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COAL RESOURCES OF VIRGINIA

By Andrew Brown, Henry L. Berryhill, Jr., Dorothy A. Taylor,

and James V. A. Trumbull

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W. E. Wrather, Director

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Prepared in cooperation with the Virginia Geological Survey

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PREFACE

This report on the coal resources of Virginia has been prepared by the U. S. Geological Survey in cooperation with the Virginia Geological Survey. It is the seventh of a series of reports published by the U. S. Geological Survey as part of a program to reappraise the coal reserves of the United States. Studies of reserves in other States are contained in the following publications: Geology of the Deep River coal field, Chatham, Lee, and Moore Counties, N. C., Preliminary map, 1949; Coal resources of Montana, Circular 53, 1949; Coal resources of Michigan, Circular 77, 1950; Coal resources of Wyoming, Circular 81, 1950; Coal resources of New Mexico, Circular 89, 1950; and Lignite resources of South Dakota, Circular 159, 1952.

W. E. WRATHER,
Director

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COAL RESOURCES OF VIRGINIA

INTRODUCTION

The U. S. Geological Survey and the Virginia Geological Survey have cooperated in preparing this reappraisal of the coal resources of Virginia, which is based on a study of all information on the reserves of the State available in the publications and files of the two organizations, supplemented by mine and drill-hole information provided by mining companies and private individuals.

Coal is found in Virginia in three widely separated and entirely dissimilar areas: the Southwest Virginia field, or simply the Southwest field, which comprises all or part of Tazewell, Buchanan, Dickenson, Russell, Scott, Wise, and Lee Counties; the Valley fields, a series of long, narrow coal-bearing areas in the Valley of Virginia that are concentrated largely in Montgomery, Pulaski, and Wythe Counties; and the Eastern fields, consisting of two relatively small basins near Richmond and Farmville, respectively. Of the total reserves of the State, about 97 percent are in the Southwest Virginia field.

In estimating reserves of the Southwest Virginia field the cooperating agencies were assisted by a series of excellent county reports covering the entire field and by the generous cooperation received from the coal-mining companies. Because of this help, it was possible not only to prepare estimates of reserves in that field by individual coal beds, but to outline most of the important mined-out areas on the bed maps and thus to prepare an estimate that takes into consideration the coal mined and lost in mining prior to January 1, 1951.

The Valley fields, which were mined to some extent prior to 1860 and which have an almost continuous production record since 1883, have been mapped and studied in some detail, but the data on the area are in general inadequate and the structure is too complex to permit a detailed estimate of reserves. Estimates of indicated and inferred reserves in six of the ten Valley fields were prepared, however, and are presented in subsequent pages. The estimates for the Valley fields are on the basis of original reserves, as mine information is too scanty and production figures too generalized to be of value in translating original reserves into remaining reserves.

The Richmond basin, the easternmost of the Eastern fields, was first mined in 1748, and operations were carried on almost continuously for 150 yr or more after that date. Activity died rapidly as rail transportation made the more easily mined Appalachian coals available, and the Eastern basins have seen little activity since about 1905. Despite the fact that an all-time total of more than 8 million tons has been taken from the Richmond basin, the data now available on the coal beds are considerably less than those on the Valley fields and it was impossible to estimate the reserves with any degree of accuracy. The reserves of the Eastern fields are therefore omitted from the tables, though the fields are discussed in later sections of this report.

Whether presented as remaining reserves (Southwest field) or original reserves (Valley fields) the estimates presented in this report have been calculated on a most conservative basis, and in all probability these estimates will be increased rather than diminished as additional field work is done. Undoubtedly much of the coal reserves shown herein as indicated or inferred reserves will be changed to the measured or indicated category as development work progresses.

Acknowledgments

The authors wish to express their appreciation for the cooperation and courtesies extended by numerous individuals and corporations that contributed the information used in compiling this report. Nearly all of the coal-mining companies operating in the State were most generous in permitting the use of their mine maps, drill-hole information, and other data, and thanks are due to the officers and representatives of those companies, who are too numerous to list here but without whose cooperation this report could not have been prepared. Among the private individuals who rendered invaluable service in procuring data, thanks are due particularly to Mr. Emmett Jones, of Norton, and Mr. Larry Patrick, of Tazewell.

SUMMARY OF RESERVES

The original and remaining coal reserves of Virginia are estimated at 12,051 million tons and 11,119 million tons, respectively, divided as follows:

Reserves of coal in Virginia

All estimates in millions of tons

Rank of coal	Original reserves	Production and mining losses	Remaining reserves as of Jan. 1, 1951
Bituminous (Southwest field)	11,696	920	10,776
Semianthracite (Valley fields).....	355	12	343
Total.....	12,051	932	11,119

Because of the lack of reliable data, no estimate of reserves for the Eastern region, which includes the Richmond and Farmville basins, is included in this report. The estimates for the Southwest and Valley fields were made on somewhat different bases, as described below.

In preparing work maps of the coal beds in the Southwest field it was found that enough closely spaced information was available to permit the mapping of mined-out areas for most beds, thus making it possible to estimate the acreage and tonnage of coal in these areas with reasonable accuracy. Therefore, the estimates of reserves in the Southwest field were made on the basis of coal shown on the work maps as remaining in the ground on January 1, 1951; the mined-out areas were omitted. The final estimates show that 5,041 million tons of coal, or 47 percent of the total, are classed as thin (14 to 28 in.) coal; 3,793 million tons or 35 percent of the total, as intermediate (28 to 42 in.) coal; and 1,942 million tons, or 18 percent of the total, as thick (more than 42 in.) coal. Considered from another point of view, 786 million tons, or 7 percent of the total, are classed as measured coal; 5,616 million tons, or 52 percent of the total, as indicated coal, and 4,374 million tons, or 41 percent of the total, as inferred coal. This distribution differs from that of most coal-bearing areas, in which the inferred reserves are usually the largest category, and reflects the relative abundance of information on the Southwest field.

The original tonnage of reserves in the mined-out areas, which were known in sufficient detail to be shown on the work maps, is estimated at about 920 million tons. As the reported all-time production from the field is about 534 million tons, at least 386 million tons were lost in mining during the life of the field. From these figures it may be deduced that the recoverability of mining in Virginia has been somewhat less than 58 percent, possibly near the 50 percent figure which is probably typical of most coal-mining areas in the United States.

More than 99 percent of the estimated reserves in the Southwest Virginia field is under less than 1,000 ft of cover, and for that reason the reserves are not divided into depth categories. Those beds and areas containing coal at depths greater than 1,000 ft are indicated in the tables by asterisks.

In preparing estimates of reserves in the Valley fields, very few mine data were available and it was necessary to make the estimates on the basis of original reserves in the ground. This figure was made current by subtracting from the original total the reported production of the fields plus an equivalent amount of coal considered to have been lost in mining. Because of the wide spacing of the data no estimate of measured coal was made, though the coal in and near the mines would normally be placed in that category. Further, because of the complex geologic structure in the Valley fields and uncertainty as to the continuity of the beds, no coal was estimated for depths greater than 1,000 ft, though some mines are known to have gone more than 1,000 ft below the surface. In brief, the estimates of indicated and inferred reserves for the Valley fields are necessarily made on a most general basis.

The original reserves in the Valley fields, calculated as described above, are estimated at 355 million tons. The all-time reported production is 6 million tons, and mining losses are estimated to have been approximately the same amount. Subtracting the production and mining losses of 12 million tons from the original total gives the remaining reserves as of January 1, 1951, as 343 million tons.

METHODS OF PREPARING RESERVE ESTIMATES

Any estimate of the coal reserves of a large area is necessarily based on a number of assumptions as to thickness, extent, and correlation of the coal beds, and other pertinent factors. It follows that such an estimate is of value to the reader only to the extent that the definitions and procedures used are explained and understood. Therefore, the criteria used in preparing this report are described briefly below.

The estimates of reserves are arranged according to the characteristics of the coal, the category of reserves based on the abundance and reliability of information, and the date to which the estimate

applies. Discussion of each of these classifications follows:

Classification according to characteristics of the coal

Characteristics considered in calculating coal reserves are the rank of the coal, the thickness of the beds, and the thickness of the overburden. The weight of the coal, necessarily a starting point in computing tonnages, is in large part a function of the rank.

Rank of coal

American coals are ranked in accordance with the Standard Classification of the American Society for Testing Materials, which is reproduced as table 1. Most of the Virginia coals, including all those in the Southwest field, range in rank from high-volatile A to low-volatile bituminous. Most of the coal in the Valley fields is of semianthracite rank. In the Eastern fields it is mostly medium- to low-volatile bituminous, but the area contains some semianthracite and a small amount of natural coke.

Weight of coal

The average weight of bituminous coal, as determined by numerous specific gravity determinations, is 1,800 tons per acre-ft; that of semianthracite is 2,000 tons per acre-ft (Averitt and Berryhill, 1950). These weights have been used in calculating the coal reserves of Virginia.

Thickness of beds

In order to provide as much information as possible on the distribution of reserves, the estimates presented herein are broken down into three thickness categories termed "thin," "intermediate," and "thick." For semianthracite and bituminous coal, beds 14 to 28 in. thick are classed as thin; those 28 to 42 in. thick, as intermediate; and those more than 42 in. thick, as thick. These figures are based primarily on mining characteristics: 14 in. is approximately the minimum thickness of coal mined by hand methods; 28 in. is the minimum usually considered suitable for machine mining and hand loading; and 42 in. is the approximate minimum thickness required at present for completely mechanized mining.

Thickness of overburden

In computing the coal reserves of the Southwest Virginia field it was found that more than 99 percent of the coal considered minable under the criteria and definitions discussed in the preceding sections lay under less than 1,000 ft of cover, and therefore no classification of reserves according to the thickness of the overburden was attempted. The small known reserves that lie under more than 1,000 ft but less than 2,000 ft are indicated in the tables by asterisks and explained in footnotes.

In the Valley fields the coal is folded to a considerable degree and in a number of areas the beds dip so steeply that the 3,000-foot limit is reached within a fairly short distance from the outcrop. Not only is the coal crushed at many such localities, but the overlying and underlying strata are deformed by faulting and folding; and mining conditions, difficult near the surface, are much worse at depth. For this reason no reserves lying deeper than 1,000 ft were computed for the Valley fields.

Classification according to abundance and reliability of data

According to the abundance and reliability of data upon which estimates are based, coal-reserve estimates are divided into three categories termed "measured," "indicated," and "inferred."

Measured reserves

Measured reserves are those for which tonnage is computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation are so closely spaced and the thickness and extent of the coal so well defined that the computed tonnage may be considered to be within 20 percent or less of the true tonnage. Although the spacing of points of observation necessary to demonstrate continuity of coal varies in different regions according to the character of the coal beds, structural conditions, and other factors, the points of observation are, in general, about half a mile apart.

Indicated reserves

Indicated reserves are those 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 they may be as much as 1 1/2 miles apart in beds of known geologic continuity.

Inferred reserves

Inferred reserves are those for which quantitative estimates are based largely on a broad knowledge of the character of the bed or region and for which there are few, if any, measurements. The estimates are based on an assumed continuity for which there is good geologic evidence. In general, inferred coal lies more than 2 miles from the outcrop.

Distinction between original, remaining, and recoverable reserves

Estimates of reserves may be made on the basis of original reserves in the ground as of a certain date, remaining reserves as of a certain date, or recoverable reserves as of a certain date. The type of estimate given for any coal field depends on a number of factors, chief among which is the amount of information available not only on the coal in the ground, but on mines, production, and mining losses. In most coal-bearing areas the data on mined-out areas in particular are scanty, and the only practical way in which a reserve estimate can be made current is to compute first the original tonnage before mining, and subtract from the figure thus obtained from the recorded production plus an allowance for mining losses. This method gives a fairly reliable over-all total for a large area, such

Table 1. CLASSIFICATION OF COALS BY RANK.[a]

Legend: F.C. = Fixed Carbon. V.M. = Volatile Matter. Btu. = British thermal units.

Class	Group	Limits of Fixed Carbon or Btu. Mineral-Matter-Free Basis	Requisite Physical Properties
I. Anthracitic	1. Meta-anthracite	Dry F.C., 98 per cent or more (Dry V.M., 2 per cent or less)	
	2. Anthracite	Dry F.C., 92 per cent or more and less than 98 per cent (Dry V.M., 8 per cent or less and more than 2 per cent)	
	3. Semianthracite	Dry F.C., 86 per cent or more and less than 92 per cent (Dry V.M., 14 per cent or less and more than 8 per cent)	Nonagglomerating[b]
II. Bituminous[d]	1. Low volatile bituminous coal	Dry F.C., 78 per cent or more and less than 86 per cent (Dry V.M., 22 per cent or less and more than 14 per cent)	
	2. Medium volatile bituminous coal.	Dry F.C., 69 per cent or more and less than 78 per cent (Dry V.M., 31 per cent or less and more than 22 per cent)	
	3. High volatile *A* bituminous coal.	Dry F.C., less than 69 per cent (Dry V.M., more than 31 per cent); and moist[c] Btu., 14,000[e] or more	
	4. High volatile *B* bituminous coal.	Moist[c] Btu., 13,000 or more and less than 14,000[e]	
	5. High volatile *C* bituminous coal.	Moist Btu., 11,000 or more and less than 13,000[e]	Either agglomerating or nonweathering[f]
III. Subbituminous	1. Subbituminous *A* coal	Moist Btu., 11,000 or more and less than 13,000[e]	Both weathering and nonagglomerating
	2. Subbituminous *B* coal	Moist Btu., 9500 or more and less than 11,000[e]	
	3. Subbituminous *C* coal	Moist Btu., 8300 or more and less than 9500[e]	
IV. Lignitic	1. Lignite	Moist Btu., less than 8300	Consolidated
	2. Brown coal	Moist Btu., less than 8300	Unconsolidated

[a] This classification does not include a few coals which have unusual physical and chemical properties and which come within the limits of fixed carbon or Btu. of the high-volatile bituminous and subbituminous ranks. All of these coals either contain less than 48 per cent dry, mineral-matter-free fixed carbon or have more than 15,500 moist, mineral-matter-free Btu.

[b] If agglomerating, classify in low-volatile group of the bituminous class.

[c] Moist Btu. refers to coal containing its natural bed moisture but not including visible water on the surface of the coal.

[d] It is recognized that there may be noncaking varieties in each group of the bituminous class.

[e] Coals having 69 per cent or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of Btu.

[f] There are three varieties of coal in the high-volatile C bituminous coal group, namely, Variety 1, agglomerating and nonweathering; Variety 2; agglomerating and weathering; Variety 3, nonagglomerating and nonweathering.

as a state, but is not satisfactory for small areas or for individual beds. In some areas, however, it is the only method that can be used; this is true in the Valley fields of Virginia, where there is insufficient detailed information about the mined-out areas.

In reappraising the reserves of the Southwest Virginia field sufficient mine information was available to make it possible to plot on the work maps both the coal beds and the mined-out areas, and thus to measure separately the remaining coal and the mined-out areas in each bed. This made it possible to present an estimate of coal remaining in the ground, in each bed, as of January 1, 1951. No claim is made that the data on the mined-out areas are 100 percent accurate, any more than that information on coal beds can attain that degree of perfection; the data on at least one fairly large mined area are known to be incomplete, and unquestionably a considerable tonnage of coal has been taken from small mines that have never been mapped. But it is considered that for most of the beds the tonnage figures for mined-out areas are within 20 percent of the true figures, and the estimates may therefore be placed in the measured category.

The reliability of the estimates of mined-out areas may be checked by comparisons with the reported production. The workings contain coal in pillars, around the edges, and the like; and though the amount of such coal is difficult to determine exactly it is usually considered, on the basis of long experience, to be approximately equal in amount to the coal actually recovered from the mine (Averitt and Berryhill, 1950). The total recorded production in the Southwest Virginia field through 1949 is approximately 534 million tons. (See table 6.) The total tonnage included in the mined-out areas shown on the work maps is about 920 million tons; and allowing for areas not mapped, because of inadequate data, it is probably safe to assume that the mined-out areas represent at least one billion tons of coal mined and lost in mining. This figure is comparable with the average mining loss of 50 percent, which was quoted above.

As it was impossible to compile estimates of the coal in the Valley fields except on the basis of original reserves, the remaining reserves in that region may be approximated by subtracting from the original reserves the reported production of about 6 million tons, plus an equal amount to take care of the mining losses, or 12 million tons in all. This leaves a total of 343 million tons remaining in the Valley fields as of January 1, 1951. This figure, added to the 10,776 million tons in the Southwest Virginia field, gives a total of 11,119 million tons for the State, as of that date. As mentioned previously, no reserves have been estimated for the Richmond and Farmville basins, which make up the Eastern fields.

How much of the coal in the Southwest and Valley fields should be considered recoverable cannot be estimated without more detailed information and study than are possible in a report of this nature. Recoverability of coal from any property is essentially an engineering problem, with so many facets of ownership, location, accessibility, dip of beds, technical mining considerations, and other factors that no general statement that is applicable to an area as large as a state can safely be made. In addition, technologic advances in many cases alter the original picture within a relatively short time. For example, certain coal beds about a foot thick in the interior of the United States were ignored when most mining was by underground methods but they are now being recovered profitably by stripping. The reverse of this condition applies in some areas where the cost of labor is so high that coal too thin for mechanized mining cannot be recovered profitably, and beds that were considered "good coal" in the not-distant past are now reduced to at least a marginal status. Because of the present varying and rapidly changing conditions it is impossible to make a definite statement as to the amount of recoverable, as opposed to the remaining, coal in Virginia. However, a figure that has a certain usefulness as an average estimate, but admittedly is not applicable to individual properties or individual beds, is based on the commonly accepted figure of 50 percent mining losses in underground operations. On the assumption that the amount of coal now lost in mining is approximately equal to the tonnage recovered, and on the further assumption that this ratio will continue into the future, the recoverable coal reserves of Virginia, as of January 1, 1951, may be considered to be 5,559 million tons.

Methods of recording data and making calculations

All tonnages presented in this report were calculated by individual beds, using counties and 15-minute quadrangles as areal units. Work maps were prepared from published topographic sheets on the scale of 1:24,000; on each map the outcrop of a single coal bed was traced, and all measured sections, drill holes, mine information, and other data pertinent to that bed were plotted. Isopach lines were then drawn on the basis of the plotted information, dividing the coal into three thickness ranges. Other lines were then drawn, breaking the deposit down into measured, indicated, and inferred categories on the basis of the spacing of the data. As practically all the Virginia coal included in the estimates lies under less than 1,000 ft of cover, few overburden lines were necessary.

The thickness of the coal was obtained by taking a weighted average of all thickness figures from outcrop and mine measurements and from drill-hole logs. The figures used are the actual thicknesses of the coal, eliminating partings, unless the partings exceed half the total thickness of the coal bed; in such cases the coal is considered to be of no value and is not included in the estimate.

The lateral extent of the coal was determined by the extent of the outcrop and by drill-hole and mine data. It was assumed, at most places, that the coal extends at least half as far back of the outcrop as it is exposed along the outcrop; therefore an arc having half the length of the outcrop as its radius was drawn to delimit the coal to be included in the estimate. In many areas the arc was modified in the light of the trace of the outcrop, known thickening or thinning of the coal within short distances, or

other local conditions. In all cases conservative methods were used in preparing the estimates.

The areas outlined on the maps as described above were measured with a planimeter to obtain the acreage underlain by coal in the different thickness groups and reserve categories. The tonnage was calculated by multiplying together the number of acres, the weighted average thickness of the coal to the nearest tenth of a foot, and 1,800 (for bituminous coal) or 2,000 (for semianthracite), the weight of the coal in tons per acre-foot. The figures were then tabulated by beds and counties, and broken down into thickness and quantity of information categories.

In making the actual arithmetical calculations the figures were carried to the nearest 10,000 tons, which small amount represented the reserves in a few thin beds in small areas. For the sake of uniformity, larger figures including county and State totals were carried to the same cut-off point. The figures for the reserves in the thicker beds and in the larger areas are, however, significant only to the nearest million tons.

COMPARISON OF PAST AND PRESENT ESTIMATES

The only previous estimate of the coal resources of Virginia as a whole is that made by M. R. Campbell in the period between 1913 and 1928, reprinted by Averitt and Berryhill (1950). Campbell estimated the original reserves of the State at 21,149 million tons of bituminous coal in the Southwest and Eastern fields and 500 million tons of semianthracite in the Valley fields. It is worthy of note that 33 percent of the total estimate of bituminous coal was considered to be in coal beds in the Lee formation in Southwest Virginia, mainly in Dickenson and Buchanan Counties. On the basis of scattered drill holes it appears likely that coals in the Lee formation do underlie much of the area to which they were assigned in the previous estimate; they are, however, at depths greater than 1,000 ft and have not been prospected except in a small way. Because of lack of specific data, tonnage calculations of coal in the Lee formation in the counties named are not included in this report.

A series of county reports covering the Southwest Virginia field, prepared jointly by the U. S. Geological Survey and the Virginia Geological Survey between 1918 and 1923, estimate the original reserves of the Southwest field at 27,200 million tons. The estimates for the individual counties range from 705 million tons for Russell County to 12,000 million tons for Buchanan County. It will be noted that these estimates, which also include reserves in the buried Lee formation of Buchanan and Dickenson Counties, are somewhat higher than the Campbell estimate, just as the Campbell estimate is higher than the present figures of 11,696 million tons of bituminous coal in the Southwest field and 355 million tons of semianthracite in the Valley fields.

The present estimate is smaller than the earlier estimates partly because more conservative methods were employed in estimating the extent of the beds underground, and partly because coal presumed to be in the deeply buried Lee formation in certain counties in the field is not included in the present estimate.

THE SOUTHWEST FIELD

Location

The Southwest Virginia coal field occupies an area about 110 miles long and a maximum of about 30 miles wide in the southwest part of the State and includes all of Buchanan and Dickenson Counties and parts of Wise, Tazewell, Russell, Scott, and Lee Counties. (See fig. 1.) The southeastern boundary of the field is the edge of the Appalachian Plateau, which, except for a re-entrant along the Powell River anticline in Lee and Wise Counties, follows a fairly straight line southwest from Pocahontas in Tazewell County to the Kentucky-Virginia State line about 6 miles west of Pennington Gap in Lee County. Other boundaries are the Kentucky and West Virginia State lines, which generally follow the crests of ridges and thus are natural boundaries topographically, but are artificial from the viewpoint of coal occurrence except in Pine Mountain, where the normal sequence of the coal beds is broken by the Pine Mountain fault.

The total area of the Southwest Virginia coal field is about 1,552 sq mi, of which 507 sq mi are in Buchanan County, 332 sq mi in Dickenson County, 451 sq mi in Wise and Scott Counties, 78 sq mi in Lee County, 84 sq mi in Russell County, and 100 sq mi in Tazewell County. The general location of the field within the State is shown on the index map (fig. 1).

Though the Southwest Virginia coal field is economically important in its own right, it is actually only a small part of the southeastern edge of the great Appalachian coal region, which extends from Alabama to Pennsylvania, and its geology and structure cannot be fully understood unless conditions in West Virginia, Kentucky, and Tennessee are taken into consideration. This is particularly true of the Pocahontas field: most of it is in West Virginia, but the southwestern tip is in Tazewell County, Va.

Topography and drainage

The Southwest Virginia coal field is in the Appalachian Plateau province. All parts of the coal-bearing area are highly dissected and are characterized by steep slopes, narrow ridges, and stream valleys which only at intervals contain enough flat land to permit farming. Local relief of about 800 to 1,200 ft within a radius of a mile is not uncommon. Near the southeastern edge of the field the influence of the adjoining Valley and Ridge province is evidenced by the roughly parallel courses of Powell, Stone, and Little Stone Mountains, of Sandy Ridge, and of the principal streams. (See pl. 1.) The greatest altitudes in the coal field are in this general area. The highest point is Powell Mountain in Wise County, which stands at 4,162 ft above sea level, and the next highest is Big A Mountain on the line between Buchanan

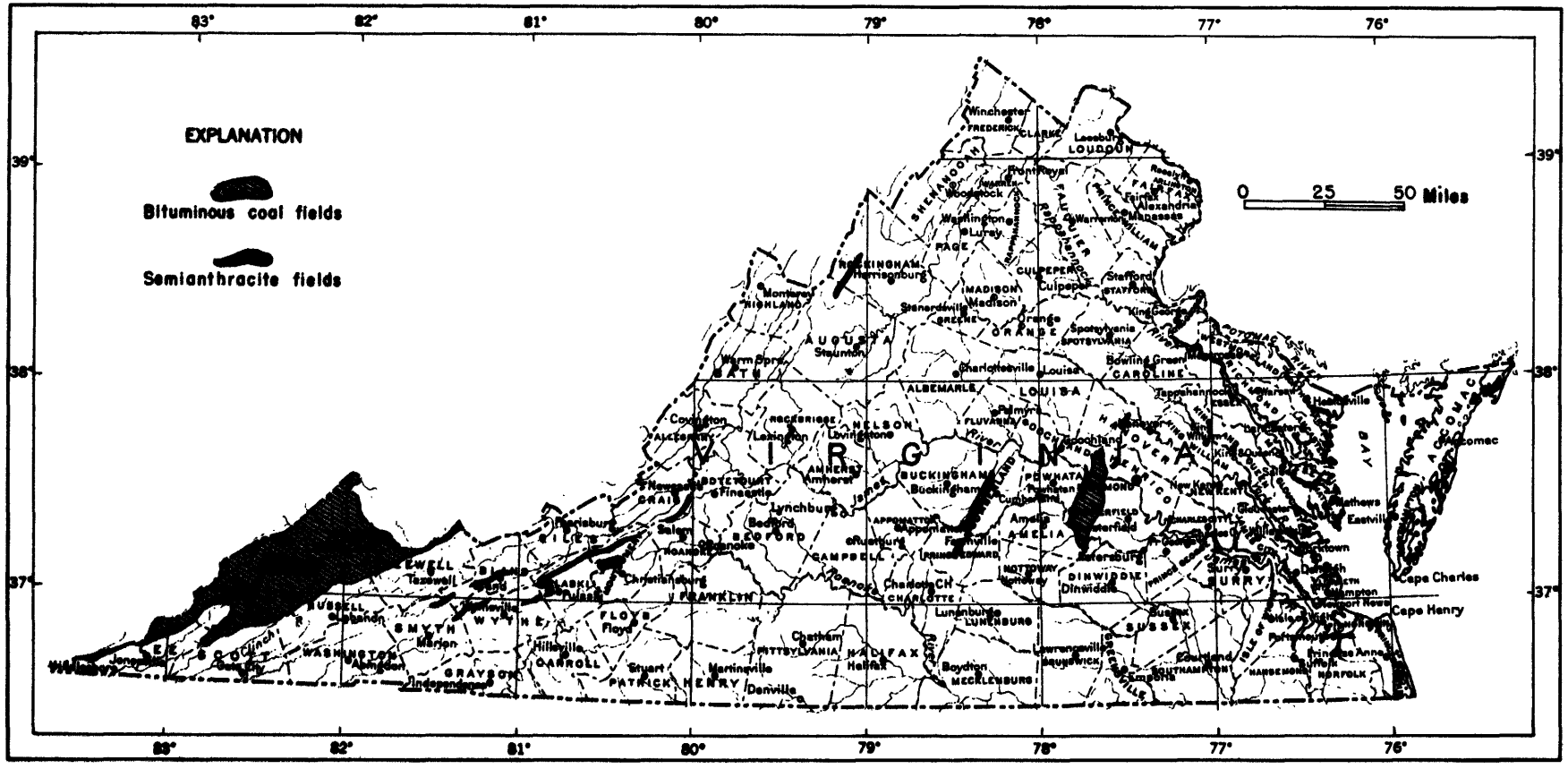

Figure 1.--Index map of Virginia, showing location of coal fields.

and Russell Counties, which reaches 3,765 ft. The lowest point in that part of the field is in southern Wise County and stands at 1,333 ft above sea level. In the northwestern part of the field both the highest and lowest points are on the Virginia-Kentucky State line. The highest is 3,137 ft on the crest of Pine Mountain, which averages 3,000 ft above sea level for a long distance; the lowest elevation is 845 ft, where the Levisa Fork of the Big Sandy River crosses the State line from Buchanan County into Kentucky.

The Southwest Virginia coal field drains in part northwestward into the Big Sandy River and thence into the Ohio River, and in part southwestward into the Tennessee River through the Clinch and Powell Rivers. The Ohio River drainage system includes the northern third of Wise County, all of Buchanan County, nearly all of Dickenson County, and the northeastern portion of Tazewell County. The coal-bearing portions of Lee, Scott, and Russell Counties are within the Tennessee River drainage system, as are approximately the southern two-thirds of Wise County, two small areas on the southern edge of Dickenson County, and the southwestern half of the coal-bearing portion of Tazewell County.

The most important stream in the Tennessee River drainage system, so far as the coal field is concerned, is the Clinch River, which flows west-southwest parallel to and a few miles south of the southeastern boundary of the coal field. It drains all the coal-bearing parts of Russell and Scott Counties, the southwestern part of Tazewell County, and, through its tributary the Guest River, the southeastern part of Wise County. The streams of Lee County and the remainder of the Tennessee River drainage area in Wise County drain into the Powell River, which flows in the same general southwesterly direction as the Clinch and about 15 miles northwest of that stream. It eventually flows into the Clinch in Campbell County, Tenn.

The pattern of the Ohio River drainage in southwest Virginia is essentially dendritic, though it shows important modifications in Wise and Dickenson Counties owing to the underlying rock structure. The principal stream is Russell Fork, which flows northwest; its principal tributary is the Pound River, which rises in the northcentral part of Wise County and flows northeastward to the main stream. The principal tributaries of the Pound River, Indian Creek in Wise County and McClure River and the Cranesnest River in Dickenson County, flow generally north. Except for a small area draining into Russell Fork through Russell Prater Creek, the drainage of Buchanan County is northwesterly through Levisa Fork, Knox Creek, and Tug Fork, and thence into the Big Sandy River. Unlike that of Wise and Dickenson Counties, the drainage pattern of Buchanan County shows little evidence of structural control.

All of the larger streams of the Southwest Virginia coal field are perennial and supply sufficient water for all present uses and for all foreseeable needs of the near future.

Climate, vegetation, and land use

The mean average temperature of the Southwest Virginia coal field ranges from 34° in January and February to 73° in July, and throughout the year the thermometer seldom goes below zero or above 95°. The daily range of temperature is wider than that in any other part of the State, particularly in the summer months when many of the days are hot but the nights are cool or cold. The precipitation averages about 50 in. and is well distributed throughout the year. The average snowfall is 21 in.; the average number of days with snow, 14.

Population

The 1950 population of the three counties lying entirely or almost entirely in the coal-bearing area--Wise, Dickenson, and Buchanan Counties--was 114,790. The population of Lee, Scott, Russell, and Tazewell Counties, which are partly within the coal field, was 136,743; but of this total only a small part, possibly not more than 30,000, are in the coal-bearing parts of the counties. On that assumption, the total population of the Southwest Virginia coal field is about 145,000.

A characteristic of the area, as of most coal-bearing areas that are mined on a large scale, is the scattering of the population in mining towns, all comparatively small but in many instances grouped close together along the railroad lines. Partly for this reason there are no large towns in the field; the two largest are Big Stone Gap and Norton in Wise County, with 5,158 and 4,293 inhabitants, respectively. The next largest towns are Pocahontas, in the northeast end of Tazewell County, and Dante, in Russell County, with 2,500 inhabitants each. Other important towns and their population are Pennington Gap, in Lee County, 1,990; Clintwood, the county seat of Dickenson County, 1,354; Grundy, the county seat of Buchanan County, 1,936; and Wise, the county seat of Wise County, 1,568. No other town in the area contains as many as 1,000 inhabitants.

Transportation

The Southwest Virginia coal field is adequately served by rail transportation. (See pl. 1.) The greatest amount of trackage in the area is that of the Norfolk and Western Railway which, through several branch lines, handles the production of Buchanan and Tazewell Counties and shares in transporting the Russell and Wise County output by way of its Bluefield-Norton line. The Carolina, Clinchfield, and Ohio Railway, usually known simply as the Clinchfield Railroad, enters the field in Russell County, passes through Dante, and then crosses Dickenson County into Kentucky. Practically all of the Dickenson County coal is handled by this line, as is a considerable tonnage from Russell County. Other railroads in the field are the Interstate Railroad,

which runs east and west across southern Lee and Wise Counties through Norton; the Louisville & Nashville Railroad, which extends southwest from Norton to Cumberland Gap; and the Southern Railway, which operates a north-south line that passes through Big Stone Gap and Appalachia. A spur of the Chesapeake and Ohio Railway enters northeastern Lee County from Kentucky and hauls the coal produced in a small part of that county.

