

# RESERVES AND RESOURCES OF SURFACE-MINABLE COAL IN ILLINOIS

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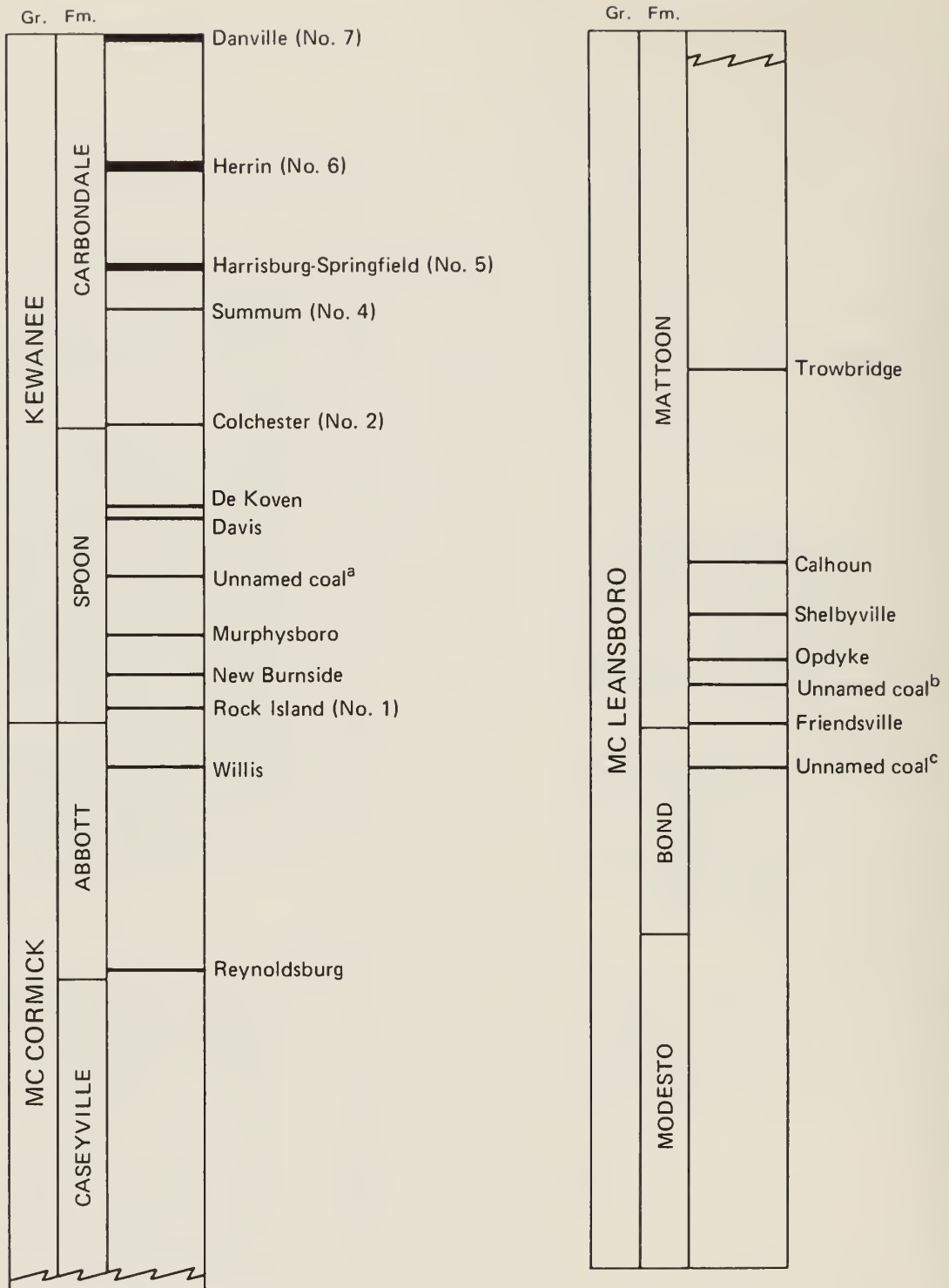


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Generalized stratigraphic section of selected coal members in Illinois

<sup>a</sup>Found near Campbell Hill, Jackson County

<sup>b</sup>Found near Belle Rive in Jefferson County and in Loudon Township, Fayette County

<sup>c</sup>Found near Bristol Hill, Crawford County

# RESERVES AND RESOURCES OF SURFACE-MINABLE COAL IN ILLINOIS

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## ABSTRACT

Surface mining accounts for nearly 50 percent of recent coal production in Illinois. In previous publications, the Illinois State Geological Survey reported that over 20 billion tons of coal in Illinois were potentially strippable; however, current economic and environmental issues associated with surface mining have created a need for estimates of the amount of strippable coal that can be recovered economically under present conditions. In estimating strippable reserves, the criteria used were (1) reliability of data, (2) overburden and coal thicknesses, (3) the size of the block of coal, and (4) proximity to man-made and natural obstacles.

On the basis of the criteria, Illinois was determined to have 6 billion tons of surface-minable coal in the ground. This reserve is made up of 185 blocks of 6 million tons or more. The amounts of strippable reserves are large in western Illinois and especially in southwestern and southern Illinois, which are more attractive for surface mining because land costs are lower, the heating value of the coal is higher, and the tonnage recoverable per acre is greater. The southwestern and southern Illinois deposits are and will continue to be the major sources of surface-mined coal in the state; however, in view of current rates of production, the remaining reserves in this area are relatively small, and opportunities for new acquisitions and long-term development are limited. Only 38 percent of the strippable reserves mapped exceed 4 feet in thickness, and most of those reserves have overburden in excess of 50 feet.

## ACKNOWLEDGMENTS

Ramesh Malhotra, former mineral economist at the Illinois State Geological Survey, inspired this project and gave valuable advice on the criteria used to judge minability. Roger B. Nance, former assistant geologist in the Coal Section of the Survey, also provided advice during the project.

## INTRODUCTION

The amount of Illinois coal that is potentially recoverable by surface mining (also called strip mining) was first estimated by Culver (1925) to be 1,407 million tons. Although Culver included coal as thin as 24 inches in his estimate, he reported that many mining companies considered 48 inches the minimum thickness for economical surface mining. As data became available, the potential for surface mining in southwestern, southern, western, northern, and central Illinois was reported (Cady, 1925 and 1937, and Henbest, 1932).

