. BM-AGA cokes from Campbell County, Tenn. coals: 1–Poplar Creek (Murray) bed, Stansbury No. 4 mine (647); 2–Red Ash bed, Diamond No. 3 mine (749).

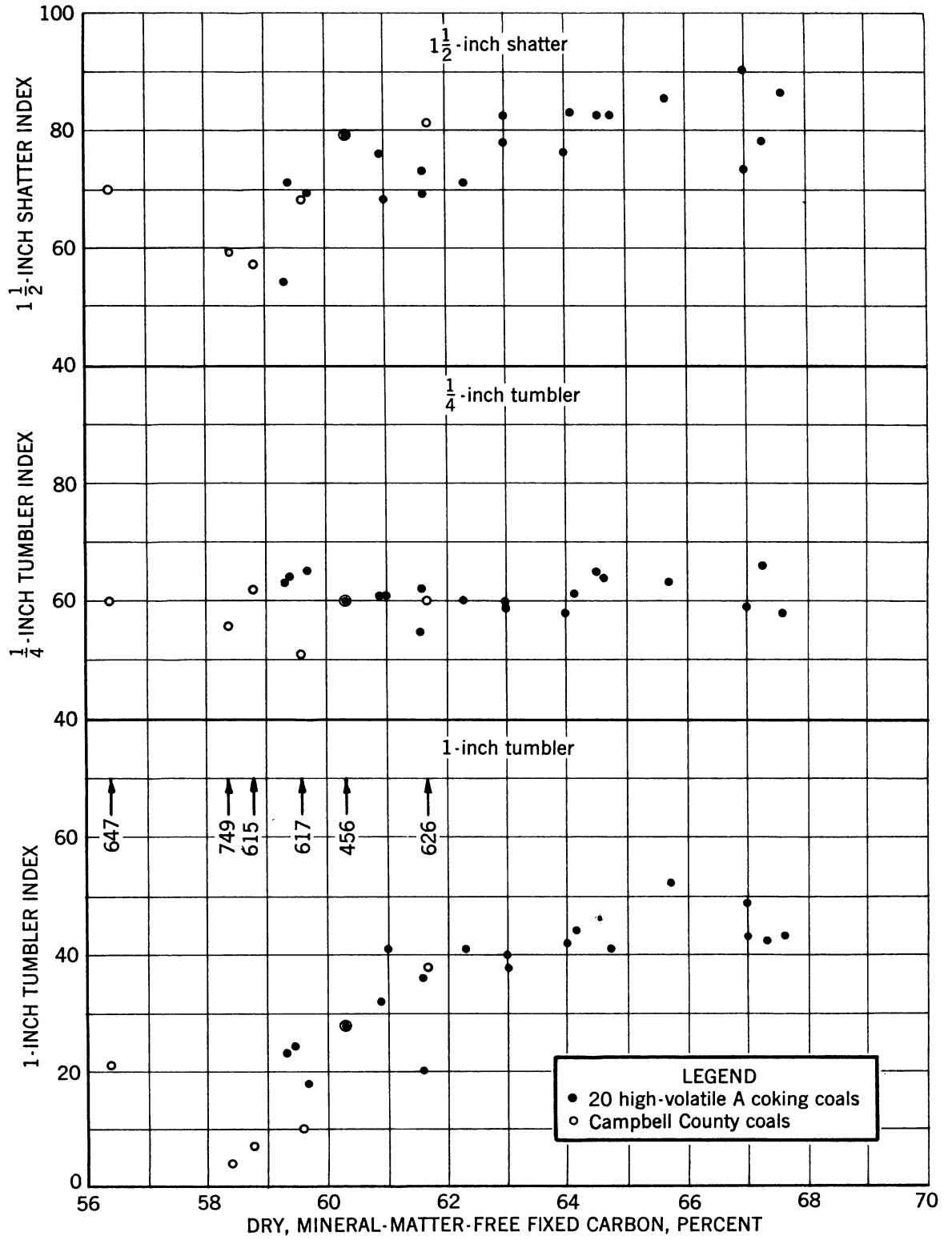

Figure 23. - Effect of dry, mineral-matter-free fixed carbon content of Campbell County and 20 high-volatile A coals coked commercially on the physical properties of coke.

APPENDIX

Completed reports giving results of studies by counties:

Estimation of Known Recoverable Reserves

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