Development of the coal field has followed closely the building of the railroads. Tazewell, Wise, Russell, and Lee Counties, the oldest producers in the area, are served by the oldest rail lines. Little large-scale mining was carried on in Dickenson County until the Clinchfield Railroad was built into the county in 1915, and the Buchanan County mining districts were not opened until 1932, when branch lines of the Norfolk and Western Railway were extended into the county.

All of southwest Virginia is served by a network of paved State and Federal highways, which make it possible to reach any part of the coal field at practically all times. The principal highways are U. S. No. 23, which runs north from Kingsport, Tenn., through Big Stone Gap, Appalachia, and Norton, Va., into Kentucky; U. S. No. 460, extending northwest and southeast across Buchanan County; U. S. No. 19, which runs a few miles southeast of the coal field from Bluefield and turns south to meet U. S. No. 11 at Abingdon; State Route 70, which connects U. S. No. 19 with U. S. No. 23; and U. S. No. 421, which runs east and west through Pennington Gap. Other important highways are State Routes 64, 72, and 80, which serve Dickenson County.

Stratigraphy

The coal-bearing rocks of southwest Virginia are the Pottsville group of the Pennsylvanian series of Carboniferous age. The Pottsville, the basal group of the Pennsylvanian in the Appalachian region, consists predominantly of alternating beds of sandstone, shale, and coal, with a few conglomeratic and calcareous strata. Although the rocks throughout the group are generally similar in composition and sequence, the group is divided, in ascending order, into the Lee formation, the Norton formation, the Gladeville sandstone, and the Wise formation. The Harlan sandstone, which overlies the Wise formation and may be of Allegheny rather than Pottsville age, occupies a small area of the highest land in Wise and Lee Counties.

Lee formation

The oldest of the coal-bearing formations, the Lee, overlies the Bluestone formation of Mississippian age throughout the Southwest Virginia coal field. The sedimentary rocks of the Bluestone formation are mostly red and olive-green shales, buff siltstones, fine-grained sandstones, and some limestone beds that are generally nonfossiliferous. At no place in the Virginia coal fields has a sharp contact between the Bluestone and the overlying Lee been found, and the two formations appear to grade into each other through a succession of beds of sandstone and shale that lack diagnostic features of either the Mississippian or the Pennsylvanian.

The Lee formation consists of coal, shale, conglomerate, and sandstone, which contains scattered quartz pebbles. The formation carries the same name across Virginia and Tennessee; it is approximately equivalent to the New River and Pocahontas formations of West Virginia, though the top of the New River is usually placed higher stratigraphically than that of the Lee. In Virginia, the top of the Lee formation is the top of a highly resistant conglomeratic sandstone that has been correlated with the Rockcastle sandstone of Tennessee.

The outcrops of the Lee formation are confined to the northwest and southeast sides of the coal field. The northwestern exposures are in the southeast slope of Pine Mountain, at or near the crest, and extend across Dickenson and Wise Counties southwest of the Breaks of Sandy. In this area the formation is about 800 ft thick and the outcrop belt averages about a mile wide. On the southeast side of the coal-bearing area the Lee is exposed in the Powell Valley anticline where it reaches its maximum width of outcrop, about 7 miles, not far northeast of Big Stone Gap. From that point northeast the outcrop belt narrows and the dips steepen so that across Scott and Russell Counties and the extreme southern part of Buchanan County the exposures are narrow and the rocks are badly crushed. The Lee is not exposed at Big A Mountain, but a short distance to the northeast it is well exposed in the valleys of the coal-bearing part of Tazewell County. The thickness of the Lee throughout the southeastern part of the coal field is 1,530 to 1,800 ft, which is about twice its thickness in Pine Mountain. There is no noticeable thickening or thinning along a northeast-trending line.

Though the Lee formation contains coal at nearly all places where it is exposed, most of the known minable beds in Virginia are in Tazewell County. In addition to the Pocahontas beds, which are mined at the northeastern tip of the county, higher beds crop out toward the southwest. The total number of named coal beds in the formation in Tazewell County is at least 17. (See pl. 3.)

Norton formation

The Norton formation is exposed in the southwestern part of the coal-bearing part of Tazewell County, in the deeper valleys in Buchanan County, and over much of Dickenson and Russell Counties. In Wise County the Norton is exposed in outliers in Powell Mountain, in a band less than half a mile wide north of Stone and Little Stone Mountains, and in a wider band south of Pine Mountain. It also crops out in many places north and east of Powell Mountain. In Lee County it crops out across the county in a band northwest of the Lee formation outcrop.

Like the underlying Lee formation, the Norton formation thickens from northwest to southeast, being about 800 ft thick in the vicinity of Pine Mountain and 1,300 to 1,500 ft thick in the southeastern part of the field. Within Virginia there is little change in the thickness of the formation from northeast to south-

west, but southwest of Lee County it thins and probably wedges out west of Cumberland Gap.

The Norton formation contains 11 named coal beds. (See pl. 3.)

Gladeville sandstone

The Gladeville sandstone is a massive medium-grained quartzose sandstone that is locally conglomeratic and that persists over large areas in the Southwest Virginia field. It is, however, somewhat difficult to trace across Buchanan County. In the southeastern part of the field the Gladeville is 90 to 150 ft thick, but like the Lee formation and the Norton formation it thins toward the northwest and is only about 40 ft thick in Pine Mountain. It contains no minable coal beds. The Gladeville sandstone has been included with the Norton formation on plate 1.

Wise formation

The Wise formation, which overlies the Gladeville sandstone, is exposed over most of Wise County north of Stone, Little Stone, and Powell Mountains, and over most of the coal-bearing portions of Lee County. The lower part of the formation caps much of the higher land in Dickenson County and the northern half of Buchanan County. The Wise is about 2,300 ft thick at Big Stone Gap, and where its full thickness is exposed in northern Wise County it averages about 2,100 ft. It is composed of shale, sandstone, and 20 or more named coal beds. It is estimated that about one-third of the formation is sandstone that differs from the sandstones in the Lee and Norton formations in that much of it is arkosic and contains a large number of feldspar grains, which gives it a white speckled appearance at weathered outcrops. It is the highest coal-bearing formation in Virginia. (See pl. 3.)

Harlan sandstone

The Harlan sandstone, which overlies the Wise formation, is composed mostly of sandstone. Its base is 5 to 50 ft above the base of the High Splint coal; its age has been determined (White, 1905) on the basis of fossil plants to be late Pottsville or early Allegheny.

Structure

The Southwest Virginia coal field may be divided, for convenience in discussing the structure, into two parts: the one lying in the Cumberland overthrust block, which comprises approximately the southwestern two-thirds of the field in Lee, Wise, Scott, Dickenson, and southern Russell Counties, as well as a small area in the southwest corner of Buchanan County; and the other northeast of the Cumberland block, in Buchanan, northern Russell, and Tazewell Counties. (See pl. 1.)

The Cumberland block

The Cumberland block, a unique structural feature of the Appalachian region in Virginia and Tennessee, is about 120 miles long northeast and southwest and averages about 10 miles wide except near its northeastern end, where its width increases to a maximum of about 23 miles. It is bounded on all sides by faults: the St. Paul or Hunter Valley fault on the southeast, the Pine Mountain fault on the northwest, the Russell Fork fault on the northeast, and the Jacksboro fault on the southwest. The Pine Mountain and St. Paul faults are low-angle thrusts from the southeast. The displacement of the Russell Fork and Jacksboro faults is mainly lateral and the fault planes are nearly vertical. All of these faults are shown on the map (pl. 1) except the Jacksboro fault, which is in Campbell County, Tenn.

In the Southwest Virginia coal field, a large part of the Cumberland block is occupied by the Middlesboro syncline, an asymmetrical depression the axis of which is parallel to and about 4 miles southeast of the crest of Pine Mountain. Other structural features are the Powell Valley anticline and the Newman Ridge syncline, known locally in Virginia as the Powell Mountain syncline; these are southeast of and roughly parallel to the Middlesboro syncline. These folds and a number of smaller anticlines and synclines are shown on the map (pl. 1). Though the faults influence mining conditions in the Southwest Virginia field to some extent, the folds exert little influence because the dips of the synclines and anticlines are so gentle that in most parts of the field the coal beds may be considered, for all practical purposes, to be flat lying.

Buchanan, Tazewell, and northeastern Russell Counties

The northeastern part of the Southwest Virginia coal field is bounded on the southeast side by a continuation of the series of thrust faults that form the southeastern boundary of the Cumberland block. Otherwise, the most important structural features in the area are the Dry Fork anticline in Buchanan County and the Pocahontas syncline in the extreme northeastern part of Tazewell County. The locations of these and other structural features are shown on the map (pl. 1).

Coal beds in the Lee formation

Description

The coal beds of the Lee formation are exposed in relatively small areas in Virginia, mostly in Tazewell County. Generally speaking, the oldest beds are exposed in the northeastern part of the field, and the thickest parts of the higher beds are successively farther southwest. Southwest of Tazewell County the rocks of the Lee formation are upturned and deformed adjacent to the fault system that bounds the coal field, and at most places the coal beds are so crushed that they cannot be mined commercially. The only important exception to this rule is the Burtons Ford bed, which crops out over a considerable distance in the south side of Powell Mountain in Scott County and contains a small reserve of minable coal. Neither the Burtons Ford bed nor the other local beds exposed in Scott and Russell Counties have been correlated with the Lee formation coals that crop out in Tazewell County.

The named coals of the Lee formation (except the local beds in Scott and Russell Counties that

have been mentioned above) are shown on the correlation chart (pl. 3). These are discussed briefly below.

The Pocahontas beds

The Pocahontas coals consist of nine coal beds numbered from the bottom upward, which occur in the basal 745 ft of the Lee formation. The thickest of the Pocahontas beds in Virginia are the Pocahontas No. 3, about 360 ft above the base of the Lee; the Pocahontas No. 4, about 75 to 105 ft above the No. 3 bed; and the Pocahontas No. 5, 30 ft or less above the Pocahontas No. 4. The No. 1 and No. 2 beds, near the base of the Lee formation, and the highest bed of the series, the No. 9, contain no known coal of minable thickness in Virginia; the No. 6, No. 7, and No. 8 beds contain comparatively small indicated and inferred reserves in Tazewell County. No mining operations in these beds are recorded in Virginia, but the No. 6 bed has been mined on a small scale in West Virginia not far from the Virginia-West Virginia State line.

The Pocahontas coal possesses distinctive qualities that make it one of the most highly regarded fuels in the Nation. It is of medium- to low-volatile bituminous rank; it possesses excellent combustion qualities; and when properly fired it burns with little smoke. It is widely used as a blending coal in the manufacture of metallurgical coke and is shipped great distances for use by coke manufacturers. The No. 3 bed, in the two available analyses of mine samples, ranges from medium- to low-volatile bituminous; the No. 5 bed, in one analysis of a mine sample is low-volatile bituminous (U. S. Bureau of Mines, 1944, pp. 72-75). The range in composition of these three analyses, on the as-received basis, follows:

Moisture	2.2- 4.5
Volatile matter	18.5-21.7
Fixed carbon	72.0-72.8
Ash	3.3- 5.0
Sulfur	0.5- 0.8

Btu: 14,270-14,940

The outcrop area of the Pocahontas beds in Virginia is relatively small, extending a maximum of 20 miles southwest of the town of Pocahontas, the center of mining activity in the beds.

Pocahontas No. 3 bed.--The Pocahontas No. 3 bed crops out in the extreme northeastern part of the Tazewell County field. Its thickness in that vicinity reaches a maximum of 11 ft and ranges from 97 to 100 in. in mines now operating in the bed. The coal thins southwestward but it is at least 30 in. thick close to the Tazewell-Russell County line, and drill-hole information shows that it is 1.4 to 3.8 ft thick under a large area in Buchanan County. Throughout its outcrop area the bed is overlain by a massive sandstone, directly upon or only a few feet above the coal which in most places extends up to the next highest bed, the Pocahontas No. 4.

The Pocahontas No. 3 was the first of the Pocahontas beds to be mined in Virginia, the first recorded production being in 1883. Although exact figures are not obtainable, it is undoubtedly true that a large proportion, probably more than half, of the total all-time production of about 117 million tons from Tazewell County has been taken from this bed. Though much of the easily obtained coal has been mined out, the bed still furnishes about 4 percent of the annual production of Virginia.

Pocahontas No. 4 bed.--The Pocahontas No. 4 is 105 ft above the No. 3 at Pocahontas, but the interval thins to 75 ft southwest of that town. The coal is 1.3 to 7.0 ft thick in Tazewell County, where it contains fairly large reserves. No commercial mining of the No. 4 coal is now being carried on in Virginia, though it has been mined in past years and some production was reported in 1950 from nearby mines in West Virginia.

Pocahontas No. 5 bed.--The Pocahontas No. 5 bed is a maximum of 30 ft above the No. 4 and in some localities appears to be a split off that bed. It is 1.3 to 6.5 ft thick over considerable areas, and where it is now being mined its thickness ranges from 66 to 78 in. The coal contains more volatile matter than the Pocahontas No. 3 bed, but otherwise there is little difference between the two beds. In 1950 approximately 14 percent of the Virginia production was recovered from this bed.

Coal beds above the Pocahontas beds in Tazewell County

The interval of about 910 ft between the Pocahontas No. 9 coal and the top of the Lee formation contains in Tazewell County nine named coal beds. These are, in ascending order, the Lower Horsepen, War Creek, "C," Middle Horsepen, Upper Horsepen, Lower Seaboard, Middle Seaboard, Greasy Creek, and Upper Seaboard beds. All of these beds except the Middle Seaboard, which is badly split by partings, contain sufficient coal of minable thickness to be included in the reserve estimates. Each of these beds is discussed briefly below.

Lower Horsepen bed.--The Lower Horsepen bed is about 95 ft above the Pocahontas No. 9 and has a maximum thickness of about 30 in.; it is separated into three benches, however, by partings that total 6 in. The bed, which probably should be correlated with the Little Fire Creek bed of West Virginia, contains only small indicated and inferred reserves in Virginia.

War Creek bed.--The War Creek bed, 160 to 170 ft above the Lower Horsepen, is 1.3 to 4.0 ft thick and averages 3 ft or more over a considerable area. In addition to its outcrops in Tazewell County the bed underlies a small area in the southern part of Buchanan County, where it is 2.9 to 4.3 ft thick. The bed is not being mined commercially at the present time but contains fairly large indicated and inferred reserves.

"C" bed.--The "C" bed is a local bed that crops out over a small area in Tazewell County and contains small indicated and inferred reserves. It is about 60 ft above the War Creek coal and ranges in thickness from 1.7 to 3.2 ft.

Middle Horsepen bed.--The Middle Horsepen coal is 110 to 120 ft above the War Creek and is 1.5 to 4.1 ft thick. In some parts of the outcrop area the value of the coal is lessened by partings, and in many localities the bed is thin or absent. The Middle Horsepen bed is not now being mined on a commercial scale.

Upper Horsepen bed.--The Upper Horsepen bed, locally known as the Smith bed, is about 50 ft above the Middle Horsepen. It ranges from 1.5 to more than 11 ft in thickness in places and averages as much as 6.6 ft over sizable areas. The bed is correlated with the Welch coal of McDowell County, W. Va., and contains considerable indicated and inferred reserves. It is not now being mined in Virginia.

Lower Seaboard bed.--The Lower Seaboard bed, 180 to 200 ft above the Upper Horsepen, is one of the most extensive coals in the western part of Tazewell County and underlies a small area in Buchanan County. It ranges in thickness from 1.8 to 4.4 ft and has been mined on a fairly large scale in the past, though no production from it has been reported in recent years. The coal, in an analysis of one mine sample, is of medium-volatile bituminous rank and has been correlated with the Sewell bed of West Virginia. A sample from the Patrick mine, formerly operating in the bed, shows, on the as-received basis, 3.6 percent ash, 1.1 percent sulfur, and 14,560 Btu (U. S. Bureau of Mines, 1944, pp. 72-73).

The Lower Seaboard bed contains considerable reserves in Tazewell and Buchanan Counties, and an unusually large proportion of the estimated reserves are in the measured category.

Middle Seaboard and Greasy Creek beds.--About 40 to 50 ft above the Lower Seaboard is the Middle Seaboard bed, which is correlated with the Sewell A bed of West Virginia. In Virginia the bed is not only thin but contains so many partings that it has not been mined except on a very small scale. No reserves have been estimated for this bed in this report.

The Greasy Creek bed is exposed only in the area north of the Dry Fork anticline, where it is 70 to 90 ft above the Middle Seaboard. It is 1.8 to 2.8 ft thick and has been correlated with the Sewell B bed of West Virginia. It contains small reserves and has been mined on a small scale in the past, though no production has been reported in recent years.

Upper Seaboard bed.--The Upper Seaboard bed is 50 ft above the Greasy Creek and 200 to 315 ft below the top of the Lee formation. It is 2.0 to 2.5 ft thick over considerable areas, and in one mine the thickness is given as 30 to 70 in. The coal ranges in rank from high-volatile A to medium-volatile bituminous; a composite of two analyses of samples from the Carter No. 6 1/2 mine shows, on the as-received basis, 6.1 percent ash, 0.6 percent sulfur, and 14,210 Btu (U. S. Bureau of Mines, 1944, pp. 76-77). The Upper Seaboard has been mined on a fairly large scale in the past and at least one mine was operating in the bed in 1950.

Coal beds in the Lee formation in Scott and Russell Counties

Aside from Tazewell and Buchanan Counties, the only commercially important bed in the Lee formation at the present time is the Burtons Ford bed, which crops out in the south side of Powell Mountain in Scott County and extends northeast into Russell County. Stratigraphically it is about 500 ft above the base of the Lee formation, but as the bed dips sharply and is overturned along most of the outcrop its exact stratigraphic position is difficult to determine. The Burtons Ford coal reaches a maximum thickness of 7 ft including partings and ranges from 1.8 to 5.7 ft thick over considerable distances. It is of high-volatile A bituminous rank; a composite of two analyses of samples from the J. S. T. mine in Scott County shows, on the as-received basis, 6.9 percent ash, 1.0 percent sulfur, and 13,690 Btu (U. S. Bureau of Mines, 1944, pp. 72-73). The bed contains fairly large reserves in Scott and Russell Counties but is not being mined commercially at the present time.

In Scott County the Lee formation contains, in addition to the Burtons Ford bed, a number of named coal beds of lenticular character and local extent. These are the Cove Creek bed (which also underlies a small area in Wise County), and the Egan (Duncan?), Carter, Tacus (Milner?), and Starns beds. The coal in these beds ranges from 1.3 to 4.2 ft in thickness; the total reserves for all of them, as of January 1, 1951, are estimated as 22 million tons of indicated and inferred coal. (See table 2.) No present-day operations in the beds are known, and the only one of the group that has been mined commercially in the past is the Cove Creek bed.

Reserves in the Lee formation

The total estimated reserves, excluding known mined-out areas, of coal in the Lee formation in Virginia, as of January 1, 1951, were 789 million tons, of which 23 million tons are classed as measured reserves, 384 million tons as indicated reserves, and 382 million tons as inferred reserves. Of this total, approximately 70 percent is in Tazewell County and 15 percent in Buchanan County; the remaining 15 percent represents the Burtons Ford and the local beds in Scott and Russell Counties. The reserves by beds and counties are summarized in tables 2 and 3, respectively; the complete distribution by beds, counties, and categories of reserves are given in tables 7 and 8.

The largest reserves in the Lee formation in Virginia are in the Pocahontas beds, especially Pocahontas No. 3, though this bed has been mined so extensively that the remaining measured reserves are small as compared to the indicated and inferred tonnage. Next to the Pocahontas No. 3, the War Creek bed contains the largest estimated reserves, but the points of information on this coal are so widely spaced that all reserves are classed as indicated or inferred. The Lower Seaboard contains the third largest total reserves and a large amount of measured coal.

Table 2.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field, as of January 1, 1951, by beds

(in millions of short tons)

Name of bed	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			Bed total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Wise formation																
High Splint	0.21	1.55	7.21	8.97	0.63	3.72	5.22	9.57	0.07	10.38	....	10.45	0.91	15.65	12.43	28.99
Morris	....	2.87	12.36	15.23	0.98	2.26	9.90	13.14	1.71	1.43	....	3.14	2.69	6.56	22.26	31.51
Pardee	0.51	2.15	28.82	31.48	2.11	16.77	24.81	43.69	1.33	....	....	1.33	3.95	18.92	53.63	76.50
Wax	....	....	....	....	....	....	2.46	2.46	....	....	....	....	....	....	2.46	2.46
Gin Creek	....	....	....	....	1.63	....	....	1.63	....	....	....	....	1.63	....	....	1.63
Phillips	....	0.16	0.34	0.50	1.13	2.90	7.64	11.67	12.40	0.48	....	12.88	13.53	3.54	7.98	25.05
Low Splint	0.29	14.49	9.13	23.93	1.13	25.27	11.66	38.06	53.57	5.44	....	59.01	54.99	45.20	20.81	121.00
Taggart	0.54	13.63	30.58	44.75	1.51	55.97	60.19	117.67	1.33	4.13	....	5.46	3.38	73.73	90.77	167.88
Taggart Marker	0.44	11.42	....	11.86	15.91	65.31	....	81.22	24.09	0.61	....	25.60	41.34	77.34	....	118.68
Kirk	....	....	....	....	1.76	....	....	1.76	....	....	....	....	1.76	....	....	1.76
Upper Standiford	....	....	....	....	....	7.33	5.81	13.14	53.66	3.54	....	57.20	53.66	10.87	5.81	70.34
Harlan	....	3.50	1.35	4.85	0.46	72.73	29.83	103.02	....	* 9.80	....	9.80	0.46	86.03	31.18	117.67
Upper St. Charles	....	0.92	....	0.92	....	2.60	....	2.60	3.03	0.13	....	3.16	3.03	3.65	....	6.68
Lower St. Charles	....	....	....	....	....	5.70	....	5.70	24.50	3.43	....	27.93	24.50	9.13	....	33.63
Pinhook	....	....	....	....	2.25	1.44	....	3.69	9.31	....	....	9.31	11.56	1.44	....	13.00
Cedar Grove	....	....	....	....	....	....	3.80	3.80	....	....	....	....	....	....	3.80	3.80
Lower Cedar Grove	....	....	....	....	0.43	....	0.32	0.75	0.71	....	0.81	1.52	1.14	....	1.13	2.27
Kelly	....	....	....	....	1.15	70.52	29.27	100.94	43.47	23.51	1.92	68.90	44.62	94.03	31.19	169.84
Stone Creek	....	....	....	....	0.63	....	....	0.63	....	....	....	....	0.63	....	....	0.63
Imboden	0.08	2.28	17.79	20.15	6.72	76.69	64.30	147.71	57.62	62.35	8.16	128.13	64.42	141.32	90.25	295.99
Rocky Fork	....	....	....	....	....	....	....	....	0.24	....	....	0.24	0.24	....	....	0.24
Addington	....	....	....	....	0.30	1.94	0.51	2.75	1.28	0.33	....	1.61	1.58	2.27	0.51	4.36
Clintwood	....	0.67	38.77	39.44	31.10	73.13	132.13	236.36	* 69.84	53.52	24.71	148.07	100.94	127.32	195.61	423.87
Eagle	1.79	6.59	14.14	22.52	39.83	96.72	37.26	173.81	34.90	3.27	....	38.17	76.52	106.58	51.40	234.50
Blair	1.20	4.37	0.04	5.61	5.50	15.81	19.78	41.09	86.91	70.33	38.39	195.63	93.61	90.51	58.21	242.33
Lyons	1.90	4.54	0.27	6.71	30.05	10.02	....	40.07	97.15	3.22	....	100.37	129.10	17.78	0.27	147.15
Doroheester	2.37	8.16	22.31	32.84	63.66	62.35	13.41	139.42	*199.44	24.11	....	223.55	265.47	94.62	35.72	395.81
Total	9.33	77.30	183.13	269.76	208.87	669.18	458.30	1,336.35	777.46	280.01	73.99	1,131.46	995.66	1,026.49	715.42	2,737.57
Norton formation																
Norton	3.23	24.10	1.49	28.82	30.92	46.89	....	77.81	65.07	....	....	65.07	99.22	70.99	1.49	171.70
Hagy	....	....	....	....	46.69	170.84	11.44	228.97	112.52	22.90	....	135.42	159.21	193.74	11.44	364.39
Splash Dam	3.70	30.11	35.81	69.62	331.50	296.44	109.34	737.28	244.01	....	....	244.01	579.21	326.55	145.15	1,050.91
Upper Banner	13.86	40.12	97.27	151.25	43.97	69.08	81.36	194.41	75.58	20.12	....	95.70	133.41	129.32	178.63	441.36
Lower Banner	4.00	38.24	39.44	81.68	195.90	151.52	62.26	409.68	284.53	13.43	....	297.96	484.43	203.19	101.70	789.32
Big Fork	....	....	....	....	0.98	....	....	0.98	7.39	6.95	....	14.34	8.37	6.95	....	15.32
Caldwell	....	....	....	....	1.17	2.75	0.95	4.87	....	....	....	....	1.17	2.75	0.95	4.87
Kennedy	0.64	2.38	....	3.02	350.52	479.92	34.02	864.46	373.14	215.76	....	588.90	724.30	698.06	34.02	1,456.38
Aily	....	....	....	....	5.50	....	....	5.50	46.95	....	....	46.95	52.45	....	....	52.45
Raven	10.02	34.88	15.46	60.36	142.01	216.43	44.96	403.40	628.21	126.14	13.90	768.25	780.24	377.45	74.32	1,232.01
Jawbone	1.66	5.52	37.69	44.87	89.21	308.45	309.31	706.97	366.37	163.52	11.56	541.65	457.44	477.49	358.56	1,293.49
Tiller	3.44	6.77	42.31	52.52	78.88	58.56	124.27	261.71	59.64	2.34	0.26	62.24	141.96	67.67	166.84	376.47
Total	40.55	182.12	269.47	492.14	1,317.25	1,800.88	777.91	3,896.04	2,263.61	571.16	25.72	2,860.49	3,621.41	2,554.16	1,073.10	7,248.67

* Overburden 0-2,000 ft.

Table 2.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field, as of January 1, 1951, by beds--Continued

(in millions of short tons)

Name of bed	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			Bed total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
	Lee formation															
Upper Seaboard	0.50	3.14	....	3.64	19.99	8.96	....	28.95	2.93	....	....	2.93	23.42	12.10	....	35.52
Greasy Creek	....	....	....	....	5.47	4.37	....	9.84	3.02	....	....	3.02	8.49	4.37	....	12.86
Middle Seaboard....	....	0.20	....	0.20	4.59	1.29	....	5.88	15.99	....	....	15.99	20.58	1.49	....	22.07
Lower Seaboard.....	0.85	6.40	1.27	8.52	44.24	14.11	....	58.35	15.16	....	....	15.16	60.25	20.51	1.27	82.03
Upper Horsepen	....	....	....	....	26.81	1.40	9.90	38.11	16.87	2.08	....	18.95	43.68	3.48	9.90	57.06
Middle Horsepen....	....	....	....	....	11.73	7.97	4.38	24.08	3.13	5.65	....	8.78	14.86	13.62	4.38	32.86
"C"	....	....	....	....	7.48	2.46	....	9.94	....	8.17	....	8.17	7.48	10.63	....	18.11
War Creek	....	....	....	....	27.48	15.17	2.23	44.88	31.01	6.48	0.96	38.45	58.49	21.65	3.19	83.33
Lower Horsepen....	....	....	....	....	4.02	3.01	....	7.03	14.37	....	....	14.37	18.39	3.01	....	21.40
Pocahontas No. 8...	....	.....	....	....	....	....	....	.....	0.35	....	....	0.35	0.35	....	....	0.35
Pocahontas No. 7...	....	....	....	....	0.03	1.57	....	1.60	4.87	0.64	....	5.51	4.90	2.21	....	7.11
Pocahontas No. 6...	....	....	....	....	5.30	....	....	5.30	6.35	....	....	6.35	11.65	....	....	11.65
Pocahontas No. 5...	0.16	0.85	1.69	2.70	4.26	9.21	5.13	18.60	14.82	6.08	....	20.90	19.24	16.14	6.82	42.20
Pocahontas No. 4...	....	....	5.65	5.65	0.42	0.68	25.70	26.80	2.87	3.53	....	6.40	3.29	4.21	31.35	38.85
Pocahontas No. 3...	....	0.03	2.75	2.78	* 0.63	* 4.83	*33.64	39.10	*61.90	*62.22	*32.30	156.42	62.53	67.08	68.69	198.30
Cove Creek.....	....	....	....	....	....	....	2.65	2.65	....	....	....	....	....	....	2.65	2.65
Egan	....	....	....	....	0.44	1.37	2.23	4.04	3.28	....	....	3.28	3.72	1.37	2.23	7.32
Carter	....	....	....	....	0.22	....	....	0.22	....	....	....	....	0.22	....	....	0.22
Tacus	....	....	....	....	1.71	0.57	0.61	2.89	4.20	....	....	4.20	5.91	0.57	0.61	7.09
Starns	....	....	....	....	1.13	3.52	0.06	4.71	....	....	....	....	1.13	3.52	0.06	4.71
Burtons Ford	....	....	....	....	2.49	26.36	22.03	50.88	52.84	....	....	52.84	55.33	26.36	22.03	103.72
Total	1.51	10.62	11.36	23.49	168.44	106.85	108.56	383.85	253.96	94.85	33.26	382.07	423.91	212.32	153.18	789.41
Grand total....	51.39	270.04	463.96	785.39	1,694.56	2,576.91	1,344.77	5,616.24	3,295.03	946.02	132.97	4,374.02	5,040.98	3,792.97	1,941.70	10,775.65

* Overburden 0-2,000 ft.

Table 3.--Estimated remaining reserves of bituminoue coal in the Southwest Virginia field as of January 1, 1951, by counties

(in millions of short tons)

County	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			County total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Buchanan	8.74	53.06	69.11	130.91	875.65	1,111.88	246.54	2,234.07	1,238.44	142.70	28.10	1,409.24	2,122.83	1,307.64	343.75	3,774.22
Dickenson	19.89	60.28	133.92	214.09	341.81	418.68	313.40	1,073.89	914.24	441.52	27.67	1,383.43	1,275.94	920.48	474.99	2,671.41
Lee	0.08	18.01	17.51	35.60	13.21	143.12	74.48	230.81	127.59	48.52	24.19	200.30	140.88	209.65	116.18	466.71
Russell	8.91	17.91	68.21	95.03	81.12	192.76	246.43	520.31	97.41	6.43	0.12	103.96	187.44	217.10	314.76	719.30
Scott	....	....	....	....	5.26	18.68	26.97	50.91	53.66	....	....	53.66	58.92	18.68	26.97	104.57
Tazewell	3.23	24.48	13.16	40.87	191.66	161.23	81.54	434.43	169.50	54.76	8.80	233.06	364.39	240.47	103.50	708.36
Wise	10.54	96.30	162.05	268.89	185.85	530.56	355.41	1,071.82	694.19	252.09	44.09	990.37	890.58	878.95	561.55	2,331.08
Total.....	51.39	270.04	463.96	785.39	1,694.56	2,576.91	1,344.77	5,616.24	3,295.03	946.02	132.97	4,374.02	5,040.98	3,792.97	1,941.70	10,775.65

Coal beds in the Norton formation

Description

The Norton formation contains in Southwest Virginia 11 named coal beds. (See pl. 3.) All but three of the beds are exposed in Buchanan, Dickenson, and Wise Counties; the lower beds, as far up in the sequence as the Lower Banner bed, are also exposed in the southwestern part of Tazewell County. The lowest coal in the formation is the Tiller bed; the highest, lying practically at the top of the unit, is the Norton. Each bed is discussed briefly below.