Cady (1952) established criteria for evaluating strip-pable coal deposits and summarized the general geologic features of the known surface-minable coals. Since 1955, the Illinois State Geological Survey has mapped over 20 billion tons of coal considered to be potentially strippable, i.e., all coal 18 or more inches thick and not more than 150 feet deep (Smith, 1957, 1958, 1961, and 1968; Smith and Berggren, 1963; Reinertsen, 1964; and Searight and Smith, 1969). These deposits constitute 13 percent of all coal in Illinois. The numbered areas shown in figure 1 correspond closely to those studied for the early reports.

In 1969, Risser suggested that surface mining had reached a peak and that increased thickness of overburden and scarcity of large blocks of coal were putting pressures on the industry's growth. After rising to more than 50 percent of the state's coal production in the early 1960s, the percentage of coal that is surface-mined has declined to about 47 percent.

## ESTIMATE OF STRIPPABLE RESERVES

Although the technology exists to surface-mine all coal less than 150 feet deep, a large amount of the coal cannot be economically or legally recovered. Much of this coal is thinner and deeper than that currently surface-mined in the state, in deposits too small to justify development and rendered unminable by proximity to man-made and natural obstacles. Because of the current focus on environmental and energy issues involving surface mining, we have re-evaluated the original data on resources to estimate

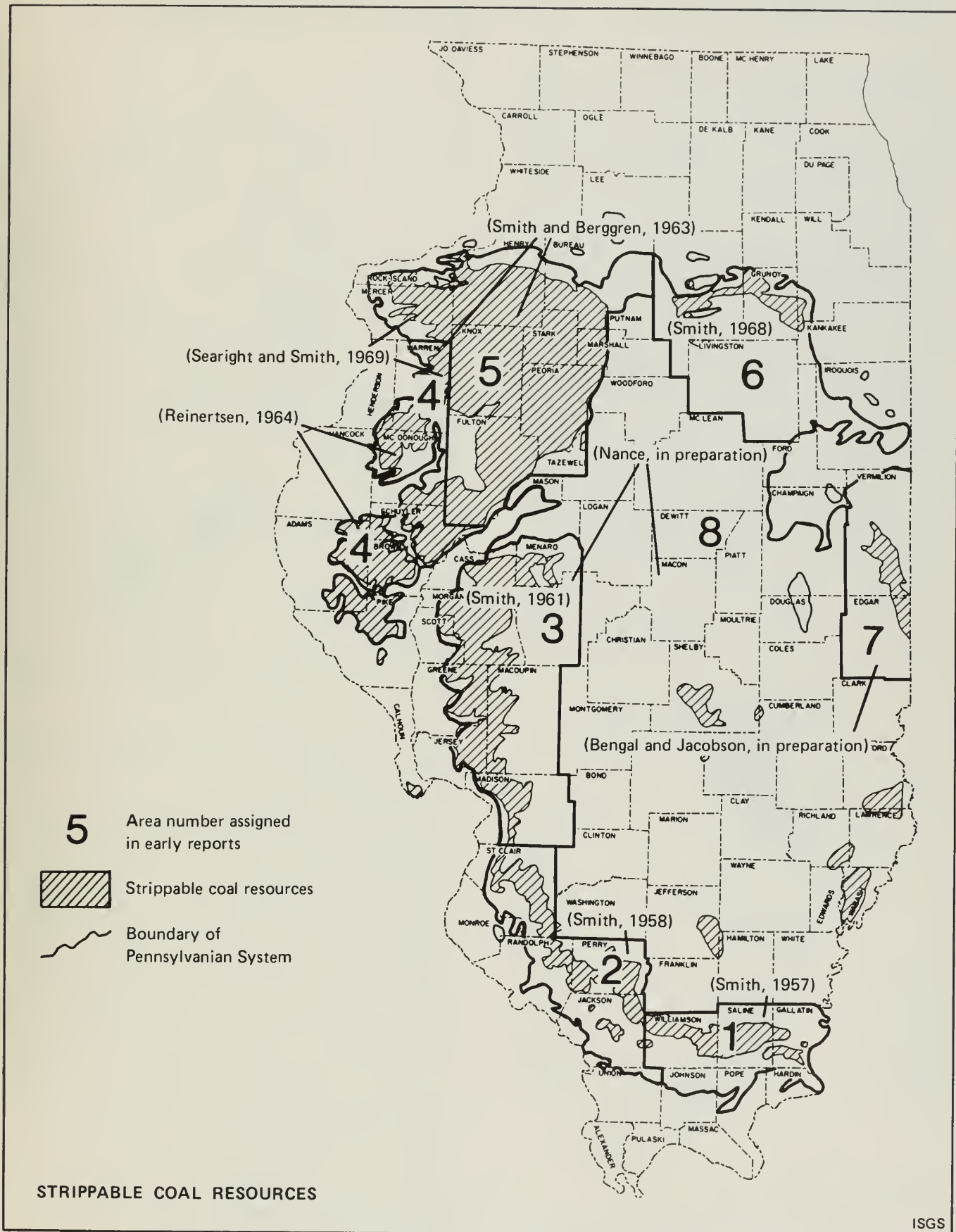
the amount of coal economically and legally surface minable. This study is not intended to replace earlier resource estimates, but to supplement them with an evaluation of the current minability of deposits.

In this report, *strippable coal resources* refers to the coal classified in earlier reports to be potentially strippable. *Strippable coal reserves* refers to that portion of the strip-pable coal resources which is economically and legally minable according to the criteria used for this study: (1) reliability of data, (2) overburden and coal thicknesses, (3) the size of the block of coal, and (4) proximity to man-made and natural obstacles. We have determined the amount of coal reserves in Illinois to be 6 billion tons, or about 30 percent of strippable coal resources. In this study we report the location, extent, and thickness of the coals and the characteristics and thickness of overburden. No attempt has been made to assess impact of laws controlling surface mining of prime agricultural land, and no recovery factor has been applied to the reserves.