Tiller bed.--The Tiller bed is about 160 ft above the base of the Norton formation in southeastern Tazewell County, the interval increasing toward the southwest and reaching about 200 ft in Dickenson County and 250 ft in Russell County. The bed underlies only a small area in Wise County. In Tazewell County the coal ranges from 1.3 to 3.5 ft in thickness, probably averaging less than 3 ft; it varies considerably within short distances and contains partings that reduce its heating value. In southeastern Buchanan County the coal is 1.2 to 5.0 ft thick, and in southeastern Dickenson County the thickness reaches a maximum of 5.9 ft. In Russell County, near Big A Mountain, it is 1.3 to 4.9 ft thick but thins toward the southwest. In Buchanan, Dickenson, and Russell Counties the Tiller bed unites locally with the higher Jawbone coal, the combined thickness of the two beds being from 7 to 15 ft.

The distribution of the Tiller bed is shown on the bed map (fig. 2). The coal is high-volatile A bituminous in rank; the range in composition of analyses of five specimen samples, two from the East mine in Tazewell County and three from the Clinchfield No. 201 mine in Russell County, is as follows (U. S. Bureau of Mines, 1944, pp. 70-71, 76-77):

Moisture	1.8- 3.0
Volatile matter	30.6-32.5
Fixed carbon	57.4-60.3
Ash	6.1- 8.9
Sulfur	0.4- 0.6

Btu: 13,500-14,180

Apparently the heating value of the Tiller coal increases from northeast to southwest, probably because of the greater number and thickness of the partings in the northeastern outcrops.

The Tiller bed has been mined in the past on a fairly large scale, but no commercial mines are at present operating in the bed.

Jawbone bed.--The Jawbone bed, which contains large reserves in Virginia, is correlated with the Iaeger bed of West Virginia; it is known locally in Virginia as the Shannon bed, the Ratliff bed, or the No. 5 coal. As the bed map (fig. 3) shows, it is exposed from southwestern Tazewell County to eastern Wise County, most of the reserve tonnage being in Dickenson, Buchanan, and Wise Counties.

In Tazewell County the Jawbone is separated from the lower Tiller bed by 30 to 50 ft of sandstone, and the bed is more than 30 in. thick at nearly all exposures, reaching a maximum thickness of 6 ft. Southwest of Tazewell County the Jawbone is locally as much as 100 ft above the Tiller, though in other places the two beds merge. Throughout its outcrop area the Jawbone coal is characterized by numerous bone partings, and consequently the analyses show a high percentage of ash. The coal is relatively thick over large areas, however; it is as much as 4.0 ft thick in Buchanan County and 5.3 ft thick in Dickenson County. Where the Jawbone and Tiller beds merge, the aggregate thickness is as much as 15 ft in Buchanan and Russell Counties and 10 ft in Wise County.

The northwestern limit of the Jawbone bed is not definitely known. Drill-hole records show that it underlies the central and western parts of Dickenson County, but it has not been reported at the Breaks of Sandy or in Pine Mountain and probably thins to extinction at depth in northwestern Buchanan, Dickenson, and Wise Counties.

The Jawbone bed ranges in rank from high-volatile A to low-volatile bituminous. It has been mined on a fairly large scale in Russell and Wise Counties, and on smaller scales in Buchanan and Tazewell Counties.

Raven bed.--The Raven bed, which crops out from southwestern Tazewell and southern Buchanan Counties on the northeast to eastern Wise County on the southwest, is one of the most valuable coals in Virginia. Because of its wide extent and economic importance it has been used as the datum bed for structure contours in Tazewell County, where it is near the base of a thin sequence of sandstone beds approximately 200 ft above the Jawbone bed, 400 ft above the base of the Norton formation, and 1,800 ft above the Pocahontas No. 3 bed. The distribution of the bed is shown on the map (fig. 4).

The Raven bed is correlated with the Lower Douglas coal of West Virginia, and in Virginia is known by a number of local names: Jewell and Jewell Ridge in Tazewell and Buchanan Counties; Red Ash, Garden Hole, and "Imboden" (or False Imboden) in Buchanan County; and Garden Hole or "Imboden" in Russell, Dickenson, and Wise Counties. The coal is thickest in western Tazewell County, where the thickness ranges from 26 to 75 in. and averages 39 in., without partings. In southeastern Buchanan County the Raven bed generally occurs as two benches a few feet apart; where these benches are united, they contain 3 to 5 ft of minable coal. In this area the interval between the Jawbone and Raven beds is about 150 ft, and both the interval and the Raven bed thin toward the northwest. In Russell, southeastern Dickenson, and eastern Wise Counties, the Raven is 140 to 200 ft above the Jawbone and is generally thin, averaging about 3 ft in Wise County, somewhat less in Dickenson County, and 2 ft, split by partings, in Russell County.

The Raven bed has been identified in Pine Mountain but is not of commercial importance in that area at the present time.

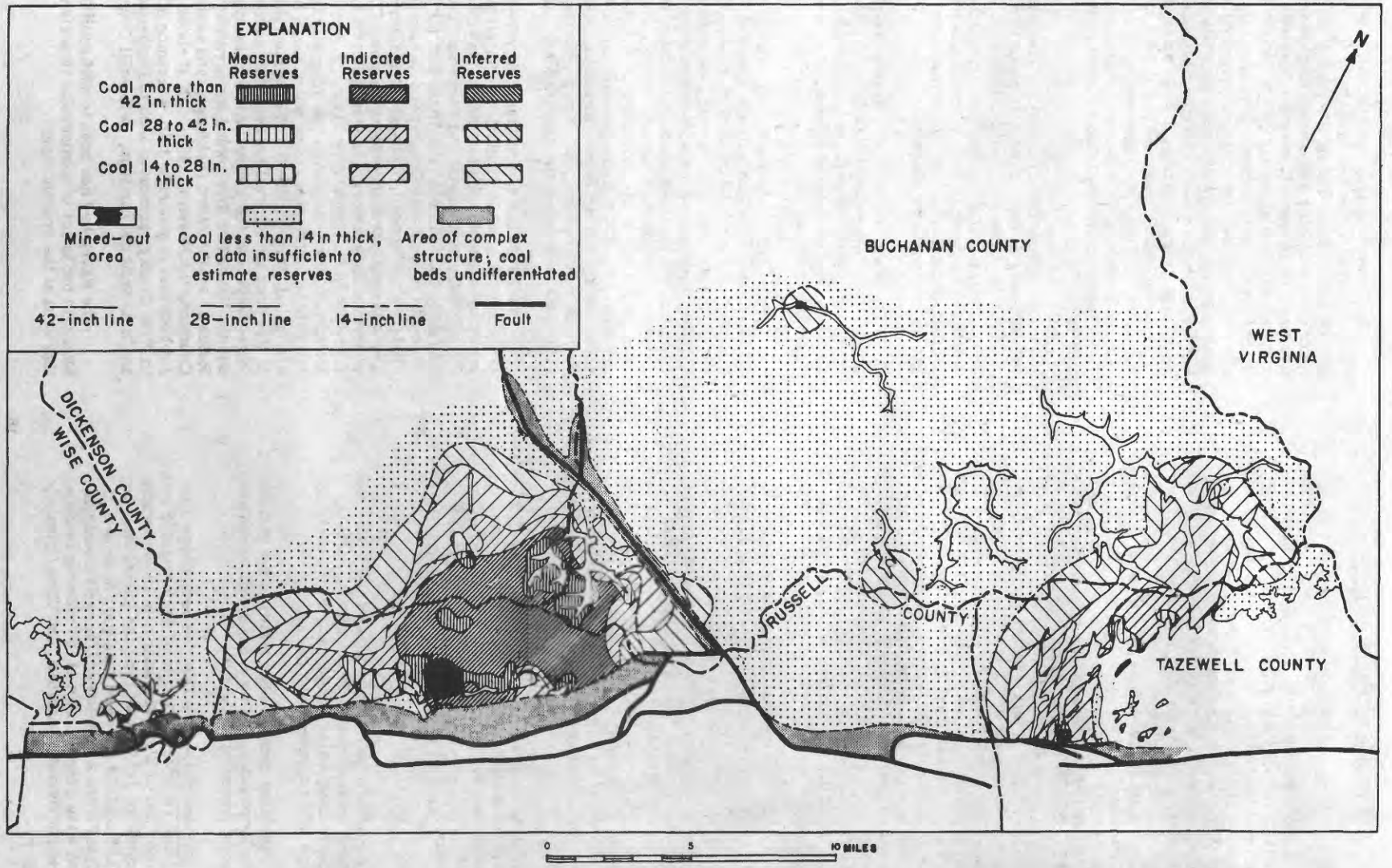

Figure 2.--Generalized map of the Tiller coal bed, Southwest Virginia field.

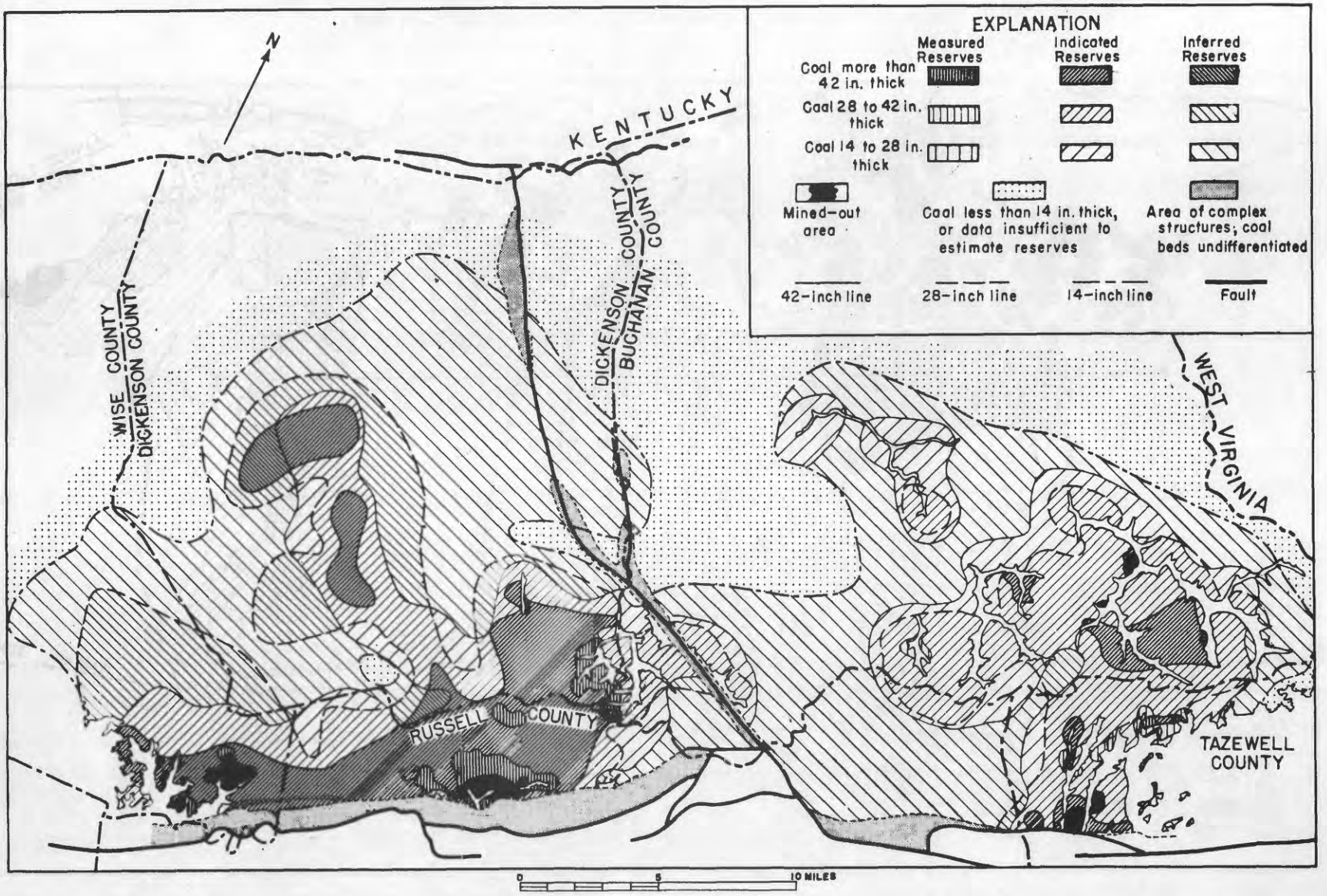

Figure 3.--Generalized map of the Jawbone coal bed, Southwest Virginia field.

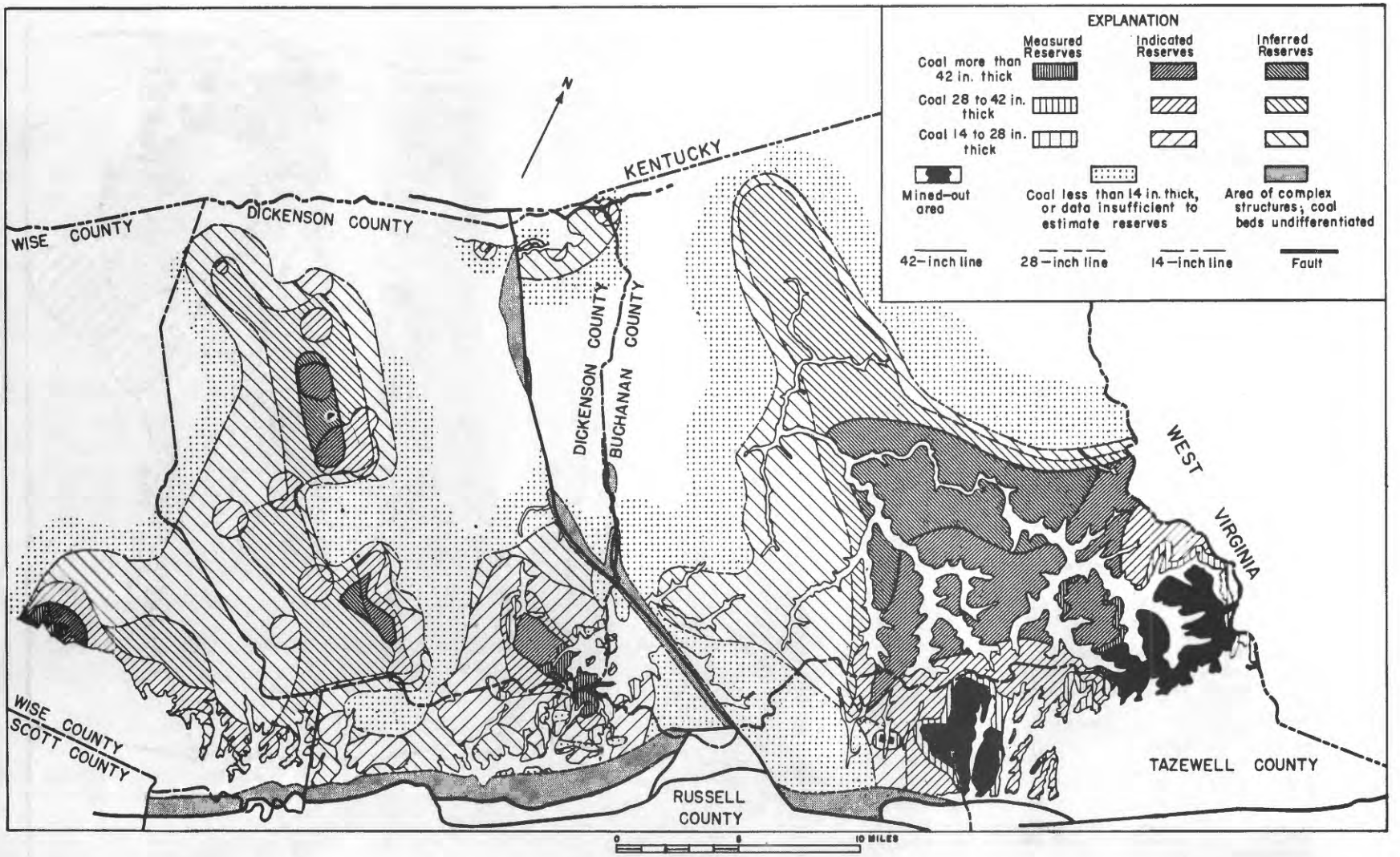

Figure 4.--Generalized map of the Raven coal bed, Southwest Virginia field.

The average of four analyses of samples, two from the Jewell Ridge No. 1 mine and two from the Raven Red Ash mine in Tazewell County, shows, on the as-received basis, 5.8 percent ash, 0.7 percent sulfur, and 14,310 Btu. The composite of two samples from the Bolling mine formerly operated in Wise County shows, on the as-received basis, 6.5 percent ash, 1.0 percent sulfur, and 13,940 Btu, (U. S. Bureau of Mines, 1944, pp. 74-77, 84-85). The coal from the Raven bed ranges in rank from high-volatile A to medium-volatile bituminous, and it possesses distinctive characteristics that have earned for it a high reputation as domestic fuel. It burns with no soot and very little smoke, holds heat for a long time, and burns almost intact until entirely consumed. The ash is low and is reddish pink in color, hence the local and trade name, "Red Ash." One highly desirable quality of the coal, when used in domestic stokers, is that the fusion temperature of the ash is high and clinkering in the stoker is reduced to a minimum.

The Raven bed is now being mined on an extensive scale in Buchanan and Tazewell Counties, and in 1950 accounted for approximately 12 percent of the Virginia production. It has been mined on a comparatively small scale in the past in Dickenson and Wise Counties, but no commercial operations are now being carried on in those counties.

Aily bed.--The Aily bed crops out in Russell, Dickenson, Buchanan, and Tazewell Counties. It is 100 to 160 ft above the Raven bed and ranges in thickness from 1.5 to 3.0 ft. It contains a small tonnage of indicated and inferred reserves but is of minor importance as compared with the underlying Raven or the overlying Kennedy coal.

Kennedy bed.--The Kennedy bed is correlated with the Douglas coal of West Virginia and is known locally as the Widow Kennedy, Harris, or Douglas. It crops out in a small area in southwestern Tazewell County, in the southeastern parts of Buchanan and Dickenson Counties, and in Russell and eastern Wise Counties. The distribution of the bed is shown on the map (fig. 5). Nearly everywhere in its outcrop area a coarse massive sandstone, which forms an excellent horizon marker, lies a few feet below the coal.

In Buchanan County the Kennedy coal is 2.5 to 4.0 ft thick. In Dickenson County the thickness varies from 1 to 10 ft within short distances, and in Russell and Wise Counties the coal is generally 2 to 4 ft thick. The bed thins to the north and in northwestern Buchanan and Dickenson Counties is of less than minable thickness or absent. Southwest of Russell Fork in Dickenson County, and over considerable areas in Russell and Wise Counties, the coal is badly crushed because of the proximity of the faults in those areas.

The Kennedy coal is of medium-volatile bituminous rank. The ash content varies from place to place, particularly in the crushed beds where it is impossible to separate the coal from foreign material in mining. The range of the ash, on the as-received basis, is 5.1 to 27.0 percent in analyses of eight specimen samples, six from Russell County and two from Dickenson County; the average sulfur content is 1.2 percent; and the heating value ranges from 10,380 to 13,960 Btu (U. S. Bureau of Mines, 1944, pp. 48-49, 70-71).

The total estimated reserves in all categories for the Kennedy bed are larger than those for any other bed in the State, but the measured reserves are relatively small. The bed was first mined in Wise County in 1893 but since that time has supplied only a small tonnage. Only one mine is known to be operating in the bed at the present time.

Caldwell bed.--About 50 ft above the Kennedy bed, in Tazewell County south of the Dry Fork anticline, a bed locally known as the Caldwell is exposed over a small area. It is from 2.0 to 5.5 ft thick and contains small reserves.

Big Fork bed.--About 150 ft above the Kennedy bed, in Tazewell County, and 30 to 100 ft above the same coal in Buchanan County, is the Big Fork bed, which ranges in thickness from 2 to 3 ft, but which crops out over small areas only. The Big Fork is essentially a local bed and is of little economic interest at the present time.

Lower Banner bed.--The Lower Banner bed is correlated with the Gilbert coal of West Virginia, and in Buchanan, Dickenson, and Russell Counties is known locally as the Cary bed. It crops out in the highest ridges of western Tazewell County and underlies most of the eastern half of Buchanan County at minable thickness. Stratigraphically it is 215 to 275 ft above the Kennedy bed in Buchanan County, 200 ft above the Kennedy in Dickenson and Russell Counties, and 180 to 225 ft above the same horizon in Wise County. In the vicinity of Keen Mountain, in Buchanan County, the coal is generally 4 to 6 ft thick and without partings. From this vicinity it thins in every direction and is divided by partings into benches over considerable areas. In the western half of Buchanan County it is generally less than 2 ft thick; but farther west, in Dickenson County, the coal is somewhat thicker, being generally 2 to 3 ft thick in the northwestern part of the county. It thickens noticeably to the southeast, however, and in southeastern Dickenson County and in Russell County it is 3 to 5 ft thick and has been mined in the vicinity of Dante, in Russell County, on a large scale. In eastern Wise County the Lower Banner bed is 30 to 45 in. thick, all clean coal.

In addition to the thinning of the bed between the Buchanan County and the Wise-Russell County districts, which is well shown on the bed map (fig. 6), the markedly different characteristics of coal from the two mining districts merit mention. The coal in the Wise-Russell County district is high-volatile A bituminous in rank. In Buchanan County, where the name "Cary" is used commercially, it is of medium-volatile rank but, like the lower Raven bed, possesses unusual qualities that enhance its market value. It is characteristically steel-gray rather than black in color and is harder than most coals of similar rank, so that a larger-than-normal proportion of lump coal is produced in mining. The distinctive color is attributed to the exceptionally large amount of attrital matter contained in the bed. The coal stands shipment well, and its storing qualities are comparable to those of the Pocahontas

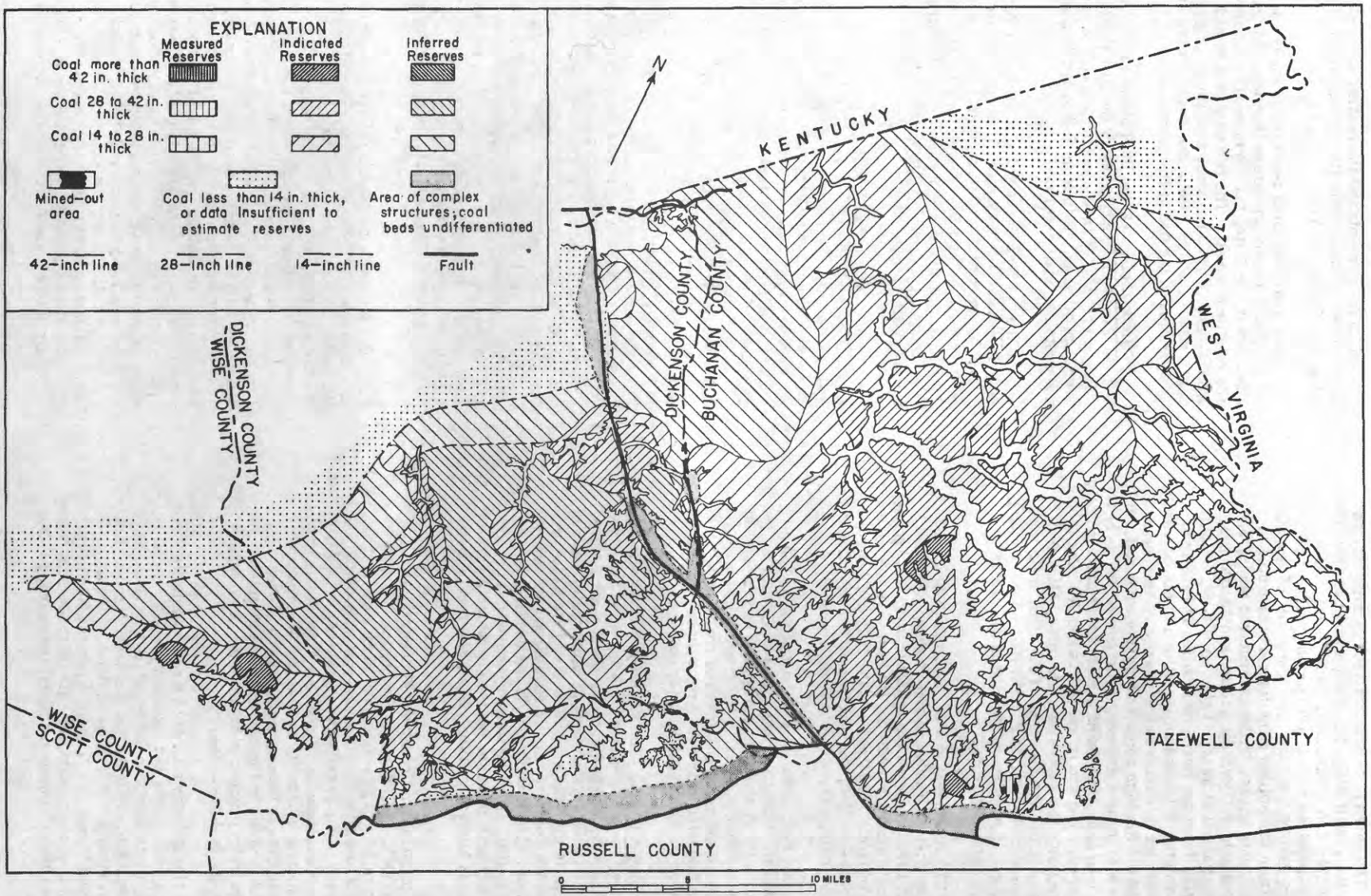

Figure 5.--Generalized map of the Kennedy coal bed, Southwest Virginia field.

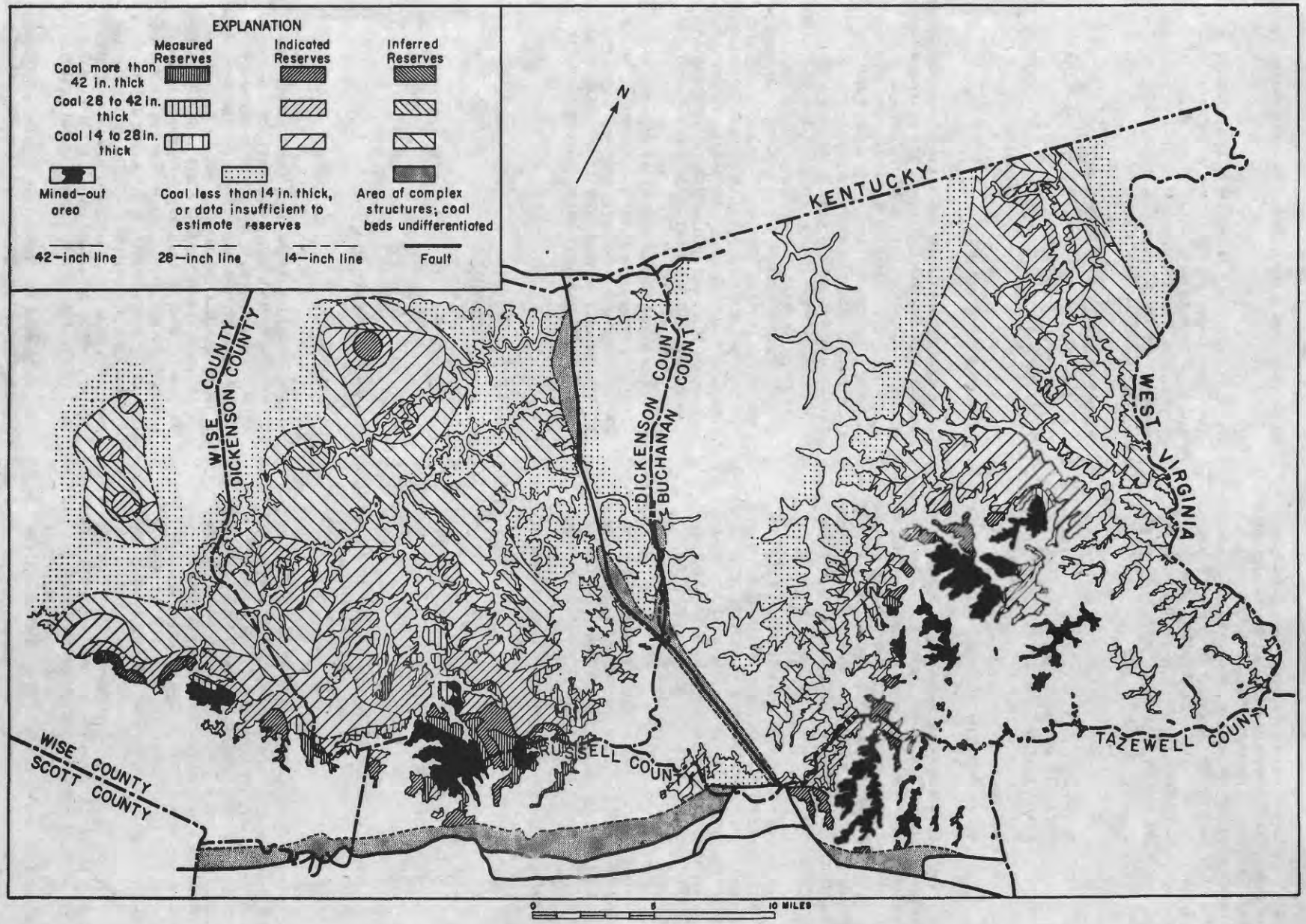

Figure 6.--Generalized map of the Lower Banner coal bed, Southwest Virginia field.

coals. As it is amost smokeless, large quantities are shipped to cities that have strict smoke abatement laws. An unusual characteristic is that the coal actually contracts on heating, whereas other coals of similar rank expand (Keystone Coal Buyers Manual, 1951, p. 319). The ash and sulfur contents vary considerably from place to place, but some of the coal is low enough in sulfur to permit its use as a blending coal in the manufacture of blast-furnace coke.

The range in composition of 10 samples from the Lower Banner or "Cary" bed in Buchanan County, and of seven samples from the Lower Banner bed in Russell and Wise Counties, all on the as-received basis, follow (U. S. Bureau of Mines, 1944, pp. 40-45, 70-73, 84-85):

	Buchanan County	Russell and Wise Counties
Moisture	1.6- 8.1	1.4- 3.1
Volatile matter	21.4-23.5	31.3-36.6
Fixed carbon	62.1-68.4	54.6-57.9
Ash	5.6- 8.8	5.7-11.2
Sulfur	0.6- 1.8	0.7- 1.1

Btu: Buchanan County, 13,120-14,280; Russell and Wise Counties, 13,030-14,300.

The different characteristics of the Lower Banner coal in Buchanan and in Wise and Russell Counties, coupled with the large area between the two districts where the coal is thin or absent, suggest the possibility that the Lower Banner and "Cary" may actually be different beds rather than one bed. The stratigraphic evidence, however, indicates that they are actually the same bed.

The Lower Banner or "Cary" is one of the most heavily mined beds in Virginia at the present time and in 1950 accounted for about 14 percent of the State's production. About three-fifths of the tonnage is produced in Buchanan County, the remainder in Russell, southern Dickenson, and eastern Wise Counties.

Upper Banner bed.--The interval between the Lower Banner bed and the next succeeding bed, the Upper Banner, increases southwestward from 30 to 80 ft in Buchanan County to 100 ft in Dickenson and Russell Counties and 150 ft in Wise County. The thickness of the coal also increases toward the southwest; in Buchanan County the bed is thin and lenticular and contains only small indicated and inferred reserves. In Dickenson and Russell Counties, on the other hand, it is one of the most important beds and is being mined extensively. Over a large area in the central part of Dickenson County the coal is 4 to 7 ft thick, and in another area in the northcentral portion of the same county it is 4 to 5 ft thick. Other areas of thick coal are in southeastern Dickenson County, in northwestern Russell County, and in Wise County close to the Dickenson County line; here the coal is 4 to 6 ft thick. Aside from the areas named above, the bed is generally divided into two or three benches by shale partings, which are generally so located that only one bench of the coal can be mined.

The Upper Banner coal is of high-volatile A bituminous rank. The range in composition, on the as-received basis, of several specimen samples from Dickenson, Russell, and Wise Counties is as follows (U. S. Bureau of Mines, 1944, pp. 46-51, 68-73, 84-87):

	Dickenson County	Russell County	Wise County
Moisture	1.6- 2.4	2.0- 3.4	2.0- 3.9
Volatile matter	30.7-33.3	34.0-37.4	30.4-34.3
Fixed carbon	58.5-63.1	51.9-56.9	52.0-60.3
Ash	4.1- 6.1	4.7- 9.5	4.6-14.4
Sulfur	0.7- 1.3	0.5- 0.9	0.5- 0.6

Btu: Dickenson County, 14,170-14,690; Russell County, 13,520-14,270; and Wise County, 12,660-14,400.

The general distribution of the Upper Banner bed is shown by the bed map (fig. 7). The bed ranks sixth among Virginia coal beds in total estimated tonnage in all categories but contains more measured reserves than any other bed in the State. It was first mined near Coeburn in 1893 and production from it has been almost continuous since that date. In 1950 the Upper Banner bed accounted for approximately 13 percent of the total Virginia production.

Splash Dam bed.--The Splash Dam bed is 60 to 90 ft above the Upper Banner and is exposed over large parts of Buchanan and Dickenson Counties. In Buchanan County it is one of the most persistent beds and crops out in most of the valleys, although at many localities the partings are thick enough to split the coal into benches and lower its commercial value. The reserves in Buchanan County are very large, however, accounting for more than two-thirds of the total estimated reserves for the bed, which ranks fourth among Virginia coals in total estimated reserves. Most of the other reserves in the bed are in Dickenson County, where the coal is 3 to 4 ft thick in the southern part of the county and 3.0 to 3.5 ft thick in the northern portion. In other areas the Splash Dam bed is generally thin or separated into benches by persistent partings. In Wise County the horizon of the bed is marked by only a thin bloom.

In general the Splash Dam coal thins noticeably from northeast to southwest and is characterized by

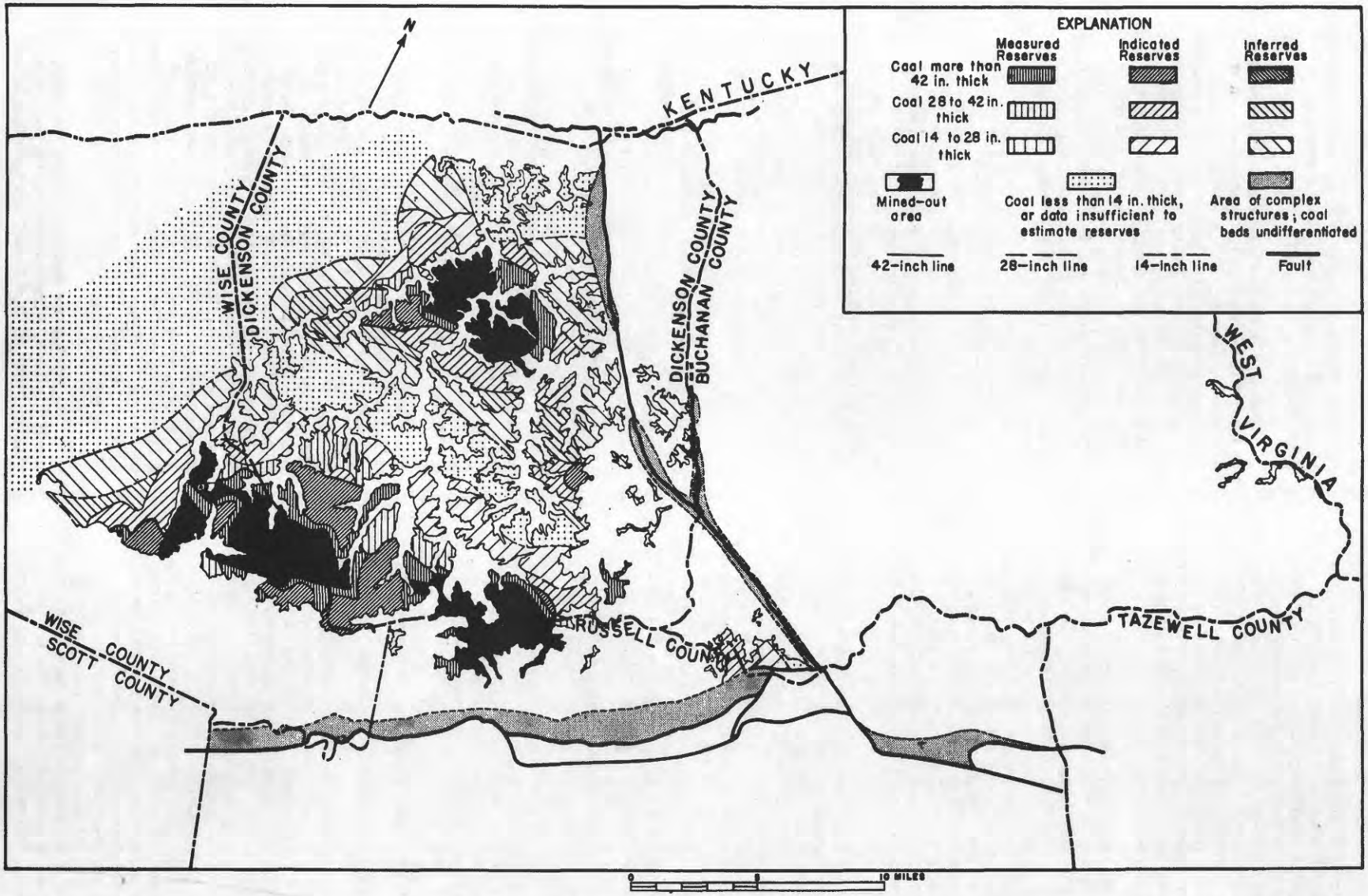

Figure 7.--Generalized map of the Upper Banner coal bed, Southwest Virginia field.

fairly large areas of relatively clean coal separated by areas in which the coal is thinner and contains so many partings that mining operations are not feasible. The bed is being mined at the present time in Dickenson and Buchanan Counties, and it accounted for about 8 percent of the annual production in 1950. The general distribution of the bed is shown on the bed map (fig. 8). As the data used in compiling this map were incomplete for certain areas, it is probable that some of the mined-out areas are shown smaller than they actually are.

Hagy bed.--The Hagy bed, the highest extensive coal in the Norton formation, is about 110 ft above the Splash Dam in Buchanan County, the interval diminishing to 100 ft in Dickenson County and 80 ft in Wise County. The coal is a few feet above a massive sandstone and averages 3 to 4 ft in thickness in Buchanan County but thins to the west, being only 1.7 to 2.7 ft thick in Dickenson and Wise Counties. The bed is known locally in Buchanan County as the War Eagle bed, and in Dickenson County as the Edwards(?) coal. It has been mined in Wise County in the past, but no commercial mines are now being operated in the bed.

Norton bed.--The Norton bed, the highest coal in the Norton formation, occurs only in Dickenson and Wise Counties, where it is 90 to 370 ft above the Hagy bed. Most of the reserves are in Wise County, where the bed is known locally as the Middle Norton, Yellow Creek, Gladeville, or Edwards coal; there it is as much as 40 ft below the Gladeville sandstone. In Dickenson County, where the local name Yellow Creek is used in some areas, the coal is directly under the Gladeville and therefore at the top of the Norton formation. The coal is 2.5 to 5.0 ft thick in the Guest River basin of Wise County but thins in every direction from that area. No coal at the horizon of the Norton bed is known in eastern Dickenson County or in Buchanan County.

The Norton coal is well suited for making coke and has been mined on a large scale for that purpose. A composite analysis, on the as-received basis, of three specimen samples from the Gladeville No. 3 mine in Wise County shows 7.5 percent ash, 1.4 percent sulfur, and 13,640 Btu (U. S. Bureau of Mines, 1944, pp. 86-87). The bed is being mined at the present time near Dorchester, in Wise County.

Reserves in the Norton formation

The total estimated reserves, excluding known mined-out areas, of coal in the Norton formation, as of January 1, 1951, were 7,249 million tons, of which 492 million tons were classed as measured reserves, 3,896 million tons as indicated reserves, and 2,861 million tons as inferred reserves. Of the total reserves of the Southwest Virginia field, the 11 beds in the Norton formation account for 67 percent of the tonnage in all categories, and for 62 percent of the measured reserves. One reason for the relatively large tonnages is that the Norton formation coals crop out across most of the Southwest Virginia field and underlie at minable depth much larger areas than the beds in either the underlying Lee formation or the overlying Wise formation. The largest reserves in the Norton formation are in Buchanan County, followed by Dickenson and Russell Counties. The distribution of reserves by counties, thickness of beds, and categories of reserves is given in tables 2, 3, 7, and 8.

The beds in the Norton formation that contain the largest reserves in all categories are, in order, the Kennedy, Jawbone, Raven, and Splash Dam. Those beds containing the largest measured reserves are the Upper Banner, Lower Banner, Splash Dam, Raven, Tiller, Jawbone, and Norton. The largest production in 1950 was from the Raven bed, followed by the Lower Banner, Upper Banner, and Splash Dam. The total annual production from the formation is on the order of 6 million tons, of which approximately half is from Buchanan County, with Dickenson, Russell, Tazewell, and Wise Counties following in the order named.

Coal beds in the Wise formation

Description

The complete section of the Wise formation is exposed in Virginia only in Lee and Wise Counties, the section being somewhat thicker in the former. Lee County also contains more coal beds in the formation, the total being 21 as compared to 17 in Wise County. Only the lower part of the formation, containing seven named coal beds, is exposed in Dickenson County; but in Buchanan County a somewhat thicker section, including nine named coal beds, crops out. The beds are discussed in the following paragraphs.

Dorchester bed.--The Dorchester bed, the lowest coal in the Wise formation, rests directly upon the Gladeville sandstone in Lee and Wise Counties, and 15 to 25 ft above that formation in Dickenson and Buchanan Counties. The bed is known by numerous local names, among which are, in Wise County, the Norton No. 2, Haskell No. 3, Gladeville, Esserville, and Big Dirt seam. In Russell, Dickenson, and Buchanan Counties the names Glamorgan and Gladeville are used widely; and Cedar and Little Cedar are employed locally in Buchanan County. (See pl. 3.) In Lee County, where the bed crops out in Stone Mountains, it is known locally as the Marcee or Cornett coal.

The Dorchester coal underlies the eastern half of Buchanan County and extends across Dickenson, Wise, and northwestern Russell Counties into Lee County. (See fig. 9.) At its northeasternmost outcrops in Buchanan County the bed is thin, averaging more than 1.7 ft in only a few places. It thickens somewhat toward the southwest, though it is generally not more than 2 ft thick in Dickenson County; but in the eastern part of Wise County it is more than 3 ft thick, and in the vicinity of Norton and westward along the Powell River the bed contains an average of 54 in. of coal and as much as 70 in. in some measured sections. A thin layer of dirty coal immediately under the roof is characteristic of the Dorchester bed over much of its outcrop area, and the bed may carry a 1- to 6-inch streak of clay and dirty coal 18 to 21 in. below the top.

The Dorchester coal is excellent for coking and is now being mined extensively for that purpose. Several mines in Wise County are operating in the

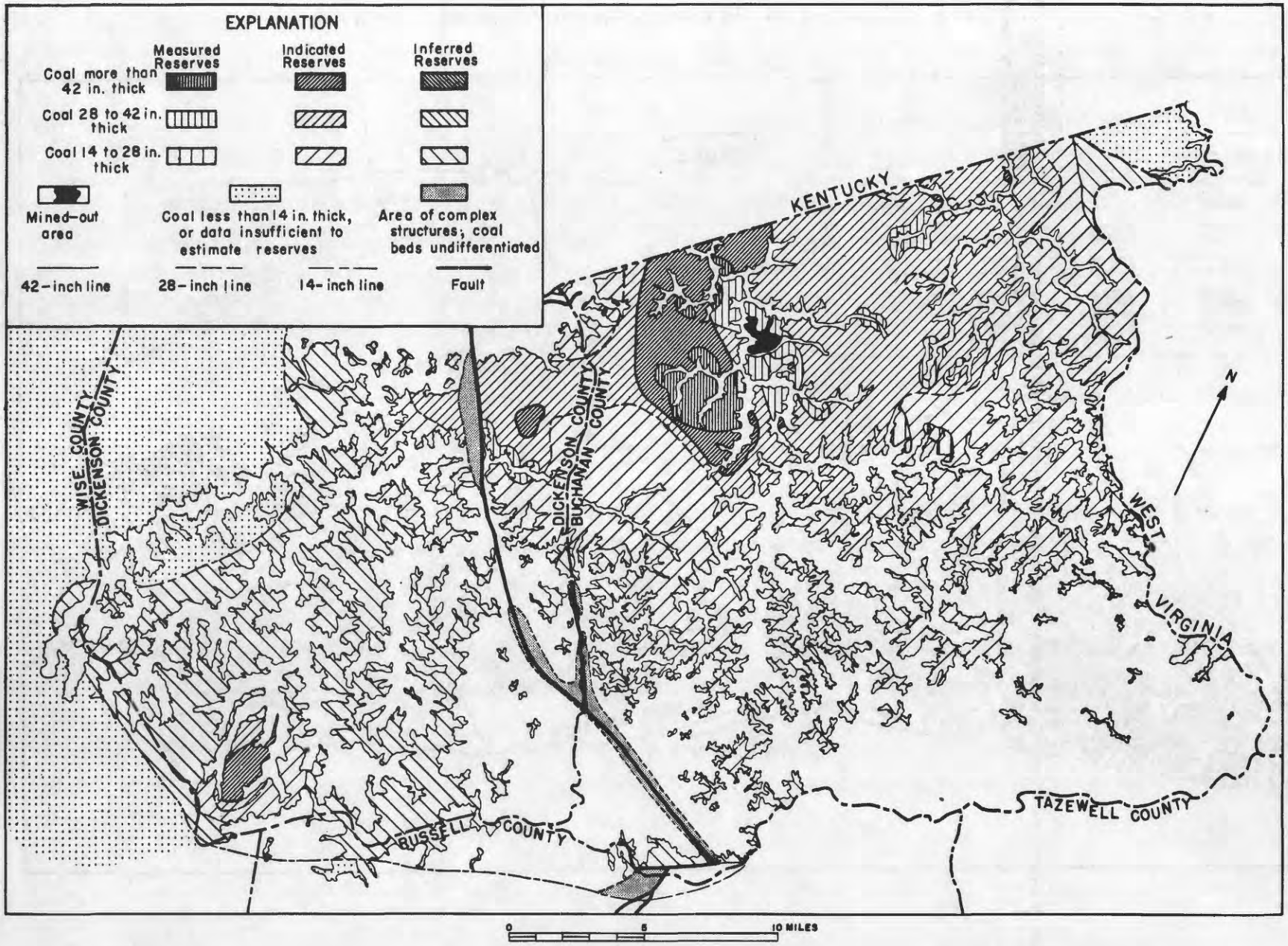

Figure 8.--Generalized map of the Splash Dam coal bed, Southwest Virginia field.

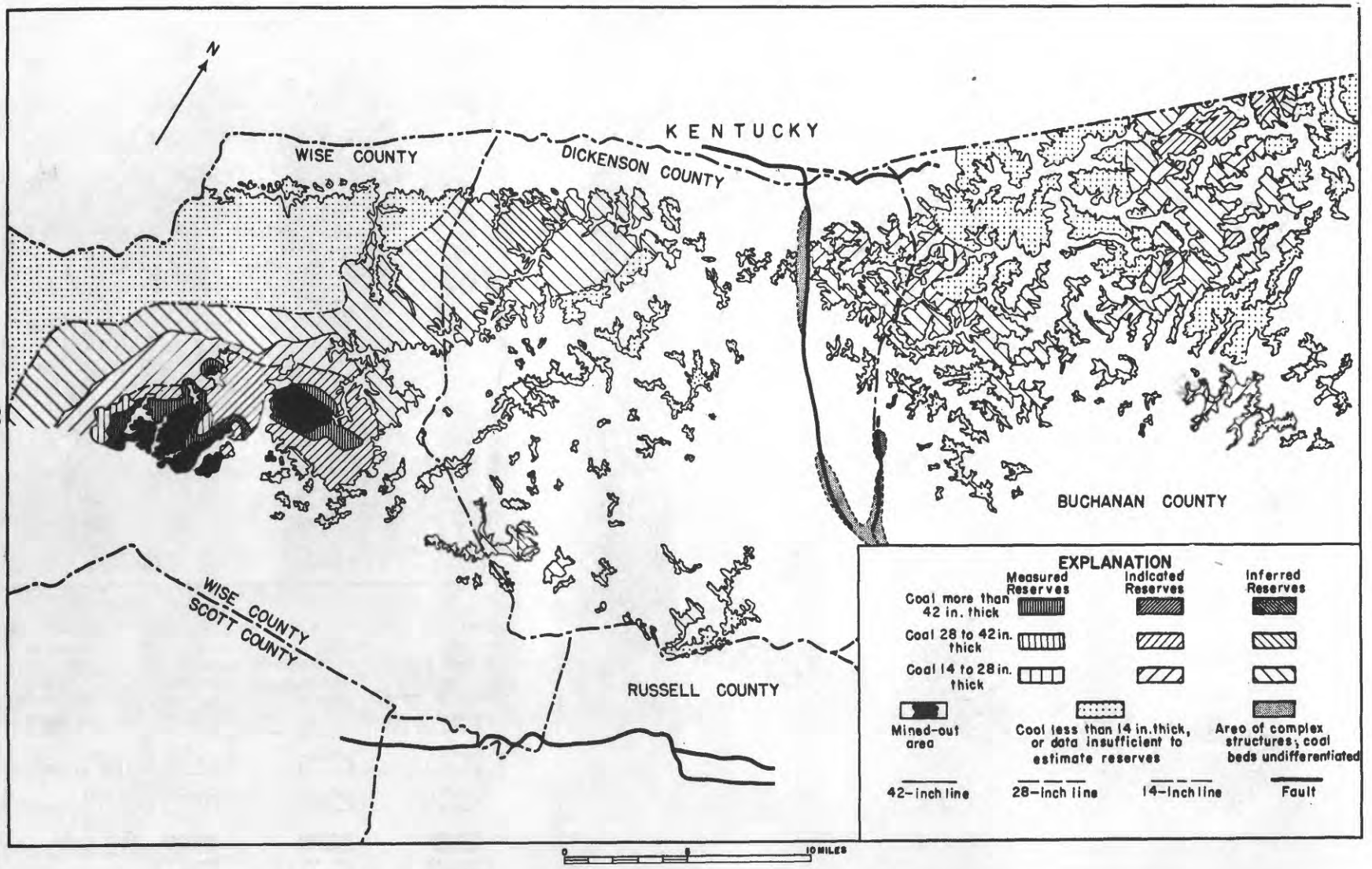

Figure 9.--Generalized map of the Dorchester coal bed, Southwest Virginia field.

bed at the present time. The range in composition, on the as-received basis, of 12 specimen samples from the Dorchester bed in Wise County is as follows (U. S. Bureau of Mines, 1944, pp. 78-85):

Moisture	2.0- 5.3
Volatile matter	31.8-36.1
Fixed carbon	53.4-59.7
Ash	4.1-10.2
Sulfur	0.8- 2.6

Btu: 13,270-14,380

Lyons bed.--The Lyons bed is 65 to 75 ft above the Dorchester in Lee County, the interval decreasing to 40 ft in Wise County and 60 ft in Dickenson County. The bed apparently thins to extinction in northeast Dickenson County and is not present in Buchanan County. Known locally as the Thompson Fraley, or Haskell No. 3 Marker bed, it is thickest in Wise County, which contains most of the relatively small reserves. There the coal is 1.3 to 3.6 ft thick; it thins to the northeast and southwest, the maximum thicknesses being 2.5 ft in Dickenson County and 2.7 ft in Lee County.

The Lyons bed has been mined on a small scale in Wise County, but no mines are now being operated commercially in the bed.

Blair bed.--The Blair bed is about 60 ft above the Dorchester in Buchanan County and 20 ft or less above the Lyons in Dickenson County, where the Blair coal is generally thin. In Wise County the interval between the Lyons and Blair beds is 50 to 80 ft and in Lee County 65 to 75 ft. Local names for the bed are: Bends Creek in Buchanan County; Norton No. 7, Haskell No. 1, and No. 3 bed in Wise County; and Bentley in Lee County. The coal is 1.5 to 4.0 ft thick throughout its outcrop area, except in Dickenson County, where the maximum thickness is about 2.5 ft. In Wise County the coal is 3.5 to 4.0 ft thick. It has a hard clear structure and as a rule is low in sulfur and ash. A composite analysis of three samples from the Esser No. 4 mine in Wise County shows, on the as-received basis, 5.2 percent ash, 0.9 percent sulfur, and 14,260 Btu (U. S. Bureau of Mines, 1944, pp. 80-81).

The Blair bed is being mined by both underground and stripping methods at several localities in Wise County and in 1950 produced about 6 percent of the total Virginia production.

Eagle bed.--The Eagle bed, known also as the Middle War Eagle, is 45 to 50 ft above the Blair bed in Buchanan and Dickenson Counties; the horizon in Wise and Lee Counties contains no coal. The bed is 1.3 to 5.0 ft thick in Buchanan County, which contains more than 90 percent of the estimated reserves, and 1.3 to 4.7 ft thick in Dickenson County. It has been mined to some extent in the past, but no commercial operations are now being carried on in the bed. The total reserves are relatively small.

Clintwood bed.--The Clintwood bed, one of the most widespread and important beds in the Wise formation, crops out across the Southwest Virginia field from Buchanan County to Lee County. In Lee County the bed is known locally as the North Fork or No. 3 bed, in Wise County as the Norton No. 8 or Big Dorchester, and in Dickenson and Buchanan Counties as the Matewan or Feds Creek coal. In Lee County the Clintwood is 125 to 150 ft above the Blair bed and 20 ft below the Addington sandstone member of the Wise formation, which is persistent in the southwestern part of the field. In Wise County the interval between the Blair and Clintwood beds is about 70 ft, and in Dickenson and Buchanan Counties it ranges from 70 to 95 ft.

The Clintwood coal crops out in the higher ridges in the northwestern and northcentral parts of Buchanan County, where it ranges in thickness from 2.5 to 7.0 ft and over large areas is free from partings. In the mines operating in Buchanan County the coal is generally 58 to 65 in. thick. In Dickenson County the bed is thickest south of the Pound River and west of the town of Clintwood, where it contains 4 to 11 ft of coal. In Wise County it crops out in many of the valleys south of the village of Pound and is as much as 8.3 ft thick as far west as Indian Creek. South and west of this area the bed is split into benches that are as much as 20 ft apart; but in the southcentral part of the field the bed contains 4 to 5 ft of coal and a 1- to 5-foot parting. In Lee County the Clintwood bed is exposed from the vicinity of St. Charles northeast into Wise County. The thickness there is variable, but the bed generally contains 3.5 ft or more of coal and reaches a maximum thickness of more than 8 ft. In some areas it contains one shale parting, 3 to 12 in. thick, in the lower part of the bed.

The distribution of the Clintwood bed is shown on the bed map (pl. 2,A). The range in composition among five analyses of samples from two mines in Buchanan County, on the as-received basis, is as follows (U. S. Bureau of Mines, 1944, pp. 38-39):

Moisture	1.9- 2.1
Volatile matter	31.4-32.1
Fixed carbon	58.7-61.9
Ash	4.4- 7.2
Sulfur	0.7- 1.6

Btu: 14,070-14,530

A specimen sample from the Virginia Blue Gem No. 1 mine in Lee County shows, on the as-received basis, the following composition (U. S. Bureau of Mines, 1944, pp. 56-57):

Moisture	3.2
Volatile matter	38.5
Fixed carbon	56.1
Ash	2.2
Sulfur	1.7

Btu: 14,060

The Clintwood coal is being mined on an extensive scale in Buchanan and Dickenson Counties and on a smaller scale in Wise County. More coal is produced from this bed than from any other bed in Virginia, the production in 1950 being about 18 percent of the total for the State. A large tonnage is recovered from the bed by strip-mining in Dickenson County.

Addington and Rocky Fork beds.--The Addington and Rocky Fork are local beds that are exposed in small areas in Wise County and that have not been correlated with any of the more widely exposed beds. The Addington bed is 20 to 40 ft above the Clintwood and is 1.3 to 3.5 ft thick; it has been mined in the past but information on areas that have been mined out is not available. The Rocky Fork bed is 40 ft above the Addington and is 1.7 to 2.0 ft thick; it has been mined on a small scale. Reserves in the Addington and Rocky Fork beds are very small.

Imboden or Campbell Creek bed.--The Imboden bed of Wise and Lee Counties extends northeastward into Dickenson and Buchanan Counties, where the accepted name of the bed is the Campbell Creek. Local names are: in Lee County, the No. 1 bed; in Wise County, the Lower Bolling and Lower Campbell Creek bed; in Dickenson and Buchanan Counties, the Imboden, Upper War Eagle, Freeburn, Burnwell, Warfield, Lower Elkhorn, Lower Marrowbone, and No. 2 Gas bed.

The Imboden, or Campbell Creek bed, lies above one of the thickest barren intervals in the Southwest Virginia coal field; the interval between the Imboden and the underlying Clintwood is 260 to 300 ft in Lee County, 300 to 500 ft in Wise County, about 270 ft in Dickenson County, and 225 ft in Buchanan County. The bed is thickest in the western part of Wise County, where at one locality it is nearly 10 ft thick and where over a large area it averages 5 to 6 ft. In the northern part of the county the bed locally contains areas of crushed coal known as "curly" coal and includes one to eight partings of shale, rash, clay, dirty coal, and sulfur ranging from 1/4 in. to 34 in. in thickness. In the Pound River drainage basin of Wise County the coal is 1.5 to 4.0 ft thick; in Lee County the maximum thickness is about 5.0 ft. In Dickenson and Buchanan Counties where, as stated above, the bed is usually known as the Campbell Creek, the range of thickness is 2.5 to 3.3 ft. As the bed crops out only in high land in these counties, reserves in the Dickenson-Buchanan part of the field are small. Distribution of the bed is shown on the bed map (pl. 2, B).

The Imboden is highly regarded as a coking coal and is mined primarily for that purpose. The range in composition of several samples from mines in Wise County is, on the as-received basis, as follows (U. S. Bureau of Mines, 1944, pp. 78-85):

Moisture	1.8- 2.8
Volatile matter	33.0-35.7
Fixed carbon	53.6-61.3
Ash	1.2-10.4
Sulfur	0.6- 0.9

Btu: 13,310-14,450

The average of two analyses, on the as-received basis, of samples from the Penn Lee No. 1 and No. 4 mines in Lee County, is (U. S. Bureau of Mines, 1944, pp. 56-57):

Moisture	2.9
Volatile matter	38.0
Fixed carbon	54.4
Ash	4.8
Sulfur	0.8

Btu: 13,720

Stone Creek bed.--The Stone Creek is exposed in a small area in the southwestern part of the coal-bearing portion of Lee County, where the maximum thickness of the coal is 2.2 ft. The reserves in this uncorrelated bed are very small.

Kelly bed.--The Kelly bed is 30 to 70 ft above the Imboden in Lee County and 20 to 40 ft above the same bed in Wise and Dickenson Counties; it does not extend as far northeast as Buchanan County. The coal has a maximum thickness of 4.8 ft in Wise County, where it contains fairly large reserves. In Lee and Dickenson Counties the reserves are small. The bed is known locally in Wise and Buchanan Counties as the Upper Bolling or Five-Foot bed and is the highest coal exposed in Dickenson County. It is being mined in Wise County.

Little Alma and Alma beds.--The Little Alma bed, less than 2 ft thick, and the Alma bed, 2.5 ft thick, crop out in small areas in northeastern Buchanan County. The Little Alma bed is 100 ft above the Campbell Creek bed and the Alma is 50 ft above the Little Alma. No reserves have been calculated for either of these beds.

Lower Cedar Grove bed.--The Lower Cedar Grove bed, also known as the Lower Thacker, is 60 ft above the Alma bed, 210 ft above the Campbell Creek, and is exposed only in the highest ridges in the northeastern part of Buchanan County. The coal is 1.5 to 8.0 ft thick, and the bed contains small indicated and inferred reserves.

Cedar Grove bed.--The Cedar Grove bed is known also as the Red Jacket, Thacker, and Upper Thacker, which names are used for the bed in West Virginia. In Virginia the bed crops out in a relatively small area in the higher parts of northeastern Buchanan County, about 80 ft above the Lower Cedar Grove. It is the highest coal in Buchanan County and is now being mined near the village of Ward, where it is 12 ft thick; it averages 10 ft over much of its outcrop area.

At the time reserves in the Cedar Grove bed were calculated complete information on recent operations in the coal was not available, and known points of information were so widely spaced that it was necessary to classify the reserves as indicated and inferred. It is likely that with a small amount of additional information it would be possible to reclassify a large part of the indicated reserves in the bed as measured coal.

Pinhook bed.--The Pinhook bed crops out in northeastern Lee County and in adjacent parts of Wise County, where it is known locally as the Meadow bed. The coal is 20 to 48 in. thick over a small area but is divided by many partings and is therefore difficult to mine, though the quality of the coal itself is good. The bed contains small reserves that are not being mined at the present time.

Lower St. Charles bed.--The Lower St. Charles bed, originally known in Lee County as the No. 2 bed, crops out in the southwestern part of the county in the "Pocket" district. Stratigraphically the bed is 150 to 250 ft above the Imboden bed; the coal is thin, being nowhere more than 3 ft thick and at most localities ranging from 1.7 to 2.5 ft. It has not been mined except for local use and contains only small reserves.

Upper St. Charles bed.--The Upper St. Charles bed of Lee County, formerly known as the No. 2A bed, probably should be correlated with the Lower Standiford coal of Wise County, though the outcrop has not been traced across the county line. The bed is 200 to 300 ft above the Imboden coal in Lee County and about 260 ft above the same bed in Wise County; it is 30 to 65 ft above the Lower St. Charles in the latter's area of occurrence. The Upper St. Charles bed is only 2.2 to 3.0 ft thick in Lee County and even less in Wise County. It has been mined in the past in Lee County, where it contains small reserves. No reserves of minable thickness are known in Wise County.

Harlan or Upper Standiford bed.--The bed known in Lee County as the Harlan or Jackrock bed, and in Wise County as the Upper Standiford bed, is also known locally in both counties as the Wilson coal. Although outcrops are not continuous from one county to the other, there is little doubt as to the continuity of the two coals and they are here discussed as one bed, which is 30 to 60 ft above the Upper St. Charles in Lee County and about 20 ft above the Lower Standiford in Wise County. The coal is fairly thick across the entire area of occurrence, ranging from 2.7 to 6.5 ft and averaging about 4 ft. It appears to be thickest--about 6 ft including partings--in northwestern Lee County and thins both northeast and southwest from that area. It generally contains one or more partings of pyritiferous shale or bony coal that range in thickness from 1 in. to more than a foot. Analyses show a large proportion of sulfur; one analysis of a sample from the Puckett Creek No. 1 mine in Lee County shows, on the as-received basis, 8.6 percent ash, 2.8 percent sulfur, and 13,040 Btu (U. S. Bureau of Mines, 1944, pp. 58-59).

The Harlan bed has been mined on a fairly large scale in Lee County, though no mines are being operated commercially in the bed at the present time. So far as is known, the bed has not been mined in Wise County.

Kirk bed.--The Kirk or No. 4 bed is known only in the southwestern part of Lee County, where it is 150 to 200 ft above the Harlan coal. It averages less than 1.5 ft in thickness and in most places is so divided by partings that it is not economical to mine. It contains only small reserves and has been mined only on a small scale.

Taggart Marker or "B" bed.--The Taggart Marker, or "B" bed, is 150 ft above the Upper Standiford in Wise County and about the same distance above the Kirk bed in Lee County. It is 30 to 50 ft below the Taggart bed in Wise County and 15 to 75 ft below that bed in Lee County. The Taggart Marker is 18 to 40 in. thick in Lee County, and, where it is now being worked in Wise County, is 39 to 42 in. thick.

The Taggart Marker is generally worked in conjunction with the overlying main bed, and present operations in the seam will be discussed under the Taggart bed. An additional reason for this treatment is that there is some doubt as to whether the bed known as the Darby or No. 5 coal in Lee County, which has usually been correlated with the Taggart, is not actually the Taggart Marker.

Taggart bed.--The Taggart bed is 30 to 75 ft above the Taggart Marker in Lee County and 30 to 50 ft above the same horizon in Wise County. The coal has many local names: No. 5, Darby, McConnell, Forty-two inch, Keokee, Roda, and "C" bed. It underlies a large area in Wise and Lee Counties at thicknesses of 2.8 to 6.5 ft but locally contains many partings that may total as much as 1 ft in Wise County and 5 in. in Lee County.