This report is an overview and should be used only as a guide to more detailed investigation for specific areas. Because the scope of the study is broad, the criteria we have used to classify reserves are generalized, and we did not take into account local factors such as composition of the overburden, quality of the coal, transportation facilities, local ordinances, and land ownership, which would have eliminated some areas classified as reserves and would have included some areas that have been eliminated. Nevertheless, we believe our criteria provide a reasonable overall estimate of the magnitude, characteristics, and locations of strippable coal reserves in Illinois.

The criteria used to classify reserves were applied on the basis of the economic conditions and mining practices prevailing during the study. A sharp rise in coal prices, a technological breakthrough in development of equipment, or the passage of new, more restrictive mining laws could significantly change the criteria used for judging economical minability. It should be noted that companies anticipate future conditions when they buy coal lands; exploration and leasing activities in areas classified as unminable by this report are not unusual.





ISGS

Figure 1



TABLE 1. Reserves of strippable coal in counties of Illinois, by coal member, in millions of tons<sup>a</sup>

County	Trowbridge	Shelbyville	Opdyke	Friendsville	Unnamed coal near Bristol Hill	Danville (No. 7)	Herrin (No. 6)	Harrisburg (No. 5)	Summum (No. 4)	Colchester (No. 2)	De Koven	Davis	Unnamed coal near Campbell Hill	Murphysboro	County Total
Adams										75.733					75.733
Bureau						55.062	94.453								149.515
Cass					21.305					2.243					2.243
Crawford	2.478														21.305
Cumberland															2.478
Edgar						64.051									64.051
Fulton					.389		133.986	268.267		269.370					672.011
Gallatin							45.811	5.742							51.533
Greene							52.339			173.894					226.233
Grundy									7.408						24.865
Hancock										17.458					28.511
Henry						39.848	141.656			19.742					201.246
Jackson							70.643	41.166					9.801	61.464	183.075
Jefferson			22.616												22.616
Jersey							30.765			53.264					84.029
Knox						2.060	167.076	221.567		129.124					519.827
La Salle							20.592								20.592
Livingston							19.965								19.965
McDonough							82.346			78.183					78.183
Macoupin							218.061								218.061
Madison										34.337					34.337
Menard								43.023							43.023
Morgan							11.190			51.011					62.201
Peoria						40.423	455.733	146.083							642.240
Perry							530.997	119.142							650.138
Pike										15.759					15.759
Randolph							143.613	79.355							222.968
St. Clair							427.132								427.132
Saline						8.471	125.730	19.718				7.707	10.120		171.746
Sangamon								109.589							109.589
Schuyler								84.663		106.798					191.460
Scott										29.619					29.619
Shelby	13.891	13.539													27.430
Stark						3.119	264.872								267.990
Vermilion						100.332	46.167								146.499
Wabash				136.306											136.306
Warren															54.563
Williamson							66.689	29.427		54.563		5.042	4.345	4.641	110.144
<b>Total</b>	<b>16.369</b>	<b>13.539</b>	<b>22.616</b>	<b>136.306</b>	<b>21.305</b>	<b>313.754</b>	<b>3,149.816</b>	<b>1,167.742</b>	<b>7.408</b>	<b>1,139.608</b>	<b>12.749</b>	<b>14.465</b>	<b>9.801</b>	<b>66.105</b>	<b>6,091.583</b>

NOTE: Columns do not total because of rounding.  
<sup>a</sup>Data collected July 1975.

tunities for developing new reserves may be more favorable in other parts of the state.

## SIZE OF RESERVE BLOCKS

Contiguous areas of coal or noncontiguous but nearly adjacent areas that are not separated by obstructions such as rivers, towns, or interstate highways are termed *blocks*. In order to be considered economically minable, coal must be in blocks of sufficient tonnage to justify an investment in mining equipment. In 1975, the production of the 36 surface mines in Illinois ranged from 1,100 to 4,532,466 tons per year. Although only 47 percent of these mines produced more than 500,000 tons per year, they accounted for 97 percent of that year's strip-mine production. On the basis of these data, 500,000 tons per year has been defined in this study as the minimum size for a mine in Illinois. Assuming a minimum mine life of 10 years at 80 percent recovery, the minimum block of coal required to support such a mine is 6 million tons in place.

Effort was made in this study to group all areas of minable coal within blocks of at least 6 million tons (fig. 4); however, no effort was made to combine larger blocks together into a single mine block. Depending on its size, a block can supply one or more mines, or several nearby blocks could be combined to support one mine. Coal that could not be reasonably combined into a block of 6 million tons was excluded from the estimate of reserves. This coal and some of the coal excluded because of natural barriers may be economically mined by small operators and thus may represent a valuable local resource.

The 6 billion tons of strippable reserves are composed of 185 reserve blocks in 38 counties. Figure 5 shows the distribution of tonnage by block size. The average block size is 33 million tons; however, if the 10 largest blocks are excluded, the average size is reduced to 22 million tons. Because many small blocks are near one another and could easily be mined by one operation, block size is not necessarily an indication of the potential size of future strip mines.

## THICKNESSES OF COAL AND OVERBURDEN

An important determinant of the amount of overburden that can be removed economically is the thickness of the overburden as compared to the thickness of the coal to be mined. A stripping ratio of the thickness of overburden to thickness of coal is often used as a means of determining the economic limit of mining. Removing 50 feet of overburden to mine 2 feet of coal is different from removing 150 feet of overburden to mine 6 feet of coal, however, even though the stripping ratio (25:1) is the same in each case. Mining greater thicknesses of overburden requires large, expensive machinery that may not be more efficient to operate than smaller, less expensive machinery (Mal-

hotra, 1975). As the depth of mining increases, the percentage of consolidated material requiring blasting in the highwall is likely to increase, and highwall instability and ground water may be encountered. For these reasons, we have not used a constant stripping ratio to determine the economic limits of mining. All coal that did not fall within the overburden limits shown in table 2 has been excluded from our estimate of reserves. Although there may be many exceptions to these overburden limits because of local conditions, we believe the tonnages and acreages involved in the exceptions would not significantly change our estimate of reserves.