The average heating value of the Taggart coal is greater than that of any other coal in Wise County, and the bed now ranks as one of the most important in Virginia. In addition to being widely used for general industrial, railroad, and domestic purposes, it has long held a prominent place in the gas and coking markets. At least ten mines are now operating in the Taggart and Taggart Marker beds.

Analyses, on the as-received basis, of several samples from mines in Lee and Wise Counties show the following range in composition for the Taggart bed (U. S. Bureau of Mines, 1944, pp. 54-59, 78-83):

	Lee County	Wise County
Moisture	2.8- 4.3	1.5- 2.8
Volatile matter	34.1-38.4	32.8-36.7
Fixed carbon	55.4-58.5	58.5-61.6
Ash	1.7- 4.6	2.2- 3.9
Sulfur	0.4- 0.8	0.6- 0.8
Btu:	13,720-14,180	14,580-14,810

Low Splint bed.--The Low Splint bed, known locally in Lee County as the No. 6 or Creveling bed and in Wise County as the Buck Knob bed, is 200 to 400 ft above the Taggart bed. It is 4.5 to 5.5 ft thick over a large area in Lee County but thins to the northeast, averaging 2.5 to 3.5 ft of coal and 6 to 12 in. of partings in Wise County. The bed contains one or more shale partings at nearly all exposures, and in the few localities where the coal is very thick the thickness of the partings generally increases also. Despite its name, the bed carries only a small proportion of true splint coal. A composite analysis of two samples from the Virginia Iron, Coal, & Coke Co. No. 2 and No. 3 mines in Lee County

shows, on the as-received basis (U. S. Bureau of Mines, 1944, pp. 58-59):

Moisture	3.5
Volatile matter	35.2
Fixed carbon	53.2
Ash	8.1
Sulfur	1.1

Btu: 13,070

Commercial operations in the Low Splint bed are concentrated in Lee County, which produces a relatively small tonnage from the bed.

Phillips bed.--The Phillips bed, also known as the No. 7, is correlated with the Fire Clay coal of Kentucky and West Virginia and has been referred to as the Dean bed in reports of the Kentucky Geological Survey. It is about 260 ft above the Low Splint bed in Wise County, where the coal is about 2 ft thick without partings; in Lee County the interval above the Low Splint varies from 250 to 400 ft, and the coal reaches a maximum thickness of 48 in. The coal generally contains a clay parting 2 to 12 in. thick in the lower part of the bed and locally has other partings of bone, clay, or shale. A composite analysis of two samples from the Phillips bed at the Benedict No. 1 mine in Lee County shows, on the as-received basis (U. S. Bureau of Mines, 1944 pp. 56-57):

Moisture	3.7
Volatile matter	35.5
Fixed carbon	52.8
Ash	8.0
Sulfur	0.8

Btu: 13,020

All of the past and present-day commercial operations in the Phillips bed are in Lee County. In Wise County the bed is too thin for economic exploitation.

Gin Creek bed.--The Gin Creek coal is confined to Lee County, where it is often referred to as the No. 8 bed. It is 150 to 250 ft above the Phillips bed and is exposed high in the flank of Little Black Mountain, where it is 2.5 to 4.0 ft thick. Its area of occurrence is small and it contains only small reserves. It has never been mined on a commercial scale.

Wax bed.--The occurrence of the Wax or No. 9 coal is confined to Lee County, where it is 75 to 125 ft above the Gin Creek bed in the same general outcrop area as that coal. It is as much as 5 ft thick and locally contains a parting near the base. It has been mined for local use and contains small reserves.

Pardee bed.--The Pardee coal underlies narrow strips in Lee and Wise Counties close to the Virginia-Kentucky State line. It is correlated with the Limestone and Smith coals of Kentucky; in Lee County it is known locally as the No. 10 bed. In Wise County it is also called the Haddix or Parsons bed. It is 40 to 50 ft above the Wax bed and 275 to 400 ft above the Phillips bed in Lee County, and about 400 ft above the Phillips in Wise County. The coal is 9 to 11 ft thick in Wise County, which contains most of the estimated reserves; but the coal may contain partings of clay, shale, sulfur, rash, or bone coal ranging up to several inches in thickness. In Lee County the coal is thinner, ranging from 4.5 to 5.0 ft in thickness, and usually carrying a thin clay parting in the upper part of the bed and a thin shale parting in the lower part.

A composite analysis of six samples from the Pardee bed at the Pardee No. 1 mine in Wise County shows, on the as-received basis (U. S. Bureau of Mines, 1944, pp. 82-83):

Moisture	2.5
Volatile matter	35.2
Fixed carbon	56.1
Ash	6.2
Sulfur	0.9

Btu: 13,750

In the past the Pardee bed has been mined on a fairly large scale in both Lee and Wise Counties, but no commercial operations in the bed are now being carried on.

Morris bed.--The Morris bed, the No. 11 bed of Lee County, is correlated with the Cornett bed of of Kentucky. It is 350 to 650 ft above the Pardee coal, cropping out in small areas in Wise and Lee Counties. In the former county it is 3.0 to 5.5 ft thick, in the latter only about 3.0 ft. It thus differs from most of the underlying beds, which reach their greatest thickness in Lee County and thin toward the northeast. The Morris bed has been mined on a small scale only in the past but is now being developed commercially in Lee County.

High Splint bed.--The High Splint bed, the No. 12 coal of Lee County, is the highest minable coal cropping out in Virginia. In Wise County, which contains most of the reserves, the bed is directly under the Harlan sandstone; in Lee County it is separated from that unit by 5 to 25 ft of shale and sandstone of the Wise formation. In both counties it is 70 ft above the Morris coal.

The High Splint is a true splint coal, usually without partings, and consistent in composition. It is 4 to 5 ft thick at most of its exposures. As it crops out high in the ridges, the area underlain by the bed is limited and the reserves are correspondingly small.

Reserves in the Wise formation

The estimated remaining reserves of coal in the Wise formation as of January 1, 1951, were 2,738 million tons, of which 270 million tons were classed as measured reserves, 1,336 million tons as indicated reserves, and 1,132 million tons as inferred reserves. The largest total reserves are, in order, in the Clintwood, Dorchester, Imboden, Blair, and Eagle beds; the greatest measured reserves in the Taggart, Clintwood, Dorchester, Pardee, and Low Splint beds. The lower coals in the formation crop out across much of the Southwest Virginia field; but the higher beds, including those that are now being mined most extensively, are largely confined to Wise and Lee Counties. The present

production is largely from the Taggart and Taggart Marker and from the Imboden, Dorchester, and Clintwood beds.

THE VALLEY FIELDS

General features

The Valley coal fields are in the Valley of Virginia in the western part of the State, mostly in Botetourt, Roanoke, Montgomery, Pulaski, Wythe, Bland, and Smyth Counties, where nine small fields are scattered over an area about 100 miles long northeast and southwest and not more than 20 miles wide. Another field is about 100 miles to the northeast, in northern Augusta and southern Rockingham Counties. The locations of the 10 Valley fields are indicated on the index map (fig. 1); the Montgomery-Pulaski-Bland-Wythe County area, which contains the estimated reserves of the Valley fields, is shown on a larger-scale map (fig. 10).

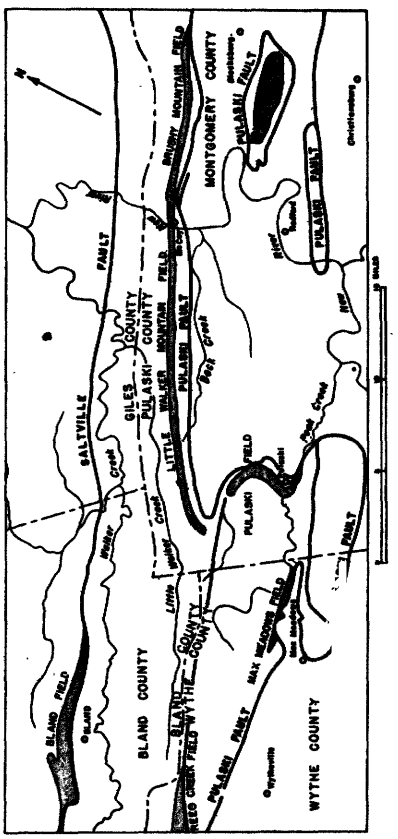

Figure 10.--Sketch map of coal fields in Montgomery, Pulaski, Wythe, and Bland Counties, Va. (Adapted from M. R. Campbell, The Valley coal fields of Virginia: Virginia Geol. Survey Bull. 25, 1925.)

The Valley of Virginia is part of the Valley and Ridge province, which lies east of the Appalachian Plateau from Alabama to Pennsylvania. The topography is essentially a series of parallel valleys and ridges trending northeast, the heights of the ridges depending largely on the relative resistance to erosion of the rocks of which they are composed. The region contains much excellent farm land, and most of the towns have sufficient industry to support a well-balanced community. In 1950 the total population of Montgomery, Pulaski, Bland, and Wythe Counties, was 96,128. The largest towns in that area are Pulaski, which has 9,136 inhabitants; Radford, 8,979; and Wytheville, 5,405. Blacksburg, in Montgomery County, is the seat of the Virginia Polytechnic Institute and is the closest town to the Price Mountain and Brushy Mountain coal fields, which have been by far the largest producers of coal in the Valley. Most of the area is drained by the New River, which flows northwest between Montgomery and Pulaski Counties and drains into the Ohio River in West Virginia.

Montgomery, Pulaski, Bland, and Wythe Counties are served by the Norfolk and Western and the Virginian Railways and have excellent highway transportation over U. S. No. 11 and a number of other good Federal and State roads. The other coal fields, in Augusta, Rockingham, and Smyth Counties, also have good rail and highway transportation.

Stratigraphy

According to Campbell (1925) the rocks exposed in the Valley coal fields form a sequence about 15,000 ft thick, ranging in age from Cambrian to Mississippian. The units composing the sequence vary in thickness from place to place, but as a general rule the beds thin from the northeast. The lower half of the sequence consists largely of dolomite and limestone, mostly of Cambrian age; the upper half is predominantly sandstone and shale of Ordovician, Silurian, Devonian, and Mississippian ages. The coal-bearing unit is the Price formation of Mississippian age, which immediately overlies the Chemung formation of Devonian age. The Chemung consists of gray and green shale and thick-bedded sandstone and reaches its maximum thickness in Virginia, about 2,000 ft, north of Bland, in Bland County.

The greatest known thickness of the Price formation, 1,700 to 1,800 ft, is in Price Mountain, Montgomery County. In western Bland County and eastern Smyth County, at the approximate southwest end of the Valley coal fields, the Price formation is only 600 ft thick. It consists throughout the coal fields of conglomerate, sandstone, shale, and coal. The conglomerate, named the Cloyd conglomerate member by Butts (1940), occurs locally at the base of the formation southwest of the New River; at other localities the basal portion of the formation consists of a purplish sandstone. The Price grades upward into the Maccrady shale, a characteristically red unit that reaches a maximum thickness of about 800 ft near the New River. The Maccrady is the youngest unit exposed in the Valley fields.

Structure

Throughout the Valley of Virginia the strata in general have been folded into northeast-trending synclines and anticlines, and at many places the folds have been overturned and faulted, generally toward the northwest. The resulting overthrust faults, which have placed older strata over younger beds, are a characteristic feature of the Valley.

The most important structural feature in the Valley coal fields is the Pulaski fault, a major overthrust extending from the vicinity of Greenville, Augusta County, southwest at least as far as

Marion, Smyth County, where it apparently splits into several minor faults. The fault plane dips to the southeast at low angle; Butts (1940) suggested that the horizontal displacement of the strata along this fault may be as much as 20 miles. In Montgomery, Pulaski, Bland, and Wythe Counties, where the fault influences the coal outcrops to a large extent, the rocks above the fault plane are mostly of Cambrian age and those below range from Ordovician to Mississippian. Strata both above and below the fault plane are folded and crushed, those below being disturbed more intensely than those above.

Coal beds

Coal occurs at many horizons in the Price formation, but the beds generally are thin and irregular. The thickest beds are in Montgomery, Pulaski, Bland, and Wythe Counties. They occur in a zone that is about 1,000 ft above the base and 700 ft below the top of the Price formation in Montgomery County but near the top of the unit in Bland and Smyth Counties. In this zone the thickest and most persistent bed is known as the Merrimac or Big bed; the other minable seam is the Langhorne or Little bed, which in Pulaski and Montgomery Counties is 20 to 70 ft below the Merrimac. At many localities, however, identification of the two beds is difficult and correlations are not always dependable. As a rule the Merrimac bed is considerably thicker than the Langhorne but usually contains more partings. Both beds are high in ash.

The Merrimac coal is mined principally in Montgomery and in the Little Walker Mountain field in Pulaski County; the Langhorne bed is mined in the other Pulaski County fields. Analyses of specimen samples from the two beds in Montgomery and Pulaski Counties show that the rank of the coal is semianthracite. For the Merrimac bed in the coal fields of Montgomery County, the range in composition of several analyses, on the as-received basis (U. S. Bureau of Mines, 1944, pp. 58-65), follows:

	Brushy Mountain field	Price Mountain field
Moisture	1.2- 4.8	1.5- 3.8
Volatile matter	10.0-12.9	8.8- 9.7
Fixed carbon	61.4-69.8	68.1-74.6
Ash	15.5-24.6	14.1-21.1
Sulfur	0.5- 0.7	0.5- 0.7
Btu	11,310-12,630	11,780-12,880

A composite analysis (U. S. Bureau of Mines, 1944, pp. 66-67), on the as-received basis, of four specimen samples from the Merrimac bed at the Parrott mine in the Little Walker Mountain coal field in Pulaski County shows:

Moisture	1.6
Volatile matter	11.4
Fixed carbon	62.6
Ash	24.4
Sulfur	0.8

Btu: 11,250

Several analyses, on the as-received basis, of specimen samples from the Langhorne bed in Montgomery and Pulaski Counties show the following range in composition (U. S. Bureau of Mines, 1944, pp. 64-69):

Moisture	2.9- 4.7
Volatile matter	9.8-12.3
Fixed carbon	66.7-72.0
Ash	12.8-19.6
Sulfur	0.3- 1.1

Btu: 11,850 - 12,890

The Max Meadows field of Wythe County includes three coal beds, which, according to several analyses, are of semianthracite rank. The range in composition of several specimen samples, on the as-received basis, follows (U. S. Bureau of Mines, 1944, pp. 88-89):

Moisture	1.8- 4.7
Volatile matter	9.4-11.4
Fixed carbon	60.0-66.2
Ash	19.3-28.4
Sulfur	0.5- 1.2

Btu: 10,530 - 11,920

The coal in the Bland and Lick Creek fields in Bland and Smyth Counties occurs in two unnamed beds. Three analyses of coal from the Bland field indicate that the rank is medium- to low-volatile bituminous rather than semianthracite--the more usual rank of the coal in the Valley fields. Insufficient analyses are available to classify the coal in Augusta and Rockingham Counties.

Coal fields

Description

The Valley of Virginia contains ten named coal fields, which are discussed below, beginning with the most northeasterly field.

North River field

The North River field is in northern Augusta and southern Rockingham Counties (See fig. 1.) The

coal-bearing formation in the field is the Pocono sandstone of Mississippian age, which is the equivalent of the Price formation of the other Valley coal fields. In the North River field the coal-bearing rocks, which are exposed near the axis of an asymmetrical syncline, extend for about 20 miles. The beds, however, are thin and irregular, and are generally composed of alternate layers of coal and bone or shale. At places where the coal is 14 or more in. thick it is generally described as "soft" and "impure," and at some localities it is badly crushed. Because of the thinness of the beds and the impurities in the coal, as well as the comparative lack of bed information and analyses, no reserves have been estimated for the North River field.

North Mountain field

The North Mountain field, which is in northern Roanoke and southwestern Botetourt Counties, is a northeast extension of the Brushy Mountain field. (See below.) The workings in the field consist of several abandoned prospects along a strip about half a mile wide on the southeastern side of North Mountain and its associated ridges. The beds dip southeastward and the field is largely near the axis of a syncline in which the rocks are badly crushed. The coal beds are generally shattered and deformed and may pinch out or thicken locally because of folding and faulting. No detailed measurements of the beds are known, and the information at hand is insufficient to estimate reserves for the field.

Brushy Mountain field

The Brushy Mountain field (fig. 10) is about 2 miles south of and parallel to the northwestern boundary of Montgomery County and extends entirely across the county, a distance of about 20 miles. Most of the field is drained by the New River, but the eastern part is in the Roanoke River drainage system.

The Price formation, which crops out in the slope of Brushy Mountain, is about 1,700 ft thick and contains minable coal about 1,000 ft above its base. Both the Merrimac and Langhorne beds crop out in the field, but the latter is generally too thin to mine profitably; at one locality in the western part of the field, for example, it consists of 12 to 14 in. of coal separated by a 1-inch parting. The Merrimac bed, however, which is 20 to 70 ft above the Langhorne, is workable throughout most of the field. Generally speaking, the coal increases in thickness from east to west, except at one locality where it reaches a maximum thickness of 13.8 ft including 3.1 ft of partings. Near the western edge of the field, close to the New River, the bed is 7.5 ft thick and contains several partings that total 1.7 ft.

The coal beds in the Brushy Mountain field generally strike N. 60°-88° E. and dip 20°-30° SE. except in the eastern part of the field, where the dip increases to about 40°. Normal faults are common throughout the field, and over much of its outcrop area the coal is so badly crushed that it is difficult to mine. In fact operations have been confined largely to three areas: the western end of the field on the banks of the New River; a second area about 5 miles northeast of the river; and the Slusser mine area, about 12 miles northeast of the river, where the Merrimac bed attains its maximum thickness of 13.8 ft.

The estimated original reserves of the Brushy Mountain field, which in the absence of precise data are classified as indicated and inferred reserves, total 89 million tons.

Price Mountain field

The Price Mountain field is an elliptical area, about 4 miles long east and west and 1 mile wide, in Montgomery County about 3 miles south of Blacksburg and 2 to 5 miles south of the Brushy Mountain field. (See fig. 10.) The coal crops out around the flanks of Price Mountain, a low-wooded ridge in the central part of the Price Mountain anticline.

Both the Merrimac and Langhorne beds crop out in the field, but only the former has been mined. The stratigraphic relationships of the two beds are essentially the same as in the Brushy Mountain field. Mining has been concentrated at the eastern end of the field, mostly in the vicinity of the Merrimac mines, where a measured section shows 5.1 ft of coal and three layers of bone, ranging individually from 0.2 to 0.6 ft in thickness and totalling 1.2 ft. In the western part of the field the coal is considered to be poor, though few actual exposures are known; the only measured section available shows the bed to be 4.9 ft thick and to contain 3.1 ft of coal. Except for one layer 14 in. thick, the coal in this area occurs in layers generally less than 10 in. thick, separated by partings 3 to 6 in. thick. The Langhorne bed, which is 40 ft below the Merrimac near the Merrimac mines, contains at one measured section 26 in. of coal and a 1-inch parting.

The coal beds in the field dip away from Price Mountain at angles ranging generally from 20° to 50°, though the beds are nearly vertical at some places on the north side of the mountain. Most of the mines are in areas where the dips are low, which are also the areas in which the coal is thickest. No commercial mines are now operating in the field.

The estimated original reserves of the Price Mountain field total 43 million tons, classified as indicated and inferred.

Little Walker Mountain field

The Little Walker Mountain field is essentially a southwestward continuation of the Brushy Mountain field across the New River into the northern part of Pulaski County. (See fig. 10.) The coal is exposed in the southeastern slope of Little Walker Mountain and the north slope of Tract Mountain, a short ridge south of Little Walker Mountain. In general the coal beds in the field strike northeast and dip 30°-55° SE., away from Little Walker Mountain.

Two coal beds near the middle of the Price formation in this field are believed to be continuations of the Merrimac and Langhorne beds of the Brushy Mountain field. The interval between the beds varies, being as little as 14 ft at one locality. Both beds have been mined in the field. In an old mine near the New River in the northeastern part of the field the Merrimac bed is about 7 ft thick, of which more

than 5 ft is coal, and it averages more than 5 ft in thickness over a considerable distance. In the western part of the field the Merrimac bed in one mine reaches a total thickness of 20.4 ft, which includes 15.8 ft of coal. Here the partings are largely concentrated in the middle part of the bed to such an extent that for practical purposes the coal may be considered to be in two benches, 6.9 ft and 4.6 ft thick, respectively.

The Langhorne bed in the Little Walker Mountain field is generally 2.0 to 2.5 ft thick but locally reaches a thickness of as much as 5.2 ft, which includes a 0.1 ft parting; even thicker sections are reported but have not been measured.

The original reserves of the Little Walker Mountain coal field are the largest of all the Valley fields, being estimated as 98 million tons of indicated and inferred coal.

Pulaski field

The Pulaski coal field is a small area in the western part of Pulaski County near the town of Pulaski. (See fig. 10.) One coal bed, believed to be the Merrimac, crops out in this field for a distance of about 7 miles. At one locality the bed is 7.0 ft thick, including two partings each 0.3 ft thick, one near the top and one near the bottom of the bed.

The coal in the Pulaski field occurs in a northeast-plunging syncline known as the Peak Creek syncline. The dip of the beds in general is less than 50° but locally, in the southeastern part of the field, the beds are nearly vertical. The trace of the Pulaski fault is less than 2 miles east of the coal outcrop at most places, and the coal throughout the field appears to be badly crushed. It has been mined to some extent in the past, operations being favored by the closeness of the mines to the town of Pulaski and by the excellent rail transportation.

The original reserves of coal in the Pulaski field are estimated at 44 million tons, all in the indicated and inferred categories.

Max Meadows field

The Max Meadows field occupies a narrow strip about 6 miles long and averages less than a mile wide north of the village of Max Meadows, in Wythe County. (See fig. 10.) In this area at least three beds are exposed near the middle of the Price formation. The lowest bed, known as the No. 3 coal, is provisionally correlated with the Langhorne bed of other Valley fields. It is reported to be 3 to 5 ft thick in the eastern part of the field and to range from 3 to 10 ft near the western end, where the beds are badly crushed; the bed, however, is highly lenticular and the thick coal underlies small areas only. The two upper beds, called the No. 2 or Clark bed and the No. 1 or Gunton bed, are probably equivalent to the Merrimac bed of other fields, which is split into two benches in the Pulaski field and in the western end of the Little Walker Mountain field. The Clark bed, in a mine near the eastern end of the field, is 25.8 ft thick, of which 16.4 ft is coal; this is the thickest coal bed known in the Valley fields. In the same mine the Gunton bed, which is 12 ft above the Clark, is 6.2 ft thick, including two partings 1 and 4 in. thick, respectively, below the middle of the bed.

The coal in the Max Meadows field is exposed less than a mile north of the axis of an overturned syncline, and the beds in the northern limb dip 15°-25° southward. Several abandoned prospects on the southern limb of the syncline show that coal is present there also, but it is so badly crushed that it has neither been correlated with other parts of the field nor even measured properly.

The original reserves of the Max Meadows field are estimated at 62 million tons, classified as indicated and inferred.

Reed Creek field

The Reed Creek field, in northern Wythe County, is on the southeast side of a ridge known as Little Walker Mountain or Brushy Mountain, a continuation of the ridge bearing those names in Pulaski and Montgomery Counties, respectively. There is a gap, however, between the coal outcrops in the Little Walker Mountain field and those in the Reed Creek field, the latter being limited by the overthrust masses of the Cove and Pulaski faults.

Three coal beds have been reported in one abandoned mine in the Reed Creek field. Although exposures are poor and few measured sections are available, it appears that the beds are continuations of those in the Max Meadows field but are much thinner or split into several benches. In an abandoned mine in the eastern part of the field the lowest bed is 2.5 ft thick; the middle bed, which is only 6 ft above the lowest bed, is 5 ft thick; and the uppermost bed, about 20 ft above the middle bed, is about 2 ft thick. Elsewhere in the field beds have been measured that range in thickness from 1 ft to 5.9 ft, of which 3.2 ft are coal. These beds, however, are exposed only locally and have not been correlated with beds in other parts of the field.

The coal beds in the Reed Creek field strike northeast and dip southeastward away from Little Walker and Brushy Mountains. Because the beds are close to major overthrust faults and are associated locally with minor folds, the coal is probably disturbed at many places. An analysis (U. S. Bureau of Mines, 1944, pp. 88-89) of a weathered sample from a prospect near the western end of the field shows, on the as-received basis, 23.6 percent ash, 0.6 percent sulfur, and 11,330 Btu.

The original reserves of the Reed Creek field are estimated at 19 million tons, classified as indicated and inferred.

Bland field

The Bland field is about 20 miles long and 1 to 2 miles wide, extending northeast across south-central Bland County. The northern limit of the field is the coal outcrop on the south side of Brushy Mountain; the other boundaries are determined by the trace of a major overthrust known as the Bland fault.

The Price formation in this area is much thinner than in the fields to the northeast, being only 600 to 700 ft thick. The rocks in general strike northeast and dip southeast and contain lenticular coal beds that have not been correlated with those of other fields. At some places where it is exposed the coal is badly crushed and contains many partings. Most sections show less than 3 ft of clean coal, but at one locality a bed contains 4.5 ft of coal and at another 6 ft of coal and 2 ft of partings.

Though the coal in all the Valley fields to the northeast is ranked as semianthracite, that in the Bland field is medium- to low-volatile bituminous. The coal is very impure; the average of two analyses shows, on the as-received basis, 48.1 percent ash, 1.3 percent sulfur, and 6,970 Btu (U. S. Bureau of Mines, 1944, pp. 38-39). Because of the impurity of the coal and the scarcity of reliable information on the beds, no reserves for the Bland field have been estimated.

Lick Creek field

The Lick Creek field, in western Bland County and northeastern Smyth County, is about 10 miles long and 1 1/2 miles wide. In this area the Price formation, which reaches a maximum of only 300 to 400 ft in thickness, crops out in the limbs of two northeast-trending synclines. The dip of the beds is in general southeast. The coal is generally thin and contains many partings. The maximum thickness reported for the Smyth County part of the field is 18 in., and, although a bed 6 to 8 ft thick is reported from one locality in the eastern part, this thickness does not conform with other measurements in the area.

No analyses of the coal in the Lick Creek field are available but it is generally considered to be of bituminous rank comparable to that in the Bland field. Because of the lack of reliable data, no reserves for the field have been estimated.

Reserves of the Valley fields

Although the Valley fields have been mined for a long time, the data available for preparing this reserve estimate are not sufficient to justify the inclusion of any measured reserves. This is particularly true because the structural conditions in the fields are such that reasonably accurate estimates of measured coal would require information spaced much more closely than is necessary for such areas as the Southwest Virginia field, for example, where the coal beds are essentially flat lying. The obtaining of closely spaced data would demand much field work and, in turn, would consume more time than it is practicable to use in preparing a state-wide reserve estimate. For this reason the estimates presented herein are not in any sense the final figures for the areas involved but are rather frameworks to which additional reserves may be added as new data become available.

Subject to the limitations discussed, the original indicated and inferred reserves of the Valley fields are estimated at 355 million tons, distributed as shown in table 4.

No reserve estimates for the fields in Augusta, Rockingham, Roanoke, Botetourt, and Smyth Counties were made because of lack of reliable data.

Although there are reports of mining in the Valley fields as early as 1782, available production figures date from 1883 only. From that year through 1949 the total reported production of the Valley fields was 6,379,656 tons. This figure is not entirely accurate because for some years the production of one or more counties in the Valley fields was grouped with that of counties in other fields, and in other years the reverse was true; but the figure may be considered a fair approximation. In general it may be said that prior to 1915 annual production from the Valley fields never reached 50,000 tons, but that from 1916 to the present time the production has exceeded 100,000 tons in every year but one, the highest production being 271,100 tons in 1929. (This figure includes a small production from Scott County, in the Southwest field.) Since 1940 production has ranged from 120,000 tons to 232,000 tons annually, nearly all from Montgomery County.

THE EASTERN FIELDS

Richmond Basin

General features

The existence of coal in the Richmond basin (see fig. 11) was first reported to the Colonial Council of Virginia in 1701 by Col. William Byrd. Mining began, so far as the records show, in 1748, and the field was mined almost continuously from that year until about 1904, reported production for the period being more than 8 million tons. (See table 5.) Since 1904 the only reported production has been in 1910-13, 1921-23, and 1940-41; the field is at present of historic rather than economic interest. It owed its development not so much to the quality or quantity of its coal as to its location close to the James River and its attendant canal systems, which furnished ready transportation for the first century of the field's life, and to the ready market provided by the city of Richmond and by other towns in Tidewater, Virginia.

The Richmond basin is about 33 miles long north and south and about 9 miles wide and comprises about 150 sq mi in parts of Amelia, Goochland, Chesterfield, Henrico, and Powhatan Counties. The eastern edge of the basin is about 8 miles west of Richmond. The northern part of the area is drained by the James River, the southern part by the Appomattox River. A few small coal-bearing areas are east of the principal basin: one is east of the village of Gayton, about 4 miles north of the James River, and the others are in the vicinity of Midlothian, about four miles south of the James.

Stratigraphy

The Richmond basin is near the eastern edge of the Piedmont Plateau and is a structural and topographic basin in which sediments of the Newark group of Upper Triassic age have been preserved. These sediments rest on pre-Cambrian granite and granite-gneiss in a trough whose western edge is

Table 4.--Estimated original reserves of semianthracite in the Valley fields of Virginia, by counties

(in millions of short tons)

Field	Indicated reserves				Inferred reserves				Total in all categories			Field total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Montgomery County												
Brushy Mt.	14.98	5.45	47.08	67.51	8.90	3.00	10.07	21.97	23.88	8.45	57.15	89.48
Price Mt.	3.18	4.00	16.23	23.41	9.20	1.36	9.07	19.63	12.38	5.36	25.30	43.04
County total	18.16	9.45	63.31	90.92	18.10	4.36	19.14	41.60	36.26	13.81	82.45	132.52
Pulaski County												
Little Walker Mt.	12.78	1.19	58.18	72.15	4.82	....	20.82	25.64	17.60	1.19	79.00	97.79
Pulaski	....	....	5.36	5.36	....	....	38.61	38.61	....	....	43.97	43.97
County total	12.78	1.19	63.54	77.51	4.82	....	59.43	64.25	17.60	1.19	122.97	141.76
Wythe County												
Max Meadows	....	....	....	....	....	5.33	57.03	62.36	....	5.33	57.03	62.36
Reed Creek	....	....	....	....	0.96	8.72	9.30	18.98	0.96	8.72	9.30	18.98
County total	....	....	....	....	0.96	14.05	66.33	81.34	0.96	14.05	66.33	81.34
Total	30.94	10.64	126.85	168.43	23.88	18.41	144.90	187.19	54.82	29.05	271.75	355.62

Table 5.--Production of coal from the Richmond basin, 1748-1882, in short tons
(Figures from Eavenson (1942), pp. 441-445)

Year	Tonnage	Year	Tonnage	Year	Tonnage	Year	Tonnage	Year	Tonnage	Year	Tonnage
1748	50	1771	500	1794	1,000	1817	58,000	1840	88,000	1863	112,068
1749	50	1772	400	1795	2,000	1818	59,000	1841	79,600	1864	111,742
1750	50	1773	400	1796	4,000	1819	60,000	1842	77,000	1865	73,730
1751	50	1774	400	1797	7,000	1820	62,000	1843	95,606	1866	70,912
1752	100	1775	400	1798	22,000	1821	64,000	1844	115,313	1867	90,810
1753	100	1776	400	1799	14,000	1822	54,000	1845	134,603	1868	96,184
1754	100	1777	500	1800	18,000	1823	43,966	1846	124,669	1869	115,564
1755	100	1778	500	1801	22,000	1824	67,040	1847	136,422	1870	90,200
1756	100	1779	500	1802	26,000	1825	66,720	1848	120,747	1871	101,932
1757	100	1780	500	1803	29,500	1826	88,641	1849	133,801	1872	95,973
1758	200	1781	500	1804	40,500	1827	84,720	1850	138,017	1873	101,504
1759	200	1782	500	1805	42,000	1828	100,080	1851	136,523	1874	81,851
1760	300	1783	400	1806	43,000	1829	93,350	1852	106,687	1875	88,706
1761	300	1784	400	1807	44,000	1830	102,799	1853	101,726	1876	57,182
1762	700	1785	400	1808	45,000	1831	104,320	1854	132,554	1877	67,907
1763	1,400	1786	400	1809	46,000	1832	132,033	1855	125,977	1878	50,000
1764	800	1787	400	1810	47,000	1833	159,697	1856	106,150	1879	45,000
1765	900	1788	400	1811	48,000	1834	124,000	1857	114,826	1880	43,079
1766	600	1789	400	1812	50,000	1835	201,600	1858	113,734	1881	50,000
1767	500	1790	400	1813	52,000	1836	124,000	1859	106,338	1882	112,000
1768	500	1791	400	1814	54,000	1837	112,000	1860	112,473		
1769	1,000	1792	400	1815	56,000	1838	107,999	1861	94,697	Total	7,222,167
1770	500	1793	700	1816	57,000	1839	96,000	1862	115,495		

bounded by a normal fault. The pre-Cambrian rocks are exposed on both sides of the trough.