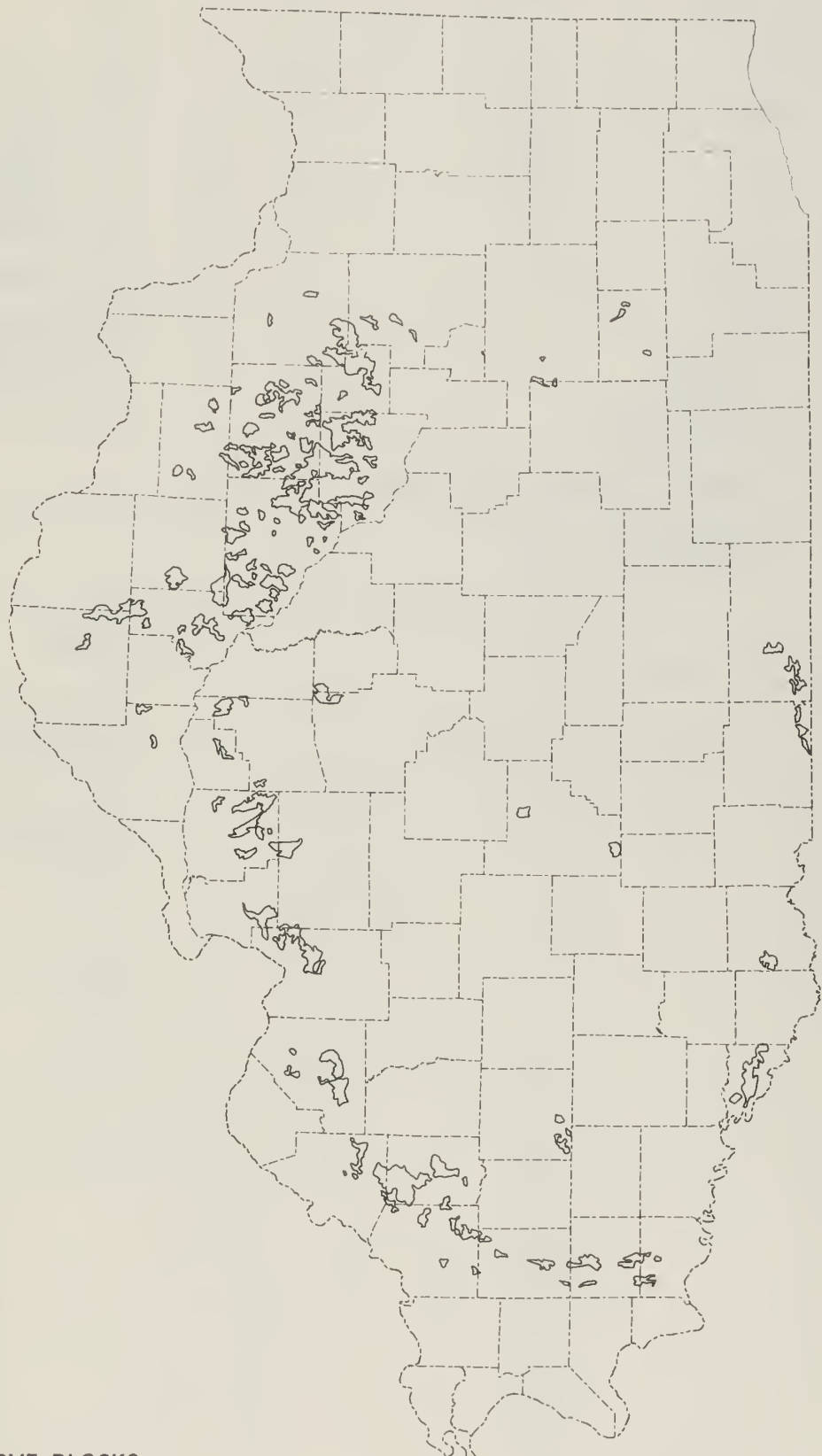
In general, we have not considered the effect of consolidation of overburden on the expense of removing it. Exceptions were made for the Colchester (No. 2) Coal Member in western Illinois, where several large areas of coal are less than 30 inches thick and have 50 to 60 feet of overburden. Because much of the overburden in this area is soft and unconsolidated, the limit of maximum overburden was raised to 60 feet. Other exceptions have been noted in appendix 2.

Most of the areas of thick shallow coal have been mined out. Only 38 percent of the coal classified as reserves is greater than 4 feet thick (fig. 6 and tables 3 and 4); however, in 1975, 69 percent of surface-mined coal came from seams greater than 4 feet thick. If surface-mining production continues at the present level or expands, companies will eventually mine the thinner reserves or mine thick coal at depths exceeding those used to define surface-minable reserves. A substantial amount of coal has less than 50 feet of overburden (fig. 7 and tables 3 and 4); however, 80 percent of this coal is less than 5 feet thick and 56 percent is less than 4 feet thick.

## COAL MEMBERS

On a seam-by-seam basis, the percentage of total resources that is included in the estimate of reserves ranges from none for the Rock Island (No. 1) Coal Member and some miscellaneous coals to 92 percent for the Opdyke Coal Member (table 5). The largest tonnages of reserves are in the Herrin (No. 6), Harrisburg-Springfield (No. 5), and Colchester (No. 2) Coals (fig. 8).

The relationship between coal thickness and depth of the reserves in each seam is shown in figures 9 through 13. The No. 6 and No. 5 Coals have the most favorable conditions of thickness and depth. No other coals have significant tonnages of coal 4 feet or greater in thickness. About 90 percent of the strippable coal produced in 1975 came from the No. 6 and No. 5 Coals, and, barring other factors, these two coals will probably continue to be most favored for strip mining. As the best blocks of these coals become mined out or unavailable, there will be an increasing shift to surface mining other coals, which in general are thinner.



STRIPPABLE COAL RESERVE BLOCKS

ISGS

Figure 4

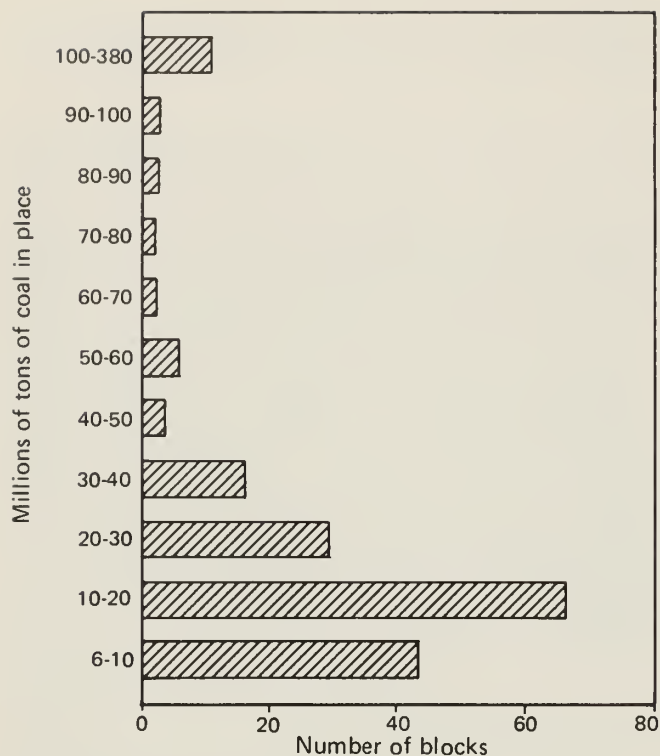


Figure 5. Sizes of strippable reserve blocks.

TABLE 2. Maximum thickness of overburden for strippable coal reserves

Coal thickness (in.)	Maximum overburden limit (ft)	Stripping ratio
18 to 29	50	33:1 to 20:1
30 to 47	75	30:1 to 19:1
48 to 71	100	25:1 to 17:1
72 or more	125	<21:1

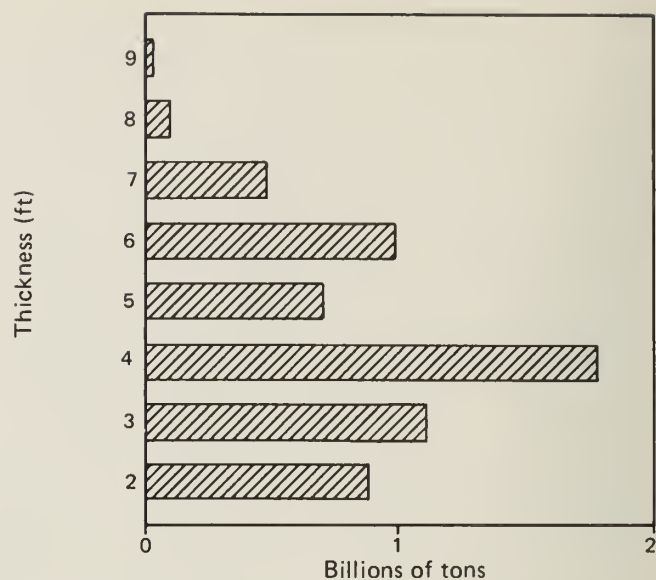


Figure 6. Average thickness of strippable coal reserves in Illinois.

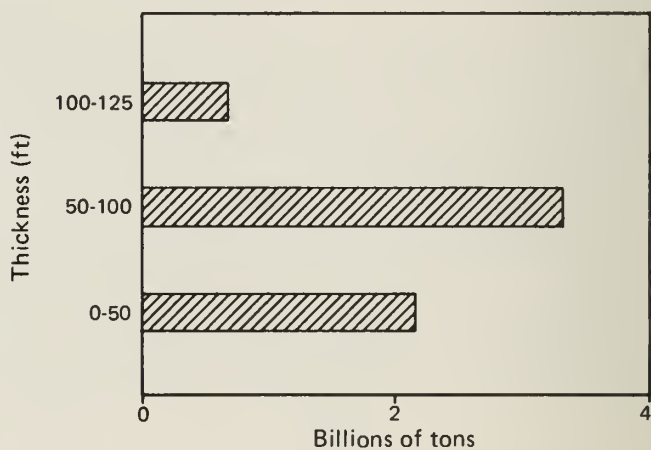


Figure 7. Thickness of overburden of strippable coal reserves in Illinois.

TABLE 3. Distribution of reserves by thickness

Thickness (in.)	Number of tons (millions)	Percentage of total reserves	Acreage	Percentage of total acreage
18	107.858	2	39,170	4
24	319.011	5	85,490	9
30	1,134.646	19	252,110	27
36	247.675	4	45,700	5
42	409.234	7	64,820	7
48	1,290.698	21	179,270	19
54	553.366	9	68,320	7
60	417.195	7	46,360	5
66	21.087	0	2,130	0
72	985.553	16	91,250	10
84	485.208	8	38,510	4
96	105.096	2	7,300	1
108	14.956	0	920	0
Total	6,091.583		882,770 <sup>a</sup>	

NOTE: Column does not equal total because of rounding.

<sup>a</sup>Excludes overlapped acreage of 38,580.

TABLE 4. Distribution of reserves by thickness of overburden

Overburden thickness (ft)	Number of tons (millions)	Percentage of total	Acreage	Percentage of total acreage
0-50	2,123.654	35	396,590	43
50-60	49.013	1	13,000	1
50-75	872.887	14	175,730	19
50-100	2,388.366	39	279,090	30
100-125	657.662	11	56,920	6
Total	6,091.583		882,770 <sup>a</sup>	

NOTE: Column does not equal total because of rounding.

<sup>a</sup>Excludes overlapped acreage of 38,580.

TABLE 5. Resources and reserves of strippable coal in Illinois, by coal member, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves <sup>b</sup>	Reserves as a percentage of resources	Production in 1975
Trowbridge	19,138	16,369	85.5	0
Shelbyville	70,370	13,539	19.2	0
Opdyke	24,609	22,616	91.9	614
Friendsville	167,232	136,306	81.5	0
Coal near Bristol Hill	43,161	21,305	49.4	0
Danville (No. 7)	1,446,766	313,754	21.7	15
Herrin (No. 6)	6,935,819	3,149,816	45.4	18,376
Harrisburg-Springfield (No. 5)	3,987,305	1,167,742	29.3	7,097
Summum (No. 4)	62,222	7,408	11.9	0
Colchester (No. 2)	7,164,105	1,139,608	15.9	687
De Koven	72,459	12,749	17.6	407
Davis	49,699	14,465	29.1	458
Rock Island (No. 1)	204,756	0	0	0
Coal near Campbell Hill	11,882	9,801	82.5	0
Murphysboro	165,866	66,105	39.9	0
Miscellaneous coals	18,548	0	0	3
Total	20,443,937	6,091,583	29.8	27.657

<sup>a</sup>As of January 1, 1976.