The thickness of the Triassic rocks is not definitely known, but Roberts (1928) suggested that possibly the original thickness was less than 2,000 ft; he considered that the basins were too small to contain thick deposits, and he also allowed for duplication of the strata by faulting. The only available detailed section of the Newark group in the Richmond basin is a composite section by Heinrich (1879) based on information from drill holes and mine shafts in the vicinity of Midlothian. The deepest drill hole was 1,338 ft. The total thickness of the composite section penetrated by drilling was 1,498.7 ft, but, as it was measured oblique to the local dip of about 40°, the actual thickness of the deposits measured was about 1,150 ft. The rocks penetrated are mostly sandstone, which is most prominent in the lower 400 and the upper 200 ft of the sequence, and shale. The sandstone is generally white, light gray to buff in most places; some of the lower strata are reddish gray. A considerable amount of light-colored feldspar is found in the sandstone. The shale is gray, drab, brown, greenish gray, or black; some of the black shale is bituminous.

Roberts divided the Newark group in Virginia into three formations; the Border conglomerate, the Manassas sandstone, and the Bull Run shale. The two last-named units are interstratified to a considerable extent. Heinrich (1879) gives the interval from the basement rocks to the coal zone in the Manassas sandstone as about 435 ft, composed of 28 ft of basal conglomerate and 407 ft of interstratified sandstone and shale. Clifford (1888) reported that the interval between the basement rocks and the coal zone varies but in places is more than 500 ft. In the small detached basins east of the main basin, however, he noted that the interval between the granite and the coal is in some places only a few inches.

The coal occurs in the upper part of the Manassas sandstone, in an interval reported by Heinrich to be about 70 ft. The coal beds are nowhere continuous, and at many places merge into carbonaceous shale. The thickness of the beds above the coal zone varies from place to place; in the vicinity of Midlothian it is about 645 ft.

Diabase dikes cut the pre-Cambrian and Triassic rocks throughout the Piedment region and crop out in a few places in the Richmond basin. As the area is covered by thick soil and good exposures are few, it is probable that the basins contain more dikes than have been seen. These intrusives have altered the nearby coal into semianthracite or, at some places, to natural coke.

Structure

The Richmond basin, above the basement rocks, consists of tilted and faulted strata that in general strike northward and dip westward. The Western Border fault, a normal fault, terminates the field to the west. The dip of the beds varies; in one mine near Midlothian it averages 30° but ranges from 19°-70°.

A prominent feature of the basin is the numerous high-angle faults, the planes of which generally strike northeastward and dip steeply toward the southeast. These faults make stratigraphic correlations and interpretations difficult and seriously handicap mining operations. Some writers have suggested that the small coal-bearing areas east of the basin proper have been separated from it by faulting.

Coal beds

Because the strata of the Richmond basin are tilted westward, the coal beds are exposed near the eastern edge of the field and are under progressively deeper cover toward the west except in a few small areas where faulting has brought them to the surface. The most important of these exposures are at Manakin, near the western edge of the Basin north of the James River, and an area north and west of Huguenot Springs, south of the river. Except for these two relatively unimportant areas, practically all of the exploration and development of the coal in the basin has been carried on along the eastern edge and in the small detached eastern coal-bearing areas.

In his discussion of the Richmond basin, Heinrich (1879) reported two or more workable coa beds, the lower 3 to 5 ft thick and the upper 20 to 40 ft thick, separated by about 50 ft of sandstone and shale. At some places he reported that the upper bed was divided into two benches by a parting 5 to 10 ft thick. A large part of Heinrich's information came from the Midlothian area, where he was in charge of the mines.

The Richmond basin has been mined in five areas: Manakin and Huguenot Springs in the northwestern part, and Gayton, Midlothian, and Winterpock on the eastern edge. At Manakin, Woodworth (1902) reported three coal beds: the lower 3 to 4 ft thick, the middle bed, 12 ft thick, and the upper bed, 6 to 8 ft thick. No figures are available for the relatively unimportant mines near Huguenot Springs. In the three eastern mining districts one to five coal beds were encountered, the topmost in general being the thickest. The Murphy Coal Corporation, which reopened the long-dormant Midlothian mines in the early 1920's, reported three beds: the lower or "A" bed, consisting of 16 in. of coal and 12 in. of shale; the middle or "B" bed, 24 to 26 in. of coal and 18 to 24 in. of shale; and the upper or "C" bed, 52 to 58 in. of coal. Shale partings are common in nearly all the beds; Clifford (1888) reported that such partings range up to 6 in. in thickness and were common at all localities except the detached basins east of the main basin. Pyrite is disseminated locally through the coal and much of the broken coal contains pyrite along the fracture planes. Besides being folded locally, fractured, and faulted, the coal thins in many places, especially at the crests of the numerous "rolls." The roof of the mines is generally sandstone but in some areas is shale. Semianthracite and natural coke are found in the vicinity of Midlothian and Gayton in at least one of the coal beds.

A few samples from the mines at Gayton show that the coal, except where it has been altered by the influence of intrusives, ranges in rank from

medium- to low-volatile bituminous. Analyses of the samples, on the as-received basis, average 12.4 percent ash, 1.6 percent sulfur, and 12,845 Btu (U. S. Bureau of Mines, 1944, pp. 52-53). The sulfur is high in all samples from the basin, ranging from 1.3 to 2.2 percent in available analyses; but at least part of this impurity is in the form of pyrite and can be largely removed by washing. The high-ash content reflects the numerous partings in the coal beds.

Coal from the Richmond basin is commonly reported to possess coking qualities, but few tests have been made to determine its actual suitability for that purpose.

Reserves

Except for a strip about a mile wide at the eastern edge of the basin and a few isolated areas farther west, practically nothing is known about the distribution of coal in the Richmond basin. Shaler and Woodworth (1899) state that nearly all coal a mile or more from the eastern outcrop is 2,500 ft or more below the surface. It may be safely said that in the foreseeable future no coal will be mined at that depth in an area where the structure is complex and where mining conditions are correspondingly difficult. Also, information as to the continuity of the beds under most of the basin is lacking. For these reasons, the only areas for which reserves could be estimated are the narrow strip along the eastern edge of the basin and the small poorly defined upthrust blocks to the west. In all of these areas the coal has been mined unsystematically for many years, and no records except those relating to production are available. Except for sporadic mining at long intervals, the mines have been idle for almost half a century and are in such condition that they cannot be explored. This fact, coupled with the poor surface exposures, makes it impossible to assemble sufficient reliable data to justify the preparation of estimates of reserves at this time. Only after a large amount of detailed geologic investigation, coupled with a carefully planned drilling program, has been done in the field can the reserves be calculated with any degree of accuracy. For that reason no estimate of reserves in the Richmond basin is included in this report.

Farmville Basin

The Farmville basin (see fig. 11) is about 30 miles west of the Richmond basin and is about 20 miles long northeast and southwest and a maximum of 5 miles wide. It covers about 40 sq mi in Buckingham, Cumberland, and Prince Edward Counties and is drained by the Appomattox River. The stratigraphy and structure of the basin are the same as in the Richmond basin. Both the pre-Cambrian and Triassic rocks are intruded by at least three north-trending diabase dikes, which have altered some of the coal to coke. The strata, which in general strike north to northeast and dip westward, are tilted and faulted.

Exploration for coal has been confined to a small area about 5 miles long at the eastern edge of the basin. A core from a drill hole three-fourths of a mile northwest of Farmville shows, in an interval of about 40 ft, four coal beds ranging in thickness from 1.5 to 2.5 ft. Heinrich (1879) reported that the coal from the Farmville basin was inferior to that from the Richmond basin and noted particularly the abundance of pyrite. No analyses of coal from the Farmville basin are available, but it is probably much like that from the Richmond basin.

For reasons given in the discussion of the Richmond basin, no estimate of reserves in the Farmville basin is given in this report.

PRODUCTION OF COAL IN VIRGINIA

The history of coal mining in Virginia falls naturally into two periods. The first period extends from the beginning of mining in the State about 1748 through 1882, the year before the Pocahontas district in Tazewell County was opened. During this time all reported production was from the Richmond basin, which exerted an influence on the economy of Richmond and the adjacent territory that is unfortunately overlooked in most histories of the period. The second period began in 1883, the year in which the first shipments of coal from the Pocahontas district were made, and continues to the present time. It has been marked by the steady growth of production in the Southwest Virginia field, a rather uniform mining activity in the Valley fields in Montgomery, Pulaski, and Wythe Counties, and the decline of production from the Richmond basin until 1904, since which time that area has been inactive except for short intervals. The two periods of mining activity in the State are discussed briefly below.

The first period, 1748-1882

Richmond Basin

The site of Colonel Byrd's discovery of coal in the Richmond basin is said to be near the town of Manakin (see fig. 11), north of the James River and about 14 miles west of Richmond. From the date of discovery in 1701 until the first recorded production in 1748 small amounts of coal doubtless were mined for local use, and one report says that a mine was opened at Midlothian in 1745. The public records in London show that coal was shipped from Hampton, Va., to New York, as early as 1758, and it is known that coal was sold at Rockett's landing, south of Richmond, 10 yr or more before the outbreak of the Revolutionary War. Until about 1820, the Richmond basin supplied coal to a rather large area along the Atlantic coast.

As the fall line of the James River is at Richmond, and the stream is not navigable above that point, transportation from the mines to the city was originally by wagon. About 1795, however, the James River Canal, which was renamed the James River and Kanawha Canal in 1835, was built along the north bank of the river upstream from Richmond, and an all-water route to the east became possible for the mines north of the river; for the mines on the south side, however, the only transportation was by wagon to Manchester, which was directly across the river from Richmond and is now a part of that city. Later, about 1820, the construction of canals throughout the country reached a pace comparable to the later railroad booms, and the new canals made

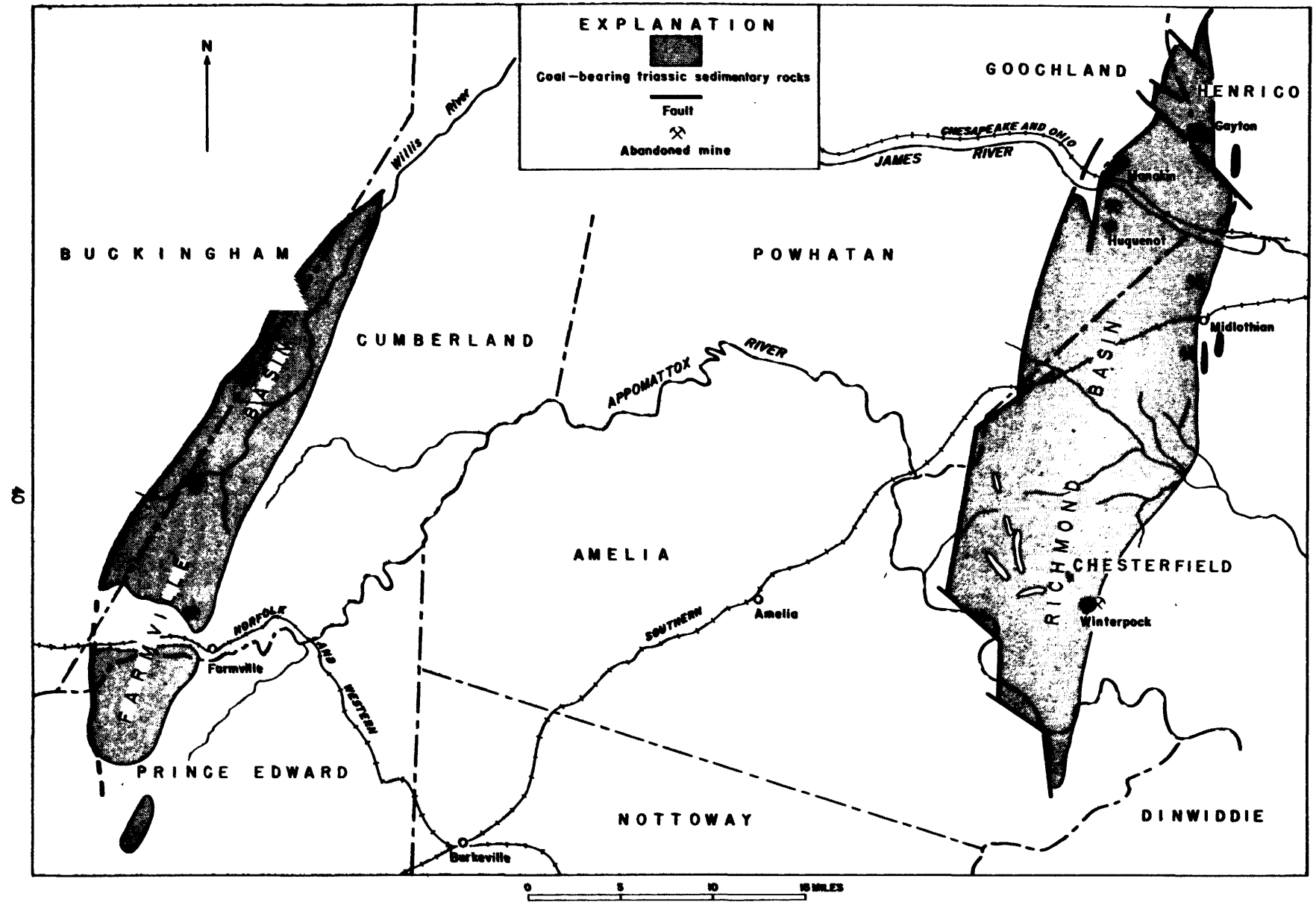

Figure 11.--Map of the Richmond and Farmville basins, Virginia. (Adapted from maps by N. S. Shaler, J. B. Woodworth, and J. K. Roberts, in The geology of the Virginia Triassic: Virginia Geol. Survey Bull. 29, 1928.)

it possible to ship Pennsylvania anthracite to the eastern seaboard and thus give Richmond coal its first serious competition. This development weakened the economic position of the Virginia miners, who attempted to reduce transportation costs by building the Tuckahoe Canal from the mines north of the James River to the James River Canal; this branch waterway was replaced in 1842 by a railroad. In the meantime, in 1831 the companies operating south of the river, where the canal was of no service, built the Chesterfield and Mansfield Railroad to carry their coal to the river. In the same year the Richmond and Danville Railroad (now the Southern Railway) was built; and in 1836 the Richmond and Petersburg Railroad (now the Atlantic Coast Line) was chartered. A branch line, the Clover Hill Railroad, connected the Richmond and Petersburg with the mines near Winterpock. In 1838 the Richmond, Fredericksburg, and Potomac railroad was built north from Richmond and was connected with the mines north of the James River by a spur line. The James River and Kanawha Canal continued in use until 1880, when the Richmond & Allegheny Railroad (now the Chesapeake and Ohio Railway) was built along its towpath.

The Richmond basin was the main source of coal for the Confederacy during the Civil War, the only other important producing area being the Montevallo field of Alabama. After the surrender the mines suffered from the general decline in business, and when the building of railroads westward in the 1870's and 1880's opened the New River and Pocahontas coal fields, the Richmond fuel was unable to meet the competition of the higher grade coals and was mined for local use only. For several years prior to 1887 only one mine operated in the field, and it was evident that the end of commercial operations was only a question of time. Production dropped until 1904, after which it ceased altogether except for small tonnages produced in a few years in unsuccessful efforts to reopen the mines.

The production figures for the Richmond basin (table 5) prior to 1883 are taken from Eavenson (1942), who also gives much interesting data on early mining operations in the Basin. The figures for the period 1883-1923 (table 6) are from the annual volumes on Mineral Resources of the United States, published by the Geological Survey and, since 1924, by the U. S. Bureau of Mines. Because of the small scale of operations in the Richmond basin, production from that area for a number of years, was grouped with the production of counties in the Southwest or Valley fields. For that reason the totals are not entirely accurate, though they are sufficiently so for most purposes. It is of particular interest to note that the largest production from the Richmond basin was in the two decades from 1830 to 1850, and that the peak year was 1835. The drop in production after 1882 is also noteworthy.

Valley fields

Coal mining in the Pulaski-Montgomery County area was reported as early as 1782, though production was small and no coal was shipped until many years later. The Price Mountain field was evidently in operation before the Civil War, and there are reliable reports that it furnished fuel for the Confederate ironclad Merrimac in 1862. This coal was probably hauled overland to the James River at or near Buchanan, a distance of about 30 miles by road, and transported to Hampton Roads by the James River canal system. There are reports of activity in other fields in the Valley before 1882, but there are no production figures for the period and it is not possible at this time to estimate, even in a most general way, the tonnage produced.

The second period, 1883-

Valley fields

Since the first publication of Mineral Resources of the United States, which covered the years 1882-83, some production has been reported in every year from the Valley coal fields; but the custom of grouping counties in different fields, made necessary by the need for protecting figures for individual properties, makes it difficult to arrive at the actual production for most of the years since that time. It can only be said that prior to 1904 mining was on a small scale, and that the production from Montgomery, Pulaski, and Wythe Counties ranged from 5,000 to 46,000 tons per year. In 1904 the Virginia Anthracite Company opened several mines and began to develop the area, marketing the product as "Virginia anthracite." Unfortunately, production figures from 1904 through 1913 are grouped with Russell County, in the Southwest Virginia field, and the true figures for the Valley cannot be given; but in 1916 production climbed for the first time above 100,000 tons and has remained above that figure ever since, except for 1921, when production dropped to 89,000 tons. The year of greatest production was 1926, when 272,000 tons were mined. Production in 1949, the latest year for which county figures are available, was 120,000 tons. The major part of the Valley production has come from Montgomery County.

Southwest field

The first commercial mining in the Southwest Virginia field was in 1883, when the Norfolk and Western Railway was built through Bluefield and opened the coal-bearing area in Virginia and West Virginia known variously as the Flat Top, Smokeless, or Pocahontas district. Production from Tazewell County, the only part of Virginia lying in the Pocahontas district, has shown a steady growth from 1883 (see fig. 12), when it produced 92,000 tons, to the present time, when it ships about 4 million tons annually; its cumulative production through 1949 is almost 119 million tons and is second only to that of Wise County, where operations began in 1893, following completion of the Clinch Valley branch of the Norfolk and Western Railway from Bluefield to Norton. Wise County has produced, through 1949, more than 203 million tons of coal; its peak year was 1923, when more than 6 million tons were mined, and present production is on the order of 4 million tons annually. The next county to be opened for production was Russell, though the production figures for that county prior to 1908 are somewhat misleading because of inclusion of counties in other fields. In 1908, however, the building of the Clinchfield Railroad opened the area around Dante, which has been a heavy producer ever since. Lee County was made accessible in 1904 by the building of the Interstate Railroad, which connected with the Louisville & Nashville Rail-

Table 6.--Recorded production of coal in Virginia, 1748-1950, in short tons
(Figures from Eavenson, 1748-1882; U. S. Geological Survey, 1883-1923; U. S. Bureau of Mines, 1924-1950)

Year	Southwest Virginia field								[a] Valley fields	[b] Richmond basin	Other	State total
	Buchanan County	Dickenson County	Lee County	Russell County	Scott County	Tazewell County	Wise County	Total				
[c] 1748-1882	....	....	....	....	....	....	....	....	....	7,222,167	....	7,222,167
1883	....	....	....	....	....	92,350	....	92,350	....	[d] 159,650	....	252,000
1884	....	....	....	....	....	256,435	....	256,435	....	[d] 79,565	....	336,000
1885	....	....	....	....	....	511,575	....	511,575	5,000	50,000	425	567,000
1886	....	....	....	....	....	639,751	....	639,751	17,200	28,000	....	684,951
1887	....	....	....	....	....	781,155	....	781,155	14,108	30,000	....	825,263
1888	....	....	[e] 5,000	....	....	988,300	....	993,300	46,700	33,000	....	1,073,000
1889	....	....	....	....	....	[f] 807,046	[g] 1,164	808,210	8,165	49,411	....	865,786
1890	....	....	....	....	....	[f] 759,038	....	759,038	5,627	19,346	....	784,011
1891	....	....	....	....	....	696,966	....	696,966	26,358	13,075	....	736,399
1892	....	....	....	....	....	614,333	....	614,333	27,216	33,656	....	675,205
1893	....	....	....	....	....	653,374	126,216	779,590	6,771	33,978	....	820,339
1894	....	....	....	....	....	827,706	330,731	1,158,437	....	[d] 70,646	....	1,229,083
1895	....	....	....	....	....	962,269	336,593	1,298,862	11,680	57,782	....	1,368,324
1896	....	....	....	....	....	785,345	357,607	1,142,952	16,101	95,670	....	1,254,723
1897	....	....	....	....	....	708,338	712,011	1,420,349	....	[d] 107,953	....	1,528,302
1898	....	....	....	....	....	782,015	992,723	1,774,738	....	[d] 40,536	....	1,815,274
1899	....	....	....	....	....	844,027	1,232,613	2,076,640	20,538	[h] 8,613	....	2,105,791
1900	....	....	....	....	....	970,866	1,363,570	2,334,436	9,814	[h] 49,504	....	2,393,754
1901	....	....	....	[f][f][j][k][l][m][n] 7,675	....	776,568	1,918,693	2,702,936	11,177	11,760	....	2,725,873
1902	....	....	....	7,831	....	723,753	2,422,417	3,154,001	12,786	16,206	....	3,182,993
1903	....	....	....	9,255	....	840,195	2,563,285	3,412,735	20,288	18,084	[i] 200	3,451,307
1904	....	....	....	177,133	....	871,720	2,359,661	3,408,514	....	2,100	[i] 300	3,410,914
1905	....	....	....	323,073	....	961,380	2,990,698	4,275,151	....	....	[i] 120	4,275,271
1906	....	....	....	302,896	....	910,638	3,041,225	4,254,759	....	....	[i] 120	4,254,879
1907	....	....	198,913	249,602	....	1,116,534	3,145,846	4,710,895	....	....	....	4,710,895
1908	....	....	464,261	255,893	....	980,014	2,558,874	4,259,042	....	....	....	4,259,042
1909	....	....	449,144	485,960	....	975,665	2,841,448	4,752,217	....	....	....	4,752,217
1910	....	....	797,096	792,763	....	1,187,146	3,730,992	6,507,997	....	....	....	6,507,997
1911	....	....	720,695	[n][n][n] 1,108,388	....	1,281,224	3,754,360	6,864,667	....	....	....	6,864,667
1912	....	....	751,276	1,293,145	....	1,302,043	4,500,174	7,846,638	....	....	....	7,846,638
1913	....	....	763,315	1,513,843	....	1,447,351	5,103,559	8,828,068	....	....	....	8,828,068
1914	....	....	732,935	1,236,114	....	1,323,530	4,620,702	7,913,281	[o][o][o][o][p][q] 46,254	....	....	7,959,535
1915	....	....	742,311	1,493,421	....	1,647,081	4,186,309	8,069,122	53,474	....	....	8,122,596
1916	....	....	828,000	1,950,036	....	1,588,044	5,228,945	9,595,025	112,449	....	....	9,707,474
1917	....	13,593	871,642	2,000,540	....	1,631,849	5,427,455	9,945,079	142,012	....	....	10,087,091
1918	....	110,931	888,400	1,998,144	....	1,624,736	5,514,132	10,136,343	153,465	....	....	10,289,808
1919	....	472,059	679,017	1,801,607	....	1,208,814	5,049,436	9,210,933	115,897	....	....	9,326,830
1920	....	614,904	946,125	2,122,891	....	1,323,712	6,062,325	11,069,957	174,149	....	[i] 134,500	11,378,606
[r] 1921	....	448,387	687,928	1,543,862	....	1,253,902	3,469,153	7,403,232	[s][t][q][q][q][q][q] 89,146	....	....	7,492,378
1922	....	870,234	762,305	2,070,574	....	1,563,847	5,022,866	10,289,826	148,475	....	[u] 52,873	10,491,174
[v] 1923	....	925,029	1,024,668	2,066,057	....	1,492,875	6,013,132	11,521,761	230,349	....	[u] 9,533	11,761,643
1924	....	794,237	1,140,102	1,602,073	....	1,801,430	5,164,420	10,502,262	191,202	....	....	10,693,464
1925	....	1,022,587	1,514,004	1,854,514	....	2,128,115	6,013,566	12,532,786	266,657	....	....	12,799,443
1926	....	1,115,377	1,971,387	1,863,968	....	2,347,552	6,563,059	13,861,343	272,043	....	....	14,133,386
1927	....	1,058,376	2,180,697	1,518,557	....	2,254,257	5,731,563	12,743,450	172,592	....	....	12,916,042
1928	....	796,006	2,200,152	1,260,086	....	2,410,491	5,061,902	11,728,637	172,296	....	....	11,900,933
1929	....	808,662	2,143,075	1,414,677	....	2,809,076	5,301,716	12,477,206	271,100	....	....	12,748,306
1930	....	987,172	1,739,276	1,254,795	....	2,506,636	4,179,347	10,667,226	240,151	....	....	10,907,377

1931	[f]	1,045,719	1,897,205	1,008,773	....	2,214,956	3,348,266	9,514,919	[q] 183,761	....	....	9,698,680
1932	[f] 40,883	769,726	1,542,502	674,069	....	1,807,586	2,700,533	7,535,299	156,881	....	....	7,692,180
1933	278,853	964,036	1,220,199	752,798	....	1,980,859	2,816,613	8,013,358	165,284	....	....	8,178,642
1934	573,262	1,176,101	1,123,366	771,531	500	[w] 2,693,756	2,836,162	9,174,678	202,003	....	....	9,376,681
1935	1,360,668	1,129,448	1,147,272	660,424	....	2,387,002	2,795,701	9,480,515	186,503	....	....	9,667,018
1936	2,235,071	1,340,486	1,342,773	[q] 642,162	....	2,968,536	2,934,224	11,463,252	198,384	....	....	11,661,636
1937	3,601,509	1,742,811	1,285,830	[q] 649,486	....	3,009,521	3,301,946	13,591,106	204,133	....	....	13,795,239
1938	3,742,470	1,370,506	987,821	[q] 509,554	....	2,800,449	2,732,504	12,143,304	139,732	....	....	12,283,036
1939	4,280,776	1,551,868	1,196,100	[q] 650,699	....	2,757,984	2,940,580	13,378,007	152,967	....	....	13,530,974
1940	4,874,311	1,767,582	1,420,683	606,270	[l] 29,197	3,283,135	3,193,440	15,174,618	173,457	....	....	15,348,075
1941	5,553,444	2,075,271	1,505,354	[x] 1,196,924	27,002	3,827,007	4,255,944	18,440,946	....	....	....	18,440,946
1942	5,978,697	2,083,496	1,559,256	1,146,692	....	4,352,499	4,785,468	19,906,108	[q] 230,071	....	....	20,136,179
1943	5,966,647	2,009,678	1,347,315	1,268,319	....	4,800,320	4,656,349	20,048,628	[q] 231,581	....	....	20,280,209
1944	5,922,513	1,676,358	931,063	1,216,399	....	4,679,870	4,866,206	19,292,409	[q] 221,465	....	....	19,513,874
1945	5,207,790	1,578,240	875,942	1,040,542	29,914	4,061,201	4,255,461	17,049,090	185,903	....	....	17,234,993
1946	4,472,647	1,333,648	599,001	1,186,603	44,446	3,884,197	3,825,987	15,346,529	180,366	....	....	15,526,895
1947	5,397,676	2,578,082	770,204	2,001,906	86,050	4,380,720	4,796,857	20,011,495	159,304	....	....	20,170,799
1948	4,914,452	2,296,657	950,283	1,499,155	5,471	3,943,220	4,214,336	17,823,574	175,831	....	....	17,999,405
1949	4,424,478	2,574,964	618,911	1,159,749	15,549	2,152,458	3,517,188	14,463,297	120,790	....	....	14,584,087
Total 1748-1949	68,826,147	41,102,234	47,522,804	54,221,428	238,129	118,956,343	203,768,253	534,635,338	6,379,656	8,230,702	198,071	549,443,767
[y] 1950	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	[z] 16,986,000
Total 1748-1950	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	566,429,767

[a] Valley fields include Montgomery, Pulaski, Wythe, Bland, and Smyth Counties.

[b] Richmond basin includes Henrico, Chesterfield, Goochland, and Powhatan Counties.

[c] Yearly production figures for this period are given in table 5.

[d] Includes Valley fields.

[e] Includes Russell, Buchanan, and Dickenson Counties.

[f] Includes Pulaski County.

[g] Includes Buchanan, Russell, Lee, Dickenson, and Wythe Counties.

[h] Includes Russell County.

[i] Small mines.

[j] Includes Pulaski and Montgomery Counties.

[k] Includes Lee and Pulaski Counties.

[m] Includes Pulaski and Montgomery Counties and small mines.

[n] Includes Pulaski, Montgomery, and Henrico Counties, and small mines.

[o] Includes small mines.

[p] Includes Scott County and small mines.

[q] Includes Scott County.

[r] Exclusive of production from wagon mines.

[s] Includes Richmond basin.

[t] Includes Scott County and Richmond basin.

[u] Includes wagon mines served by rail.

[v] From 1924 to present, wagon-mine production omitted.

[w] Includes the Tazewell County operations for one mine producing in both Tazewell County, Va., and McDowell County, W. Va. All tonnage for this mine in earlier years was tabulated in McDowell County, W. Va. (U. S. Minerals Yearbook, 1935, p. 303.)

[x] Includes Valley fields and Richmond basin.

[y] County totals not available.

[z] Preliminary.