<sup>b</sup>As of July 1, 1975.

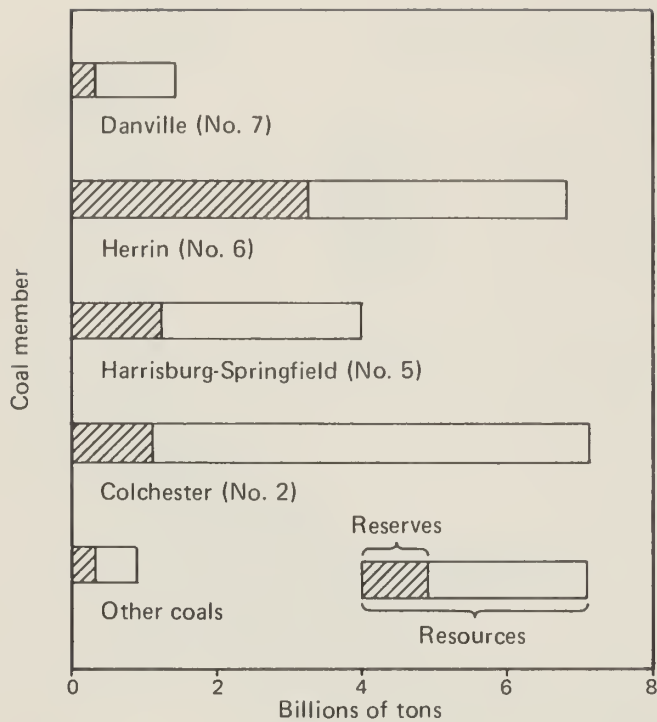


Figure 8. Reserves and resources of strippable coal in Illinois.

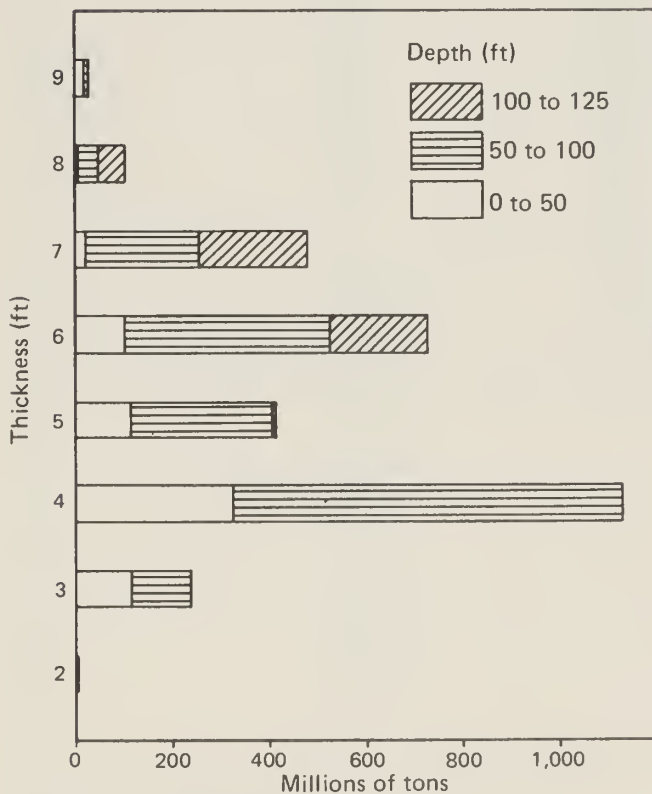


Figure 9. Strippable reserves of Herrin (No. 6) Coal.

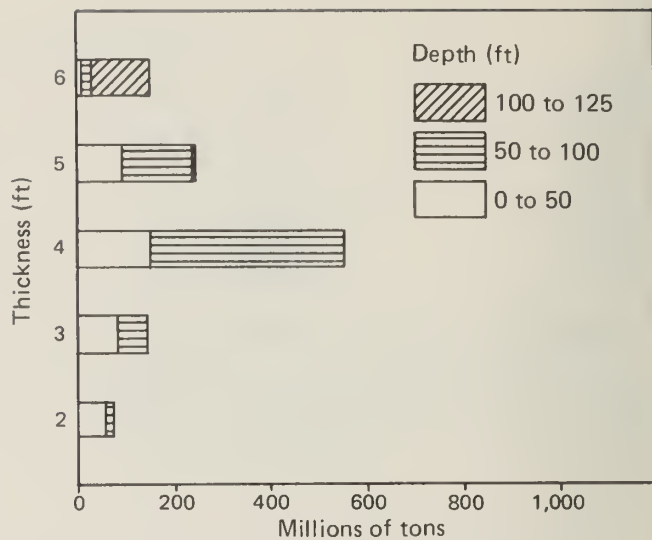


Figure 10. Strippable reserves of Harrisburg-Springfield (No. 5) Coal.

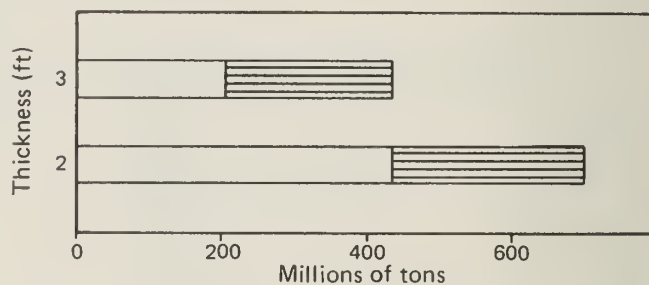
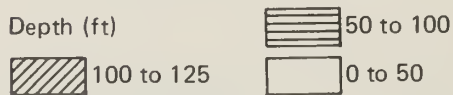


Figure 11. Strippable reserves of Colchester (No. 2) Coal.

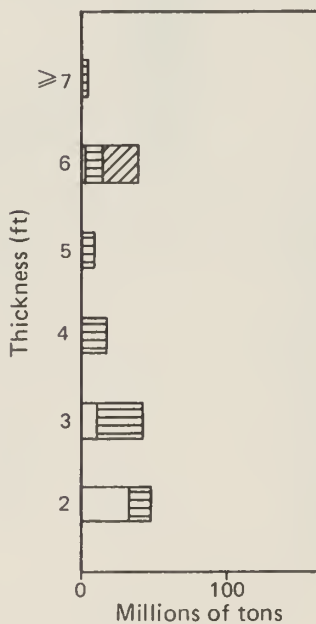


Figure 12. Strippable reserves of Danville (No. 7) Coal.

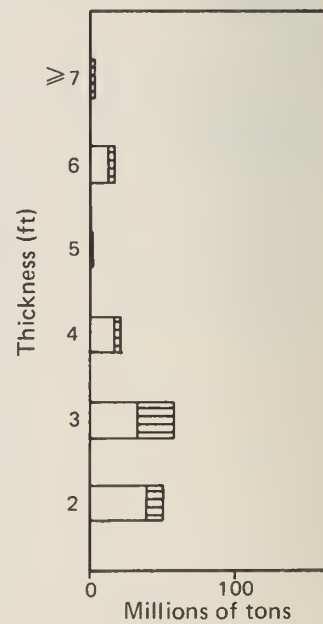


Figure 13. Strippable reserves of other coals.



## ADDITIONS TO RESERVES

In the future, additional surface-minable reserves will come from two sources—new discoveries of coal and coal that is now considered uneconomical to mine. The amount of additional strippable coal that will be discovered is probably not very great and will be of only local significance. The outcrops of all the major seams have been mapped, and the areas along the outcrops for which we have no data are not large.

Of the 14 billion tons of strippable coal resources that was not included in the estimate of reserves, about 7 percent (1 billion tons) were overlain by man-made obstacles and will probably never be mined. The remaining 13 billion tons are mostly coals that have been considered too deep to be economically minable. Some of this coal will undoubtedly be mined as new technology and increased demand for coal improves the economics of surface mining. How much of this 13 billion tons will be mined by surface methods is difficult to predict and depends on many inter-related variables, including availability of western coal, development of alternate forms of energy, restrictive legislation, and the economics of underground mining.

## DESCRIPTIONS OF AREAS CONTAINING RESERVES

For earlier studies of strippable coal resources, Illinois was divided into eight areas. This classification, with slight modification (fig. 1) is used here to summarize the nature of strippable reserves and resources throughout the state. More detailed information on the distribution, stratigraphy, and chemical quality of strippable coals in a particular area can be found in the original studies. For each area, we have included a table showing (1) the coal seams for which strippable resources have been mapped, (2) the estimated 1976 strippable resources for each seam, (3) the strippable reserves for each seam, (4) the percentage of strippable re-

sources that have been classified as reserves, and (5) the number of mines that were operating in 1975 and produced more than 500,000 tons per year. Smaller mines are mentioned in the text, but are not indicated in the table. Because they usually have short-term contracts or sell their coal on the spot market, the number, location, production, and ownership of these small mines change frequently. Their contribution to the percentage of the state's total coal production is too small to have been considered within the scope of this study.

With the exception of the Rock Island (No. 1) Coal, the coals of the Abbott and Spoon Formations are strippable only in areas 1 and 2. The coals of the Bond and Mattoon Formations are strippable only in area 8. One or more of the coals in the Carbondale Formation are strippable in all areas except area 8.

### Area 1. (Gallatin, Hardin, Johnson, Pope, Saline, and Williamson Counties)

The strippable reserves in area 1 comprise 22 blocks in 6 seams. Because a large percentage of the overburden in this area is greater than 100 feet thick, excessive thickness of overburden is the primary reason for excluding resources from strippable reserves (table 6). Total production in 1975 from the 4 operating mines in the area was 2,823,968 tons, or about 10 percent of the total production of surface-mined coal in Illinois.

The area has long contained a number of small strip mines, i.e., those producing less than 500,000 tons per year. In 1975 ten small mines in area 1 produced a combined total of 426,392 tons, or about 1.5 percent of the state's total strip-mine production.

The Danville (No. 7) Coal (formerly called the "Cutler Coal") averages 18 to 24 inches thick throughout area 1 and is generally greater than 50 feet deep. Only one block

TABLE 6. Resources and reserves of strippable coal in area 1, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Danville (No. 7) <sup>b</sup>	135,444	8,471	6.3	0
Herrin (No. 6)	629,362	238,230	37.9	3
Harrisburg (No. 5)	401,479	54,887	13.7	0
De Koven	72,459	12,749	17.6	} 1
Davis	49,699	14,465	29.1	
Murphysboro	36,412	4,641 <sup>c</sup>	12.7	0
Total	1,324,855	333,443	25.2	4

<sup>a</sup>Data from Smith, 1957.

<sup>b</sup>Formerly "Cutler Coal" (Smith, 1957).

<sup>c</sup>The remainder of this block is in area 2.

of Danville Coal has been classified as a reserve. No strip-pable resources or reserves of Danville Coal have been mapped in Gallatin County, even though that county may contain coal, because of insufficient data.

The thickness of the Herrin (No. 6) Coal in this area ranges from 36 to 108 inches, but is generally 48 to 60 inches. About 38 percent of the strippable resources of the Herrin (No. 6) Coal has been classified as strippable reserves and comprises 12 blocks ranging from 9 million to 93 million tons in place. In some parts of area 1, the Herrin Coal has a relatively low sulfur content.

The thickness of the Harrisburg (No. 5) Coal averages 48 to 60 inches throughout this area. The Harrisburg Coal is in four reserve blocks, which range from 6 million to 18 million tons. The Harrisburg Coal is low in sulfur in some parts of area 1.

The De Koven Coal is generally 36 inches thick; the Davis Coal ranges in thickness from 36 to 48 inches. The Davis Coal is 15 to 25 feet beneath the De Koven and has usually been mined with the De Koven in a single operation. The two reserve blocks mapped in the De Koven Coal completely overlap the two reserve blocks mapped in the Davis Coal. Since both coals would undoubtedly be mined together in these blocks, the overburden limit for the Davis Coal has been extended somewhat in order to match that of the overlying De Koven block, and their tonnage combined to meet the minimum block size. For large parts of Gallatin, Williamson, and Saline Counties, available data are insufficient to map the De Koven and Davis Coals. Future exploration may disclose significant reserves in these places. A large strip mine in one such place in Gallatin County has mined the Davis and De Koven Coals for several years.