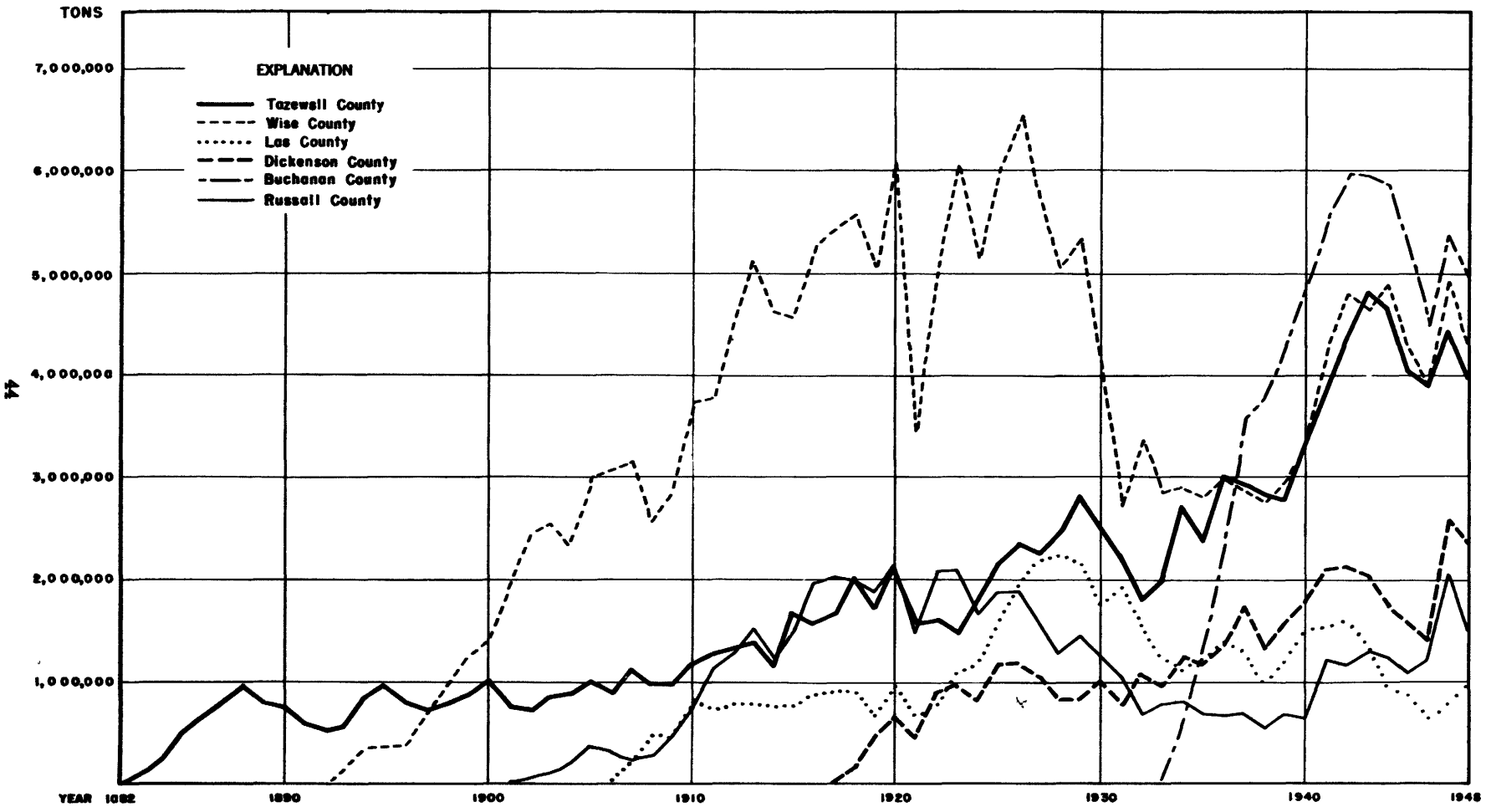

Figure 12.--Graph showing production of Southwest Virginia field by counties, 1882-1948.

Table 7.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by beds and counties

(in millions of short tons)

County	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			County total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Beds in the Wise formation																
High Splint bed																
Lee	....	0.84	....	0.84	....	....	....	....	....	....	....	....	....	0.84	....	0.84
Wise	0.21	0.71	7.21	8.13	0.63	3.72	5.22	9.57	0.07	10.38	....	10.45	0.91	14.81	12.43	28.15
Total ..	0.21	1.55	7.21	8.97	0.63	3.72	5.22	9.57	0.07	10.38	....	10.45	0.91	15.65	12.43	28.99
Morris bed																
Lee	....	0.06	0.04	0.10	....	1.57	....	1.57	....	1.10	....	1.10	....	2.73	0.04	2.77
Wise	....	2.81	12.32	15.13	0.98	0.69	9.90	11.57	1.71	0.33	....	2.04	2.69	3.83	22.22	28.74
Total ..	....	2.87	12.36	15.23	0.98	2.26	9.90	13.14	1.71	1.43	....	3.14	2.69	6.56	22.26	31.51
Pardee bed																
Lee	....	....	0.60	0.60	....	....	1.34	1.34	0.37	....	....	0.37	0.37	....	1.94	2.31
Wise	0.51	2.15	28.22	30.88	2.11	16.77	23.47	42.35	0.96	....	....	0.96	3.58	18.92	51.69	74.19
Total ..	0.51	2.15	28.82	31.48	2.11	16.77	24.81	43.69	1.33	....	....	1.33	3.95	18.92	53.63	76.50
Wax bed																
Lee	....	....	....	....	....	....	2.46	2.46	....	....	....	....	....	....	2.46	2.46
Gin Creek bed																
Lee	....	....	....	....	1.63	....	....	1.63	....	....	....	....	1.63	....	....	1.63
Phillips bed																
Lee	....	0.16	0.34	0.50	....	2.90	7.64	10.54	1.65	0.48	....	2.13	1.65	3.54	7.98	13.17
Wise	....	....	....	....	1.13	....	....	1.13	10.75	....	....	10.75	11.88	....	....	11.88
Total ..	....	0.16	0.34	0.50	1.13	2.90	7.64	11.67	12.40	0.48	....	12.88	13.53	3.54	7.98	25.05
Low Splint bed																
Lee	....	0.08	7.32	7.40	....	2.61	9.09	11.70	2.31	....	....	2.31	2.31	2.69	16.41	21.41
Wise	0.29	14.41	1.83	16.53	1.13	22.66	2.57	26.36	51.26	5.44	....	56.70	52.68	42.51	4.40	99.59
Total ..	0.29	14.49	9.15	23.93	1.13	25.27	11.66	38.06	53.57	5.44	....	59.01	54.99	45.20	20.81	121.00
Taggart bed																
Lee	....	10.85	4.07	14.92	....	24.59	7.08	31.67	....	....	....	....	....	35.44	11.15	46.59
Wise	0.54	2.78	26.51	29.83	1.51	31.38	53.11	86.00	1.33	4.13	....	5.46	3.38	38.29	79.62	121.29
Total ..	0.54	13.63	30.58	44.75	1.51	55.97	60.19	117.67	1.33	4.13	....	5.46	3.38	73.73	90.77	167.88

Table 7.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by beds and counties (in millions of short tons)--Continued

County	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	County total
Taggart Marker bed																
Lee	....	....	....	....	4.33	5.36	....	9.69	22.59	0.61	....	23.20	26.92	5.97	....	32.89
Wise	0.44	11.42	....	11.86	11.58	59.95	....	71.53	2.40	....	....	2.40	14.42	71.37	....	85.79
Total	0.44	11.42	....	11.86	15.91	65.31	....	81.22	24.99	0.61	....	25.60	41.34	77.34	....	118.68
Kirk bed																
Lee	....	....	....	....	1.76	....	....	1.76	....	....	....	....	1.76	....	....	1.76
Upper Standiford bed																
Wise	....	....	....	....	....	7.33	5.81	13.14	53.66	3.54	....	57.20	53.66	10.87	5.81	70.34
Harlan bed																
Lee	....	3.50	1.35	4.85	0.46	72.73	29.83	103.02	....	* 9.80	....	9.80	0.46	86.03	31.18	117.67
Upper St. Charles bed																
Lee	....	0.92	....	0.92	....	2.60	....	2.60	3.03	0.13	....	3.16	3.03	3.65	....	6.68
Lower St. Charles bed																
Lee	....	....	....	....	....	5.70	....	5.70	24.50	3.43	....	27.93	24.50	9.13	....	33.63
Cedar Grove bed																
Buchanan	....	....	....	....	....	....	3.80	3.80	....	....	....	....	....	....	3.80	3.80
Lower Cedar Grove bed																
Buchanan	....	....	....	....	0.43	....	0.32	0.75	0.71	....	0.81	1.52	1.14	....	1.13	2.27
Pinhook bed																
Lee	....	....	....	....	1.02	0.88	....	1.90	7.23	....	....	7.23	8.25	0.88	....	9.13
Wise	....	....	....	....	1.23	0.56	....	1.79	2.08	....	....	2.08	3.31	0.56	....	3.87
Total	....	....	....	....	2.25	1.44	....	3.69	9.31	....	....	9.31	11.56	1.44	....	13.00
Kelly bed																
Dickenson	....	....	....	....	....	....	2.77	2.77	....	....	1.92	1.92	....	....	4.69	4.69
Lee	....	....	....	....	....	9.23	....	9.23	2.62	4.13	....	6.75	2.62	13.36	....	15.98
Wise	....	....	....	....	1.15	61.29	26.50	88.94	40.85	19.38	....	60.23	42.00	80.67	26.50	149.17
Total	....	....	....	....	1.15	70.52	29.27	100.94	43.47	23.51	1.92	68.90	44.62	94.03	31.19	169.84
Stone Creek bed																
Lee	....	....	....	....	0.63	....	....	0.63	....	....	....	....	0.63	....	....	0.63
Imboden bed (Campbell Creek bed of Buchanan County)																
Buchanan	....	....	....	....	....	30.23	....	30.23	....	19.52	....	19.52	....	49.75	....	49.75
Dickenson	....	....	....	....	....	2.18	....	2.18	....	2.20	....	2.20	....	4.38	....	4.38
Lee	0.08	1.60	3.39	5.07	1.40	13.81	6.55	21.76	27.67	0.98	....	28.65	29.15	16.39	9.94	55.48
Wise	....	0.68	14.40	15.08	5.32	30.47	57.75	93.54	29.95	39.65	8.16	77.76	35.27	70.80	80.31	186.38
Total	0.08	2.28	17.79	20.15	6.72	76.69	64.30	147.71	57.62	62.35	8.16	128.13	64.42	141.32	90.25	295.99

* Overburden 0-2,000 ft.

Beds in the Wise formation--Continued

Rocky Fork bed

Wise	....	....	....	....	....	....	....	....	0.24	....	....	0.24	0.24	....	....	0.24

Addington bed

Wise	....	....	....	....	0.30	1.94	0.51	2.75	1.28	0.33	....	1.61	1.58	2.27	0.51	4.36

Clintwood bed

Buchanan	....	0.18	12.33	12.51	6.40	30.24	29.41	66.05	3.17	11.05	....	14.22	9.57	41.47	41.74	92.78
Dickenson	....	....	14.81	14.81	12.45	1.77	43.96	58.18	4.94	0.80	0.41	6.05	17.29	2.57	59.18	79.04
Lee	....	....	0.40	0.40	1.98	1.14	10.49	13.61	* 24.78	22.08	23.79	70.65	26.76	23.22	34.68	84.66
Wise.....	....	0.49	11.23	11.72	10.27	39.98	48.27	98.52	37.05	19.59	0.51	57.15	47.32	60.06	60.01	167.39
Total...	....	0.67	38.77	39.44	31.10	73.13	132.13	236.36	69.84	53.52	24.71	148.07	100.94	127.32	195.61	423.87

Eagle bed

Buchanan	0.98	4.92	8.20	14.10	32.98	96.17	36.68	165.83	32.60	3.17	....	35.77	66.56	104.26	44.88	215.70
Dickenson	0.81	1.67	5.94	8.42	6.85	0.55	0.58	7.98	2.30	0.10	....	2.40	9.96	2.32	6.52	18.80
Total...	1.79	6.59	14.14	22.52	39.83	96.72	37.26	173.81	34.90	3.27	....	38.17	76.52	106.58	51.40	234.50

Blair bed

Buchanan	....	....	....	....	....	11.50	19.78	31.28	1.74	25.83	2.83	30.40	1.74	37.33	22.61	61.68
Dickenson	....	....	....	....	....	....	....	....	6.63	7.76	....	14.39	6.63	7.76	....	14.39
Lee.....	....	....	....	....	....	....	....	....	6.49	2.35	0.40	9.24	6.49	2.35	0.40	9.24
Wise.....	1.20	4.37	0.04	5.61	5.50	4.31	....	9.81	72.05	34.39	35.16	141.60	78.75	43.07	35.20	157.02
Total...	1.20	4.37	0.04	5.61	5.50	15.81	19.78	41.09	86.91	70.33	38.39	195.63	93.61	90.51	58.21	242.33

Lyons bed

Dickenson	....	....	....	....	....	0.28	....	0.28	8.76	....	....	8.76	8.76	0.28	....	9.04
Lee.....	....	....	....	....	....	....	....	....	2.55	3.22	....	5.77	2.55	3.22	....	5.77
Wise.....	1.90	4.54	0.27	6.71	30.05	9.74	....	39.79	85.84	....	....	85.84	117.79	14.28	0.27	132.34
Total...	1.90	4.54	0.27	6.71	30.05	10.02	....	40.07	97.15	3.22	....	100.37	129.10	17.78	0.27	147.15

Dorchester bed

Buchanan	0.93	0.66	....	1.59	26.60	15.67	....	42.27	60.98	0.49	....	61.47	88.51	16.82	....	105.33
Dickenson	....	....	....	....	6.39	1.61	....	8.00	65.09	21.33	....	86.42	71.48	22.94	....	94.42
Lee.....	....	....	....	....	....	....	....	....	1.80	0.21	....	2.01	1.80	0.21	....	2.01
Russell..	....	....	....	....	....	....	....	....	0.08	....	....	0.08	0.08	....	....	0.08
Wise.....	1.44	7.50	22.31	31.25	30.67	45.07	13.41	89.15	* 71.49	2.08	....	73.57	103.60	54.65	35.72	193.97
Total...	2.37	8.16	22.31	32.84	63.66	62.35	13.41	139.42	199.44	24.11	....	223.55	265.47	94.62	35.72	395.81
Formation total..	9.33	77.30	183.13	269.76	208.87	669.18	458.30	1,336.35	777.46	280.01	73.99	1,131.46	995.66	1,026.49	715.42	2,737.57

* Overburden 0-2,000 ft.

Table 7.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by beds and counties (in millions of short tons)--Continued

County	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	County total
Beds in the Norton formation																
Norton bed																
Dickenson	....	....	....	....	....	....	....	....	1.51	....	....	1.51	1.51	....	....	1.51
Wise	3.23	24.10	1.49	28.82	30.92	46.89	....	77.81	63.56	....	....	63.56	97.71	70.99	1.49	170.19
Total ..	3.23	24.10	1.49	28.82	30.92	46.89	....	77.81	65.07	....	....	65.07	99.22	70.99	1.49	171.70
Hagy bed																
Buchanan	....	....	....	....	25.70	168.62	11.44	205.76	75.11	22.90	....	98.01	100.81	191.52	11.44	303.77
Dickenson	....	....	....	....	11.91	2.22	....	14.13	37.41	....	....	37.41	49.32	2.22	....	51.54
Wise	....	....	....	....	9.08	....	....	9.08	....	....	....	....	9.08	....	....	9.08
Total ..	....	....	....	....	46.69	170.84	11.44	228.97	112.52	22.90	....	135.42	159.21	193.74	11.44	364.39
Splash Dam bed																
Buchanan	3.28	26.93	35.72	65.93	262.57	240.28	92.37	595.22	47.35	....	....	47.35	313.20	267.21	128.09	708.50
Dickenson	0.42	3.18	0.09	3.69	67.51	56.16	16.97	140.64	178.14	....	....	178.14	246.07	59.34	17.06	322.47
Russell..	....	....	....	....	....	....	....	....	8.58	....	....	8.58	8.58	....	....	8.58
Wise	....	....	....	....	1.42	....	....	1.42	9.94	....	....	9.94	11.36	....	....	11.36
Total ...	3.70	30.11	35.81	69.62	331.50	296.44	109.34	737.28	244.01	....	....	244.01	579.21	326.55	145.15	1,050.91
Upper Banner bed																
Buchanan	....	....	....	....	1.90	1.50	....	3.40	2.43	....	....	2.43	4.33	1.50	....	5.83
Dickenson	12.36	27.80	66.10	106.26	38.06	50.38	56.83	145.27	57.52	16.38	....	73.90	107.94	94.56	122.93	325.43
Russell..	0.85	1.30	9.75	11.90	0.73	2.37	1.00	4.10	....	....	....	....	1.58	3.67	10.75	16.00
Wise	0.65	11.02	21.42	33.09	3.28	14.83	23.53	41.64	15.63	3.74	....	19.37	19.56	29.59	44.95	94.10
Total ..	13.86	40.12	97.27	151.25	43.97	69.08	81.36	194.41	75.58	20.12	....	95.70	133.41	129.32	178.63	441.36
Lower Banner bed																
Buchanan	0.76	2.12	3.94	6.82	96.32	31.24	19.87	147.43	132.18	....	....	132.18	229.26	33.36	23.81	286.43
Dickenson	3.24	22.58	14.65	40.47	81.14	83.84	14.72	179.70	113.46	6.27	....	119.73	197.84	112.69	29.37	339.90
Russell .	....	4.73	11.29	16.02	1.09	11.79	15.71	28.59	1.26	....	....	1.26	2.35	16.52	27.00	45.87
Tazewell	....	....	....	....	0.08	0.14	0.12	0.34	....	....	....	....	0.08	0.14	0.12	0.34
Wise	....	8.81	9.56	18.37	17.27	24.51	11.84	53.62	37.63	7.16	....	44.79	54.90	40.48	21.40	116.78
Total ..	4.00	38.24	39.44	81.68	195.90	151.52	62.26	409.68	284.53	13.43	....	297.96	484.43	203.19	101.70	789.32
Big Fork bed																
Buchanan	....	....	....	....	0.98	....	....	0.98	7.04	1.51	....	8.55	8.02	1.51	....	9.53
Russell	....	....	....	....	....	....	....	....	....	4.80	....	4.80	....	4.80	....	4.80
Tazewell	....	....	....	....	....	....	....	....	0.35	0.64	....	0.99	0.35	0.64	....	0.99
Total ..	....	....	....	....	0.98	....	....	0.98	7.39	6.95	....	14.34	8.37	6.95	....	15.32
Caldwell bed																
Tazewell	....	....	....	....	1.17	2.75	0.95	4.87	....	....	....	....	1.17	2.75	0.95	4.87
Kennedy bed																
Buchanan	0.64	0.05	....	0.69	278.57	254.96	7.96	541.49	222.87	6.90	....	229.77	502.08	261.91	7.96	771.95
Dickenson	....	....	....	....	40.44	84.71	3.56	128.71	120.36	185.18	....	305.54	160.80	269.89	3.56	434.25
Russell	....	2.33	....	2.33	15.20	93.75	6.34	115.29	10.12	0.35	....	10.47	25.32	96.43	6.34	128.09
Tazewell	....	....	....	....	1.84	7.40	....	9.24	....	....	....	....	1.84	7.40	....	9.24
Wise	....	....	....	....	14.47	39.10	16.16	69.73	19.79	23.33	....	43.12	34.26	62.43	16.16	112.85
Total ..	0.64	2.38	....	3.02	350.52	479.92	34.02	864.46	373.14	215.76	....	588.90	724.30	698.06	34.02	1,456.38

Beds in the Norton formation--Continued

Ally bed

Buchanan	....	....	....	....	5.50	....	....	5.50	36.79	....	....	36.79	42.29	....	....	42.29
Dickenson	....	....	....	....	....	....	....	....	8.26	....	....	8.26	8.26	....	....	8.26
Tazewell	....	....	....	....	....	....	....	....	1.90	....	....	1.90	1.90	....	....	1.90
Total...	....	....	....	....	5.50	....	....	5.50	46.95	....	....	46.95	52.45	....	....	52.45

Raven bed

Buchanan	1.69	14.21	1.28	17.18	53.65	82.57	....	136.22	422.29	....	....	422.29	477.63	96.78	1.28	575.69
Dickenson	2.22	4.22	7.91	14.35	46.30	47.96	32.78	127.04	134.36	103.72	13.90	251.98	182.88	155.90	54.59	393.37
Russell..	5.98	6.69	2.57	15.24	36.18	23.39	0.76	60.33	23.27	....	....	23.27	65.43	30.08	3.33	98.84
Tazewell.	....	9.39	0.40	9.79	0.94	22.67	....	23.61	....	....	....	....	0.94	32.06	0.40	33.40
Wise	0.13	0.37	3.30	3.80	4.94	39.84	11.42	56.20	48.29	22.42	....	70.71	53.36	62.63	14.72	130.71
Total...	10.02	34.88	15.46	60.36	142.01	216.43	44.96	403.40	628.21	126.14	13.90	768.25	780.24	377.45	74.32	1,232.01

Jawbone bed

Buchanan	0.25	2.11	1.59	3.95	57.47	138.63	7.17	203.27	120.77	8.94	....	129.71	178.49	149.68	8.76	336.93
Dickenson	0.25	0.66	9.55	10.46	12.05	75.13	105.73	192.91	162.88	97.78	11.44	272.10	175.18	173.57	126.72	475.47
Russell..	....	....	23.21	23.21	11.75	27.60	140.05	179.40	45.46	1.28	0.12	46.86	57.21	28.88	163.38	249.47
Scott....	....	....	....	....	....	....	0.48	0.48	....	....	....	....	....	....	0.48	0.48
Tazewell	1.16	2.61	1.40	5.17	7.76	38.88	10.26	56.90	10.66	1.01	....	11.67	19.58	42.50	11.66	73.74
Wise	....	0.14	1.94	2.08	0.18	28.21	45.62	74.01	26.80	54.51	....	81.31	26.98	82.86	47.56	157.40
Total...	1.66	5.52	37.69	44.87	89.21	308.45	309.31	706.97	366.57	163.52	11.56	541.65	457.44	477.49	358.56	1,293.49

Tiller bed

Buchanan	0.21	1.88	6.05	8.14	26.16	10.27	6.97	43.40	25.25	0.65	....	25.90	51.62	12.80	13.02	77.44
Dickenson	0.59	0.17	14.87	15.63	18.71	11.89	35.50	66.10	12.72	....	....	12.72	32.02	12.06	50.37	94.45
Russell..	2.08	2.86	21.39	26.33	16.17	22.04	81.80	120.01	8.22	....	....	8.22	26.47	24.90	103.19	154.56
Tazewell	0.56	1.86	....	2.42	17.84	14.36	....	32.20	10.11	....	....	10.11	29.51	16.22	....	44.73
Wise	....	....	....	....	....	....	....	....	3.34	1.69	0.26	5.29	3.34	1.69	0.26	5.29
Total...	3.44	6.77	42.31	52.52	78.88	58.56	124.27	261.71	59.64	2.34	0.26	62.24	141.96	67.67	166.84	376.47
Formation total..	40.55	182.12	269.47	492.14	1,317.25	1,800.88	777.91	3,896.04	2,263.61	571.16	25.72	2,860.49	3,621.41	2,554.16	1,073.10	7,248.67

Beds in the Lee formation

Upper Seaboard bed

Tazewell	0.50	3.14	....	3.64	19.99	8.96	....	28.95	2.93	....	....	2.93	23.42	12.10	....	35.52

Greasy Creek bed

Tazewell	....	....	....	....	5.47	4.37	....	9.84	3.02	....	....	3.02	8.49	4.37	....	12.86

Table 7.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by beds and counties

(in millions of short tons)--Continued

County	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			County total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Middle Seaboard bed																
Tazewell	....	0.20	....	0.20	4.59	1.29	....	5.88	15.99	....	....	15.99	20.58	1.49	....	22.07
Lower Seaboard bed																
Buchanan	....	....	....	....	0.42	....	....	0.42	7.23	....	....	7.23	7.65	....	....	7.65
Tazewell	0.85	6.40	1.27	8.52	43.82	14.11	....	57.93	7.93	....	....	7.93	52.60	20.51	1.27	74.38
Total	0.85	6.40	1.27	8.52	44.24	14.11	....	58.35	15.16	....	....	15.16	60.25	20.51	1.27	82.03
Upper Horsepen bed																
Tazewell	....	....	....	....	26.81	1.40	9.90	38.11	16.87	2.08	....	18.95	43.68	3.48	9.90	57.06
Middle Horsepen bed																
Tazewell	....	....	....	....	11.73	7.97	4.38	24.08	3.13	5.65	....	8.78	14.86	13.62	4.38	32.86
"C" bed																
Tazewell	....	....	....	....	7.48	2.46	....	9.94	....	8.17	....	8.17	7.48	10.63	....	18.11
War Creek bed																
Buchanan	....	....	....	....	....	....	....	....	....	2.00	0.96	2.96	....	2.00	0.96	2.96
Tazewell	....	....	....	....	27.48	15.17	2.23	44.88	31.01	4.48	....	35.49	58.49	19.65	2.23	80.37
Total	....	....	....	....	27.48	15.17	2.23	44.88	31.01	6.48	0.96	38.45	58.49	21.65	3.19	83.33
Lower Horsepen bed																
Tazewell	....	....	....	....	4.02	3.01	....	7.03	14.37	....	....	14.37	18.39	3.01	....	21.40
Pocahontas No. 8 bed																
Tazewell	....	....	....	....	....	....	....	....	0.35	....	....	0.35	0.35	....	....	0.35
Pocanontas No. 7 bed																
Tazewell	....	....	....	....	0.03	1.57	....	1.60	4.87	0.64	....	5.51	4.90	2.21	....	7.11
Pocahontas No. 6 bed																
Tazewell	....	....	....	....	5.30	....	....	5.30	6.35	....	....	6.35	11.65	....	....	11.65
Pocahontas No. 5 bed																
Tazewell	0.16	0.85	1.69	2.70	4.26	9.21	5.13	18.60	14.82	6.08	....	20.90	19.24	16.14	6.82	42.20
Pocahontas No. 4 bed																
Tazewell	....	....	5.65	5.65	0.42	0.68	25.70	26.80	2.87	3.53	....	6.40	3.29	4.21	31.35	38.85
Pocahontas No. 3 bed																
Buchanan	....	....	....	....	....	....	10.77	10.77	39.93	39.74	23.50	103.17	39.93	39.74	34.27	* 113.94
Tazewell	....	0.03	2.75	2.78	** 0.63	** 4.83	**22.87	28.33	**21.97	**22.48	** 8.80	53.25	22.60	27.34	34.42	84.36
Total	....	0.03	2.75	2.78	0.63	4.83	33.64	39.10	61.90	62.22	32.30	156.42	62.53	67.08	68.69	198.30

* Overburden 1,000-2,000 ft.
** Overburden 0-2,000 ft.

Beds in the Lee formation--Continued

Cove Creek bed

Scott ...	....	....	....	....	....	....	2.46	2.46	....	....	....	....	....	....	2.46	2.46
Wise	....	....	....	....	....	....	0.19	0.19	....	....	....	....	....	....	0.19	0.19
Total...	....	....	....	....	....	....	2.65	2.65	....	....	....	....	....	....	2.65	2.65

Egan bed

Scott....	....	....	....	....	0.44	1.37	2.23	4.04	3.28	....	....	3.28	3.72	1.37	2.23	7.32

Carter bed

Scott....	....	....	....	....	0.22	....	....	0.22	....	....	....	....	0.22	....	....	0.22

Tacus bed

Scott....	....	....	....	....	1.71	0.57	0.61	2.89	4.20	....	....	4.20	5.91	0.57	0.61	7.09

Starns bed

Scott....	....	....	....	....	1.13	3.52	0.06	4.71	....	....	....	....	1.13	3.52	0.06	4.71

Burtons Ford bed

Russell..	....	....	....	....	....	11.82	0.77	12.59	0.42	....	....	0.42	0.42	11.82	0.77	13.01
Scott ...	....	....	....	....	1.76	13.22	21.13	36.11	46.18	....	....	46.18	47.94	13.22	21.13	82.29
Wise.....	....	....	....	....	0.73	1.32	0.13	2.18	6.24	....	....	6.24	6.97	1.32	0.13	8.42
Total...	....	....	....	....	2.49	26.36	22.03	50.88	52.84	....	....	52.84	55.33	26.36	22.03	103.72
Formation total...	1.51	10.62	11.36	23.49	168.44	106.85	108.56	383.85	253.96	94.85	33.26	382.07	423.91	212.32	153.18	789.41
Grand total..	51.39	270.04	463.96	785.39	1,694.56	2,576.91	1,344.77	5,616.24	3,295.03	946.02	132.97	4,374.02	5,040.98	3,792.97	1,941.70	10,775.65

Table 8.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by counties and beds

(in millions of short tons)

Name of bed	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			Bed total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Buchanan County																
Cedar Grove	....	....	....	....	....	....	3.80	3.80	....	....	....	....	....	....	3.80	3.80
Lower Cedar Grove	....	....	....	....	0.43	....	0.32	0.75	0.71	....	0.81	1.52	1.14	....	1.13	2.27
Campbell Creek	....	....	....	....	....	30.23	....	30.23	....	19.52	....	19.52	....	49.75	....	49.75
Clintwood	....	0.18	12.33	12.51	6.40	30.24	29.41	66.05	3.17	11.05	....	14.22	9.57	41.47	41.74	92.78
Eagle	0.98	4.92	8.20	14.10	32.98	96.17	36.68	165.83	32.60	3.17	....	35.77	66.56	104.26	44.88	215.70
Blair	....	....	....	....	....	11.50	19.78	31.28	1.74	25.83	2.83	30.40	1.74	37.33	22.61	61.68
Dorchester	0.93	0.66	....	1.59	26.60	15.67	....	42.27	60.98	0.49	....	61.47	88.51	16.82	....	105.33
Hagy	....	....	....	....	25.70	168.62	11.44	205.76	75.11	22.90	....	98.01	100.81	191.52	11.44	303.77
Splash Dam	3.28	26.93	35.72	65.93	262.57	240.28	92.37	595.22	47.35	....	....	47.35	313.20	267.21	128.09	708.50
Upper Banner	....	....	....	....	1.90	1.50	....	3.40	2.43	....	....	2.43	4.33	1.50	....	5.83
Lower Banner	0.76	2.12	3.94	6.82	96.32	31.24	19.87	147.43	132.18	....	....	132.18	229.26	33.36	23.81	286.43
Big Fork	....	....	....	....	0.98	....	....	0.98	7.04	1.51	....	8.55	8.02	1.51	....	9.53
Kennedy	0.64	0.05	....	0.69	278.57	254.96	7.96	541.49	222.87	6.90	....	229.77	502.08	261.91	7.96	771.95
Ally	....	....	....	....	5.50	....	....	5.50	36.79	....	....	36.79	42.29	....	....	42.29
Raven	1.69	14.21	1.28	17.18	53.65	82.57	....	136.22	422.29	....	....	422.29	477.63	96.78	1.28	575.69
Jawbone	0.25	2.11	1.59	3.95	57.47	138.63	7.17	203.27	120.77	8.94	....	129.71	178.49	149.68	8.76	336.93
Tiller	0.21	1.88	6.05	8.14	26.16	10.27	6.97	43.40	25.25	0.65	....	25.90	51.62	12.80	13.02	77.44
Lower Seaboard	....	....	....	....	0.42	....	....	0.42	7.23	....	....	7.23	7.65	....	....	7.65
War Creek	....	....	....	....	....	....	....	....	....	2.00	0.96	2.96	....	2.00	0.96	2.96
Pocahontas No. 3	....	....	....	....	....	....	10.77	10.77	39.93	39.74	23.50	103.17	39.93	39.74	34.27	* 113.94
Total	8.74	53.06	69.11	130.91	875.65	1,111.88	246.54	2,234.07	1,238.44	142.70	28.10	1,409.24	2,122.83	1,307.64	343.75	3,774.22
Dickenson County																
Kelly	....	....	....	....	....	....	2.77	2.77	....	....	1.92	1.92	....	....	4.69	4.69
Imboden	....	....	....	....	2.18	....	....	2.18	....	2.20	....	2.20	....	4.38	....	4.38
Clintwood	....	....	14.81	14.81	12.45	1.77	43.96	58.18	4.84	0.80	0.41	6.05	17.29	2.57	59.18	79.04
Eagle	0.81	1.67	5.94	8.42	6.45	0.55	0.58	7.98	2.30	0.10	....	2.40	9.96	2.32	6.52	18.80
Blair	....	....	....	....	....	....	....	....	6.63	7.76	....	14.39	6.63	7.76	....	14.39
Lyons	....	....	....	....	....	0.28	....	0.28	8.76	....	....	8.76	8.76	0.28	....	9.04
Dorchester	....	....	....	....	6.39	1.61	....	8.00	65.09	21.33	....	86.42	71.48	22.94	....	94.42
Norton	....	....	....	....	....	....	....	....	1.51	....	....	1.51	1.51	....	....	1.51
Hagy	....	....	....	....	11.91	2.22	....	14.13	37.41	....	....	37.41	49.32	2.22	....	51.54
Splash Dam	0.42	3.18	0.09	3.69	67.51	56.16	16.97	140.64	178.14	....	....	178.14	246.07	59.34	17.06	322.47
Upper Banner	12.36	27.80	66.10	106.26	38.06	50.38	56.83	145.27	57.52	16.38	....	73.90	107.94	94.56	122.93	325.43
Lower Banner	3.24	22.58	14.65	40.47	81.14	83.84	14.72	179.70	113.46	6.27	....	119.73	197.84	112.69	29.37	339.90
Kennedy	....	....	....	....	40.44	84.71	3.56	128.71	120.36	185.18	....	305.54	160.80	269.89	3.56	434.25
Ally	....	....	....	....	....	....	....	....	8.26	....	....	8.26	8.26	....	....	8.26
Raven	2.22	4.22	7.91	14.35	46.30	47.96	32.78	127.04	134.36	103.72	13.90	251.98	182.88	155.90	54.59	393.37
Jawbone	0.25	0.66	9.55	10.46	12.05	75.13	105.73	192.91	162.88	97.78	11.44	272.10	175.18	173.57	126.72	475.47
Tiller	0.59	0.17	14.87	15.63	18.71	11.89	35.50	66.10	12.72	....	....	12.72	32.02	12.06	50.37	94.45
Total	19.89	60.28	133.92	214.09	341.81	418.68	313.40	1,073.89	914.24	441.52	27.67	1,383.43	1,275.94	920.48	474.99	2,671.41

* Overburden 1,000-2,000 ft.

Table 8.--Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by counties and beds

(in millions of short tons)

Name of bed	Measured reserves				Indicated reserves				Inferred reserves				Total in all categories			Bed total
	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	Total	In beds 14 to 28 in. thick	In beds 28 to 42 in. thick	In beds more than 42 in. thick	
Lee County																
High Splint	....	0.84	....	0.84	....	....	....	....	....	....	....	....	....	0.84	....	0.84
Morris	....	0.06	0.04	0.10	....	1.57	....	1.57	....	1.10	....	1.10	....	2.73	0.04	2.77
Purdue	....	....	0.60	0.60	....	....	1.34	1.34	0.37	....	....	0.37	0.37	....	1.94	2.31
Wax	....	....	....	....	....	....	2.46	2.46	....	....	....	....	....	....	2.46	2.46
Gin Creek	....	....	....	....	1.63	....	....	1.63	....	....	....	....	1.63	....	....	1.63
Phillips	....	0.16	0.34	0.50	....	2.90	7.64	10.54	1.65	0.48	....	2.13	1.65	3.54	7.98	13.17
Low Splint	....	0.08	7.32	7.40	....	2.61	9.09	11.70	2.31	....	....	2.31	2.31	2.69	16.41	21.41
Taggart	....	10.85	4.07	14.92	....	24.59	7.08	31.67	....	....	....	....	....	35.44	11.15	46.59
Taggart Marker	....	....	....	....	4.33	5.36	....	9.69	22.59	0.61	....	23.20	26.92	5.97	....	32.89
Kirk	....	....	....	....	1.76	....	....	1.76	....	....	....	....	1.76	....	....	1.76
Harlan	....	3.50	1.35	4.85	0.46	72.73	29.83	103.02	....	* 9.80	....	9.80	0.46	86.03	31.18	117.67
Upper St. Charles	....	0.92	....	0.92	....	2.60	....	2.60	3.03	0.13	....	3.16	3.03	3.65	....	6.68
Lower St. Charles	....	....	....	....	....	5.70	....	5.70	24.50	3.43	....	27.93	24.50	9.13	....	33.63
Pinhook	....	....	....	....	1.02	0.88	....	1.90	7.23	....	....	7.23	8.25	0.88	....	9.13
Kelly	....	....	....	....	....	9.23	....	9.23	2.62	4.13	....	6.75	2.62	13.36	....	15.98
Stone Creek	....	....	....	....	0.63	....	....	0.63	....	....	....	....	0.63	....	....	0.63
Imboden	0.08	1.60	3.39	5.07	1.40	13.81	6.55	21.76	27.67	0.98	....	28.65	29.15	16.39	9.94	55.48
Clintwood	....	....	0.40	0.40	1.98	1.14	10.49	13.61	* 24.78	22.08	23.79	70.65	26.76	23.22	34.68	84.66
Blair	....	....	....	....	....	....	....	....	6.49	2.35	0.40	9.24	6.49	2.35	0.40	9.24
Lyons	....	....	....	....	....	....	....	....	2.55	3.22	....	5.77	2.55	3.22	....	5.77
Dorchester	....	....	....	....	....	....	....	....	1.80	0.21	....	2.01	1.80	0.21	....	2.01
Total	0.08	18.01	17.51	35.60	13.21	143.12	74.48	230.81	127.59	48.52	24.19	200.30	140.88	209.65	116.18	466.71
Russell County																
Dorchester	....	....	....	....	....	....	....	....	0.08	....	....	0.08	0.08	....	....	0.08
Splash Dam	....	....	....	....	....	....	....	....	8.58	....	....	8.58	8.58	....	....	8.58
Upper Banner	0.85	1.30	9.75	11.90	0.73	2.37	1.00	4.10	....	....	....	....	1.58	3.67	10.75	16.00
Lower Banner	....	4.73	11.29	16.02	1.09	11.79	15.71	28.59	1.26	....	....	1.26	2.35	16.52	27.00	45.87
Big Fork	....	....	....	....	....	....	....	....	....	4.80	....	4.80	....	4.80	....	4.80
Kennedy	....	2.33	....	2.33	15.20	93.75	6.34	115.29	10.12	0.35	....	10.47	25.32	96.43	6.34	128.09
Raven	5.98	6.69	2.57	15.24	36.18	23.39	0.76	60.33	23.27	....	....	23.27	65.43	30.08	3.33	98.84
Jawbone	....	....	23.21	23.21	11.75	27.60	140.05	179.40	45.46	1.28	0.12	46.86	57.21	28.88	163.38	249.47
Tiller	2.08	2.86	21.39	26.33	16.17	22.04	81.80	120.01	8.22	....	....	8.22	26.47	24.90	103.19	154.56
Burtons Fork	....	....	....	....	....	11.82	0.77	12.59	0.42	....	....	0.42	0.42	11.82	0.77	13.01
Total	8.91	17.91	68.21	95.03	81.12	192.76	246.43	520.31	97.41	6.43	0.12	103.96	187.44	217.10	314.76	719.30
Scott County																
Jawbone	....	....	....	....	....	....	0.48	0.48	....	....	....	....	....	....	0.48	0.48
Cove Creek	....	....	....	....	....	....	2.46	2.46	....	....	....	....	....	....	2.46	2.46
Ryan	....	....	....	....	0.44	1.37	2.23	4.04	3.28	....	....	3.28	3.72	1.37	2.23	7.32
Carter	....	....	....	....	0.22	....	....	0.22	....	....	....	....	0.22	....	....	0.22
Tacoa	....	....	....	....	1.71	0.57	0.61	2.89	4.20	....	....	4.20	5.91	0.57	0.61	7.09
Stafford	....	....	....	....	1.13	3.52	0.06	4.71	....	....	....	....	1.13	3.52	0.06	4.71
Burtons Fork	....	....	....	....	1.76	13.22	21.13	36.11	46.18	....	....	46.18	47.94	13.22	21.13	82.29
Total	....	....	....	....	5.26	18.68	26.97	50.91	53.66	....	....	53.66	58.92	18.68	26.97	104.57

* Overburden 0-2,000 ft.

Table 8.——Estimated remaining reserves of bituminous coal in the Southwest Virginia field as of January 1, 1951, by counties and beds——Continued

Tazewell County

Lower Banner	....	....	....	....	0.08	0.14	0.12	0.34	....	....	....	....	0.08	0.14	0.12	0.34
Big Fork	....	....	....	....	....	....	....	....	0.35	0.64	....	0.99	0.35	0.64	....	0.99
Caldwell	....	....	....	....	1.17	2.75	0.95	4.87	....	....	....	....	1.17	2.75	0.95	4.87
Kennedy	....	....	....	....	1.84	7.40	....	9.24	....	....	....	....	1.84	7.40	....	9.24
Ally	....	....	....	....	....	....	....	....	1.90	....	....	1.90	1.90	....	....	1.90
Raven	....	9.39	0.40	9.79	0.94	22.67	....	23.61	....	....	....	....	0.94	32.06	0.40	33.40
Jawbone	1.16	2.61	1.40	5.17	7.76	38.88	10.26	56.90	10.66	1.01	....	11.67	19.58	42.50	11.66	73.74
Tiller	0.56	1.86	....	2.42	17.84	14.36	....	32.20	10.11	....	....	10.11	28.51	16.22	....	44.73
Upper Seaboard	0.50	3.14	....	3.64	19.99	8.96	....	28.95	2.93	....	....	2.93	23.42	12.10	....	35.52
Greasy Creek	....	....	....	....	5.47	4.37	....	9.84	3.02	....	....	3.02	8.49	4.37	....	12.86
Middle Seaboard	....	0.20	....	0.20	4.59	1.29	....	5.88	15.99	....	....	15.99	20.58	1.49	....	22.07
Lower Seaboard	0.85	6.40	1.27	8.52	43.82	14.11	....	57.93	7.93	....	....	7.93	52.60	20.51	1.27	74.38
Upper Horsepen	....	....	....	....	26.81	1.40	9.90	38.11	16.87	2.08	....	18.95	43.68	3.48	9.90	57.06
Middle Horsepen	....	....	....	....	11.73	7.97	4.38	24.08	3.13	5.65	....	8.78	14.86	13.62	4.38	32.86
"C"	....	....	....	....	7.48	2.46	....	9.94	....	8.17	....	8.17	7.48	10.63	....	18.11
War Creek	....	....	....	....	27.48	15.17	2.23	44.88	31.01	4.48	....	35.49	58.49	19.65	2.23	80.37
Lower Horsepen	....	....	....	....	4.02	3.01	....	7.03	14.37	....	....	14.37	18.39	3.01	....	21.40
Pocahontas No. 8	....	....	....	....	....	....	....	....	0.35	....	....	0.35	0.35	....	....	0.35
Pocahontas No. 7	....	....	....	....	0.03	1.57	....	1.60	4.87	0.64	....	5.51	4.90	2.21	....	7.11
Pocahontas No. 6	....	....	....	....	5.30	....	....	5.30	6.35	....	....	6.35	11.65	....	....	11.65
Pocahontas No. 5	0.16	0.85	1.69	2.70	4.26	9.21	5.13	18.60	14.82	6.08	....	20.90	19.24	16.14	6.82	42.20
Pocahontas No. 4	....	....	5.65	5.65	0.42	0.68	25.70	26.80	2.87	3.53	....	6.40	3.29	4.21	31.35	38.85
Pocahontas No. 3	....	0.03	2.75	2.78	* 0.63	* 4.83	* 22.87	28.33	* 21.97	* 22.48	* 8.80	53.25	22.60	27.34	34.42	84.36
Total	3.23	24.48	13.16	40.87	191.66	161.23	81.54	434.43	169.50	54.76	8.80	233.06	364.39	240.47	103.50	708.36

Wise County

High Splint	0.21	0.71	7.21	8.13	0.63	3.72	5.22	9.57	0.07	10.38	....	10.45	0.91	14.81	12.43	28.15
Morris	....	2.81	12.32	15.13	0.98	0.69	9.90	11.57	1.71	0.33	....	2.04	2.69	3.83	22.22	28.74
Pardee	0.51	2.15	28.22	30.88	2.11	16.77	23.47	42.35	0.96	....	....	0.96	3.58	18.92	51.69	74.19
Phillips	....	....	....	....	1.13	....	....	1.13	10.75	....	....	10.75	11.88	....	....	11.88
Low Splint	0.29	14.41	1.83	16.53	1.13	22.66	2.57	26.36	51.26	5.44	....	56.70	52.68	42.51	4.40	99.59
Taggart	0.54	2.78	26.51	29.83	1.51	31.38	53.11	86.00	1.33	4.13	....	5.46	3.38	38.29	79.62	121.29
Taggart Marker	0.44	11.42	....	11.86	11.58	59.95	....	71.53	2.40	....	....	2.40	14.42	71.37	....	85.79
Upper Standiford	....	....	....	....	....	7.33	5.81	13.14	53.66	3.54	....	57.20	53.66	10.87	5.81	70.34
Pinhook	....	....	....	....	1.23	0.56	....	1.79	2.08	....	....	2.08	3.31	0.56	....	3.87
Kelly	....	....	....	....	1.15	61.29	26.50	88.94	40.85	19.38	....	60.23	42.00	80.67	26.50	149.17
Imboden	....	0.68	14.40	15.08	5.32	30.47	57.75	93.54	29.95	39.65	8.16	77.76	35.27	70.80	80.31	186.38
Rocky Ford	....	....	....	....	....	....	....	....	0.24	....	....	0.24	0.24	....	....	0.24
Addington	....	....	....	....	0.30	1.94	0.51	2.75	1.28	0.33	....	1.61	1.58	2.27	0.51	4.36
Clintwood	....	0.49	11.23	11.72	10.27	39.98	48.27	98.52	37.05	19.59	0.51	57.15	47.32	60.06	60.01	167.39
Blair	1.20	4.37	0.04	5.61	5.50	4.31	....	9.81	72.05	34.39	35.16	141.60	78.75	43.07	35.20	157.02
Lyons	1.90	4.54	0.27	6.71	30.05	9.74	....	39.79	85.84	....	....	85.84	117.79	14.28	0.27	132.34
Dorchester	1.44	7.50	22.31	31.25	30.67	45.07	13.41	89.15	* 71.49	2.08	....	73.57	103.60	54.65	35.72	193.97
Norton	3.23	24.10	1.49	28.82	30.92	46.89	....	77.81	63.56	....	....	63.56	97.71	70.99	1.49	170.19
Hagy	....	....	....	....	9.08	....	....	9.08	....	....	....	....	9.08	....	....	9.08
Splash Dam	....	....	....	....	1.42	....	....	1.42	9.94	....	....	9.94	11.36	....	....	11.36
Upper Banner	0.65	11.02	21.42	33.09	3.28	14.83	23.53	41.64	15.63	3.74	....	19.37	19.56	29.59	44.95	94.10
Lower Banner	....	8.81	9.56	18.37	17.27	24.51	11.84	53.62	37.63	7.16	....	44.79	54.90	40.48	21.40	116.78
Kennedy	....	....	....	....	14.47	39.10	16.16	69.73	19.79	23.33	....	43.12	34.26	62.43	16.16	112.85
Raven	0.13	0.37	3.30	3.80	4.94	39.84	11.42	56.20	48.29	22.42	....	70.71	53.36	62.63	14.72	130.71
Jawbone	....	0.14	1.94	2.08	0.18	28.21	45.62	74.01	26.80	54.51	....	81.31	26.98	82.86	47.56	157.40
Tiller	....	....	....	....	....	....	....	....	3.34	1.69	0.26	5.29	3.34	1.69	0.26	5.29
Cove Creek	....	....	....	....	....	....	0.19	0.19	....	....	....	....	....	....	0.19	0.19
Burtons Ford	....	....	....	....	0.73	1.32	0.13	2.18	6.24	....	....	6.24	6.97	1.32	0.13	8.42
Total	10.54	96.30	162.05	268.89	185.85	530.56	355.41	1,071.82	694.19	252.09	44.09	990.37	890.58	878.95	561.55	2,331.08
Grand total	51.39	270.04	463.96	785.39	1,694.56	2,576.91	1,344.77	5,616.24	3,295.03	946.02	132.97	4,374.02	5,040.98	3,792.97	1,941.70	10,775.65

* Overburden 0-1,000 ft.

road and the Southern Railway to open the previously undeveloped area. The first reported production from Dickenson County was in 1917, when mines in that county along the Clinchfield Railroad were opened; production from that county has increased steadily and is now approaching 3 million tons annually.

The last part of the Southwest field to be opened to mining was Buchanan County, which was made accessible in 1932 by branches of the Norfolk & Western Railway. Development in the county since that year has been very rapid, production having climbed to about 5 million tons annually in 1948. During the 18 yr from 1932 through 1949 more than 68 million tons of coal have been mined in the County, which thus ranks third in all-time production, behind Wise and Tazewell Counties.

The reported cumulative production, through 1949, of the Southwest field of Virginia is about 534 million tons, compared with approximately 6 million tons for the Valley fields and 8 million tons from the Richmond basin of the Eastern fields. At the present time production from the Southwest field is approximately 99 percent of the annual State production, the remainder being from the Valley fields. In 1949 Virginia ranked eighth among coal-producing states, after Indiana and before Alabama.

COAL MINING IN VIRGINIA

Mining methods

In 1949, the latest year for which figures are available, underground mining accounted for 92.7 percent of the total reported production of Virginia (U. S. Bureau of Mines, 1950). The room-and-pillar system of mining is used almost exclusively; most mines are reached by drifts, only a few by shafts. The average annual production per mine is 43,535 tons, compared with the national average of 51,159 tons. The production per man-day is also comparatively low, being 4.83 tons in Virginia as against a national average of 5.42 tons. It is interesting to note that 94.4 percent of the coal is cut by machines, but that only 47.6 percent is loaded mechanically; the Nation-wide figures are 91.4 percent and 66.7 percent, respectively.

The low percentage of coal loaded mechanically possibly reflects the comparatively large number of small (1,000 to 50,000 tons annually) mines in Virginia. The number of mines in each size range, and the percentages for Virginia and for the United States as a whole, are given below; mines producing less than 1,000 tons per year, which do not report their production figures, are not included.

Size of coal mines in Virginia compared with the national average

Annual capacity, (tons)	Virginia			United States	
	Number of mines	Percent of total number	Percent of production	Percent of total number	Percent of production
More than 500,000	4	1.2	18.8	1.9	29.3
100,000 - 500,000	34	10.2	47.5	10.3	43.4
50,000 - 100,000	23	6.9	11.7	7.9	10.9
10,000 - 50,000	103	30.7	14.5	25.1	11.4
1,000 - 10,000	171	51.0	7.5	54.9	5.0
Total	335	100.0	100.0	100.0	100.0

Of the coal produced in Virginia, 1.8 percent is used at the mine, 73.5 percent is shipped directly by rail, 21.2 percent is hauled by trucks to railheads for shipment, and only 3.5 percent is trucked to its destination. The percentage of truck-hauled coal is only about one-third of the national average of 10.9 percent and probably reflects the final destination of Virginia coal, much of which is shipped to distant points in the United States for special purposes, and very large tonnages of which are shipped overseas through the port of Hampton Roads. Another inference from the low percentage of truck shipments is that only a small part of the coal mined in Virginia is used in nearby areas.

The nature of the terrain in both the Southwest and Valley fields is such that possibilities for strip-mining are limited, and that method of recovery accounted for only 7.3 percent of the State's production in 1949 as compared to the Nation-wide average of 24.2 percent. Of the 335 mines reported as operating in 1949, only 16, with an average annual production of 67,100 tons, were strip mines. The average production per man-day was 14.87 tons, compared with the national average of 15.33 tons.

Recoverability in mining

The percentage of coal recovered in mining operations varies greatly from place to place and from time to time, according to the thickness, structure, and other characteristics of the coal beds, the methods used in mining, and many other factors. The first published report on recoverability in coal mining was that of Rice and Paul (1925) who estimated the average loss in mining in bituminous coal mines in the eastern United States at 34.7 percent, the figures by States ranging from 20.0 percent for Virginia to 49.0 percent for Illinois. The extremely low figure for Virginia is based on studies of 34 mines and took into account six types of loss: coal left in the roof or bottom; coal left in pillars; coal lost in oil- and gas-well pillars; coal lost under buildings, railroads, highways, and other places; coal lost in handling and preparation; and coal lost by rolls, thin or dirty layers, and streams. No consideration was given to coal in overlying beds lost through mining in lower beds, nor to coal lying between mined areas; the figures apply to individual mining properties rather than to the mining districts as a whole. Further, the mines studied in 1925 were comparatively large, and it may be presumed that they were favorably

located in thick, easily accessible coal and were well managed. Since 1925 it has been necessary to mine thinner coal, at greater depths and under less favorable conditions generally than prevailed at that time; under these conditions mining losses, even if considered on a mine-by-mine rather than an over-all basis, probably have increased considerably.

Mining losses over large areas as distinguished from those in individual mines have been discussed at considerable length by Averitt and Berryhill (1950), who estimate the average loss throughout the United States, on the basis of numerous estimates made by qualified persons, as being about 50 percent; in other words, the amount of coal lost in mining a given large area may be expected to be approximately equal to the tonnage actually recovered. Studies of the mined-out areas in the Southwest Virginia field, which are estimated to have contained about 920 million tons of coal as compared to reported production of about 534 million tons, indicate that the 50 percent figure is not far from the true percentage for the Virginia coal fields.

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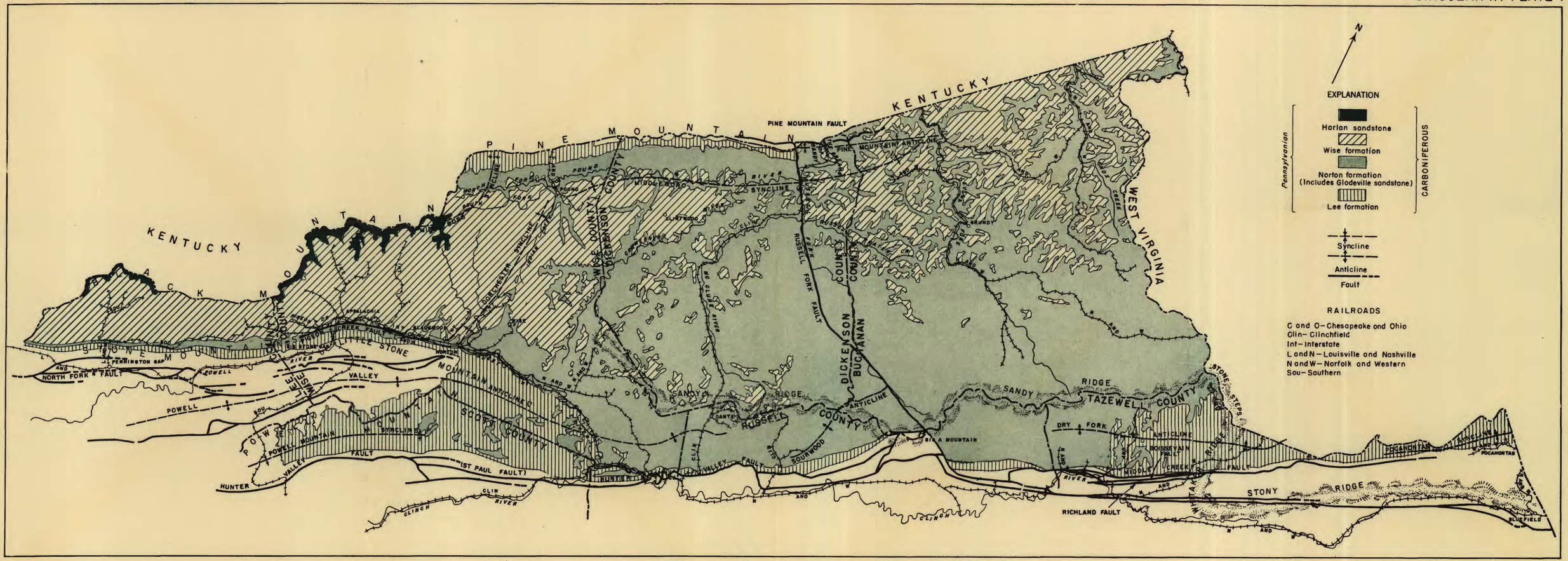
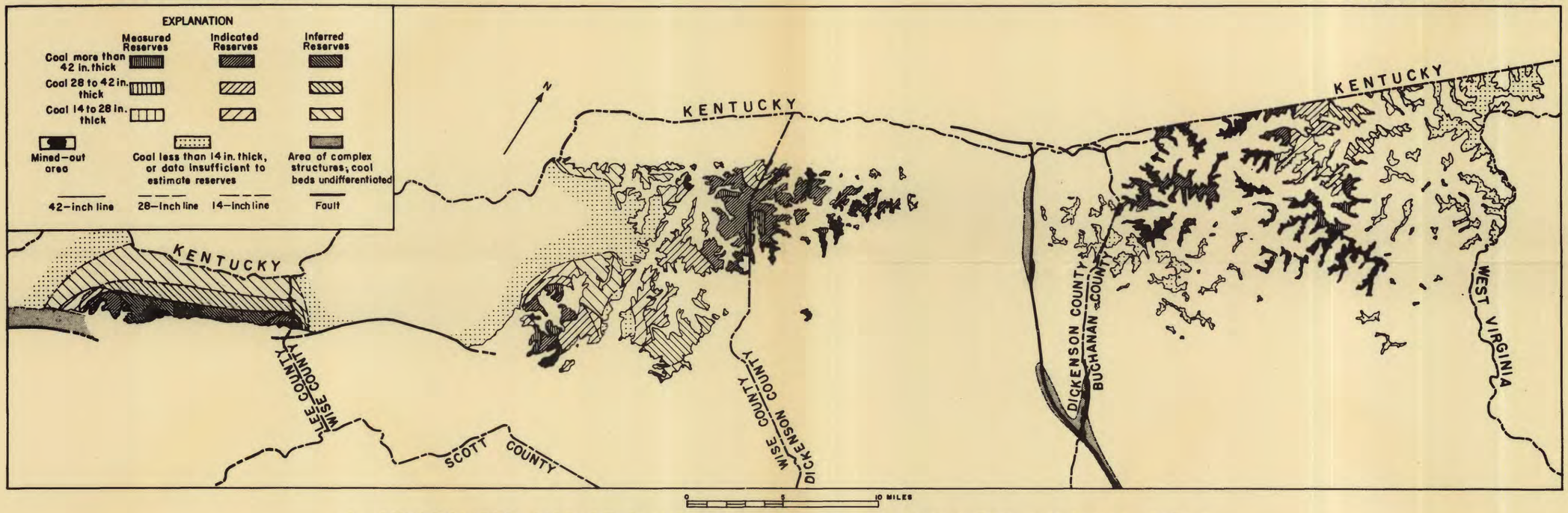
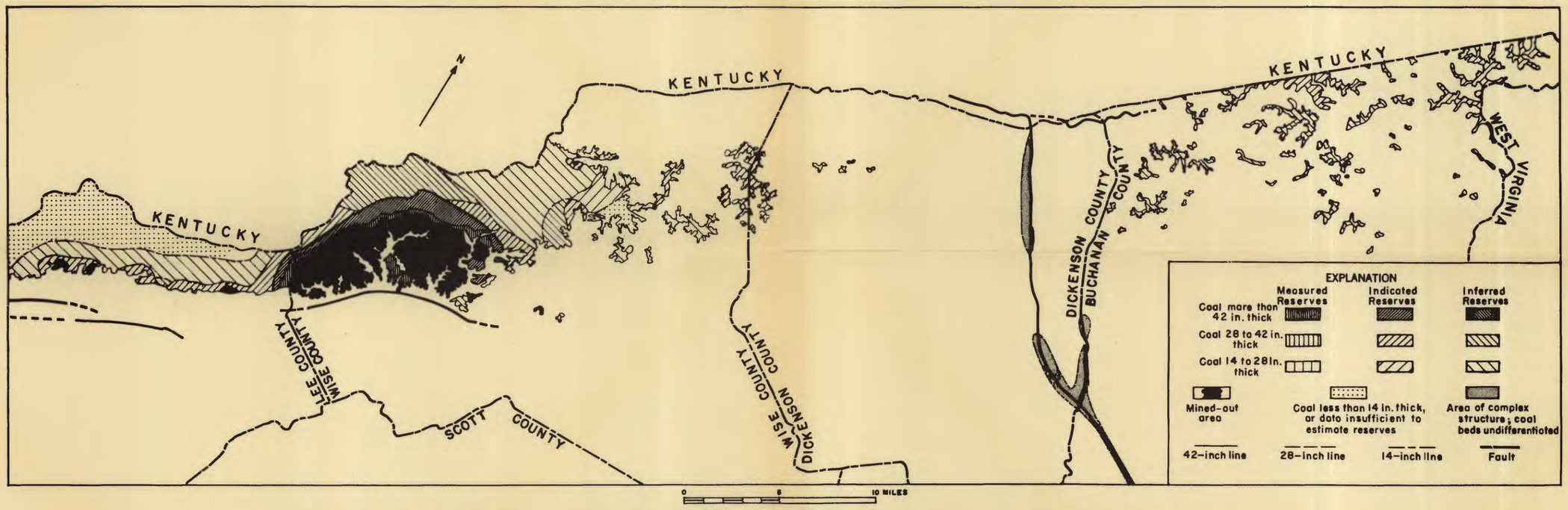
CIRCULAR 171 PLATE 1



GEOLOGIC MAP OF THE SOUTHWEST VIRGINIA COAL FIELD



A. GENERALIZED MAP OF CLINTWOOD COAL BED, SOUTHWEST VIRGINIA FIELD



B. GENERALIZED MAP OF IMBODEN OR CAMPBELL CREEK COAL BED, SOUTHWEST VIRGINIA FIELD

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CIRCULAR 171 PLATE 3

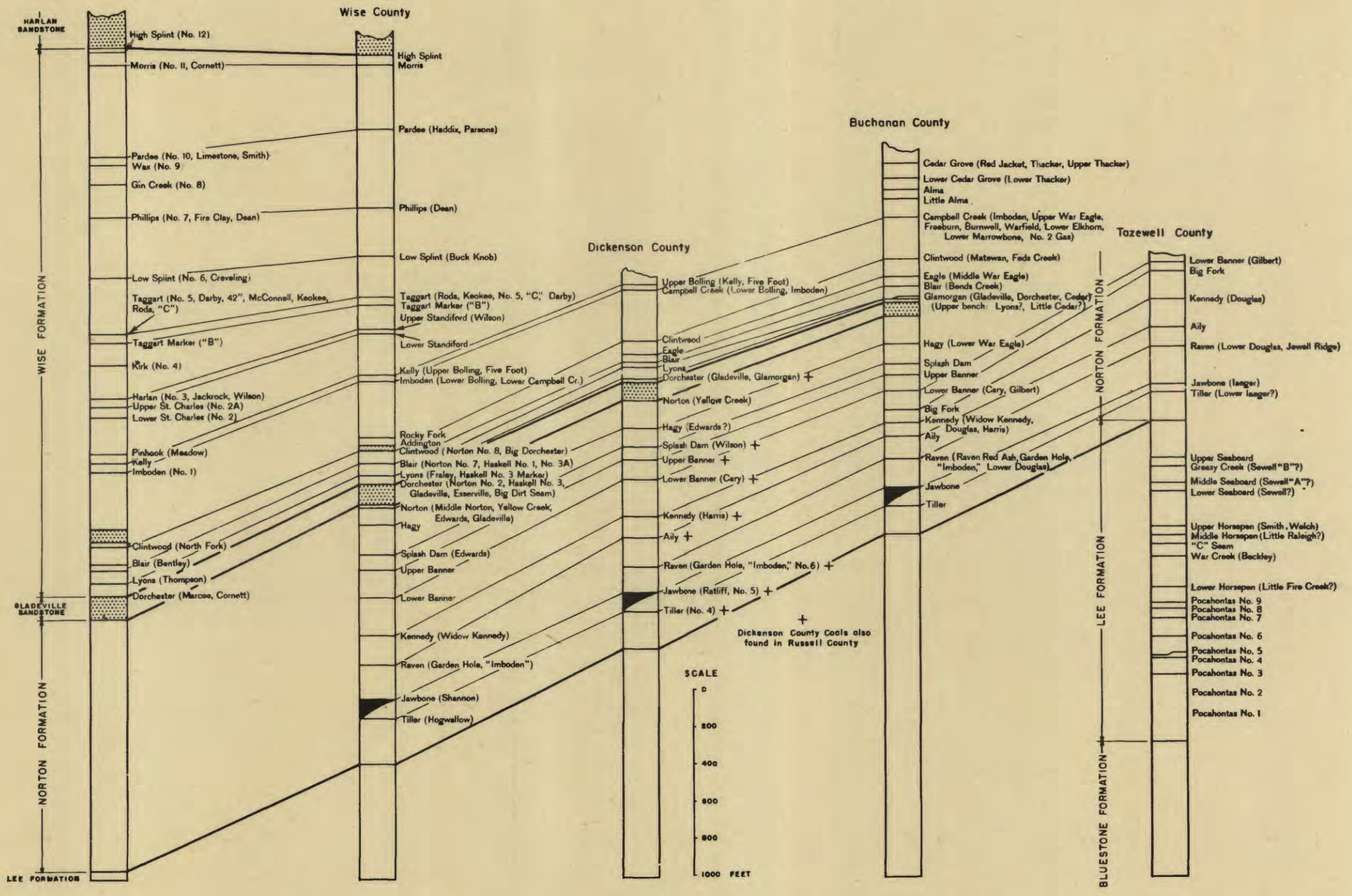

CHART SHOWING STRATIGRAPHIC POSITION OF COAL BEDS IN THE SOUTHWEST VIRGINIA FIELD