The Murphysboro Coal has been mapped only in extreme western Williamson County, where its thickness ranges from 36 to 96 inches. Much of the mapped resources of this coal lie within the Crab Orchard Lake Wildlife Refuge and cannot be mined.

Because of a lack of data, no resources or reserves of the New Burnside, Reynoldsburg, or Willis Coals have been mapped. These coals are mined locally, and further exploration may reveal additional reserve blocks.

#### Area 2. (Jackson, Monroe, Perry, Randolph, and St. Clair Counties)

The thick, relatively flat-lying coals in area 2 represent some of the best surface-mining conditions in the state. Of the coal resources in area 2, 21 blocks of coal ranging from 9 million to 374 million tons have been classified as reserves (table 7). Heavy urban development in the Belleville area and excessive overburden thickness of some resources have excluded them from reserves. Many small blocks of coal below the minimum size, sandwiched between abandoned mines and other obstacles, have also been excluded. Area 2 contains the largest surface mines in the state. Each of seven mines produces more than 1 million tons per year, and three of these produce more than 3 million tons per year each. The combined production of the seven mines represents 67 percent of the total strippable coal production in the state. In 1975 three small surface mines operated in this area, but their combined production amounted to just over 100,000 tons.

With the development of large stripping equipment in the last 15 years, several companies have been mining the Herrin (No. 6) together with the Harrisburg (No. 5), which are well-suited for multi-seam mining because the interval between them is only 20 to 30 feet in this area. Multi-seam mining may permit economic recovery of coal with overburden thicknesses greater than the maximums set for this study.

The thickness of the Herrin (No. 6) Coal ranges from 42 to 96 inches, but averages between 72 and 84 inches over most of the area. The 12 reserve blocks in the Herrin Coal, among the largest in the state, are currently being mined, and reserves are sufficient to support production

TABLE 7. Resources and reserves of strippable coal in area 2, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Herrin (No. 6)	2,118,877	1,172,385	55.3	} 4
Harrisburg (No. 5)	433,711	239,663	55.3	
Unnamed coal near Campbell Hill, Jackson County	11,882	9,801	82.5	0
Murphysboro	129,454	61,464	47.5	0
Total	2,693,924	1,483,313	55.1	8

<sup>a</sup>Data from Smith, 1958.

for many years. Because the roof sequence of the Herrin Coal in Randolph and St. Clair Counties contains several thick limestones, several companies have developed underground mines in what has been mapped in this area as strippable coal. The Herrin Coal is low in sulfur in a small part of area 2.

The Harrisburg (No. 5) Coal, which ranges from 28 to 54 inches thick, is currently being mined in conjunction with the Herrin Coal, which lies about 20 feet above. The Harrisburg Coal has not been mapped in large parts of Jackson, Randolph, Perry, and St. Clair Counties, where the Harrisburg Coal is believed to be thin or absent.

A coal near Campbell Hill (Cady, 1952) averaging 48 inches thick has been mapped in a small part of Jackson County. W. H. Smith (1958) referred to it as the "Seahorne Coal," which may be correlative with the Wise Ridge Coal further to the southeast (Nance, personal communication). This coal has not been extensively mapped because of a lack of sufficient data.

The Murphysboro Coal, which has been mapped in scattered places in Jackson County, ranges from 24 to 96 inches thick. In some places the Murphysboro Coal has been reported to have a relatively low sulfur content. Exploration may reveal additional reserve blocks.

**Area 3. (Madison, Macoupin, Jersey, Greene, Scott, Morgan, Sangamon, Menard, and Cass Counties)**

The strippable coal reserves mapped in area 3 comprise 18 blocks ranging in size from 10 million to 137 million tons. Cultural development in the Collinsville-Edwardsville-Alton urban belt is responsible for the exclusion of much of the coal in Madison County from reserves (table 8). Several large industrial pipelines pass through the reserve blocks in this area, and a detailed evaluation of these blocks may prove them uneconomical to surface-mine. North of Madison County, the primary factors causing exclusion of coal are excessive thickness of overburden or insufficient data. No strip mining has taken place in area 3.

The thickness of the Herrin (No. 6) Coal averages 60 to 72 inches in central and southern Madison County,

where it lies at strippable depths, but thins northward. No data are available for large parts of Jersey, Macoupin, Morgan, and Cass Counties, where the Herrin Coal may lie at strippable depths. Where data are available, the Herrin Coal varies in thickness from 24 to 84 inches, but generally it is 30 to 36 inches. The overburden appears to be fairly thick (75 to 150 feet) over most of the area, so any coal discovered would have to be proportionally thick to be classified as a strippable reserve.

One reserve block is delineated in the Springfield (No. 5) Coal in northwestern Sangamon and southwestern Menard Counties. Here the Springfield Coal averages 72 inches thick at depths from 50 to 125 feet below the surface. The overburden is greater than 100 feet thick over 81 percent of the block. The Springfield Coal has not been mapped west or north of this block because of a lack of data; significant reserves may exist there.

The Colchester (No. 2) Coal ranges from 24 to 36 inches throughout the area. A large part of Jersey and Greene Counties has been mapped as having 50 or less feet of overburden, but data on thickness is insufficient. Most of the Colchester Coal has been excluded from reserve estimates because the thickness of overburden is excessive. The overburden is generally greater than 50 feet thick, and over large areas it is more than 100 feet thick.

**Area 4. (Adams, Brown, Calhoun, Hancock, McDonough, Pike, Schuyler, Warren, and Henderson Counties)**

With the exception of the Peabody Key Mine, which operated in Schuyler County from 1958 to 1966, mining activity in area 4 has consisted entirely of small local operations (table 9). In recent years the Colchester (No. 2) Coal has been actively prospected by several companies.

The Springfield (No. 5) Coal is found only in a very small part of Warren County and in a large outlier in Schuyler County. In Schuyler County, the thickness of coal ranges from 18 to 60 inches and averages 60 inches over a large area.

The Colchester (No. 2) Coal covers a large part of area 4. It ranges in thickness from 18 to 36 inches, but is generally less than 30 inches thick. Of the 19 reserve blocks of

TABLE 8. Resources and reserves of strippable coal in area 3, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Herrin (No. 6)	1,346,703	394,701	29.3	0
Springfield (No. 5)	1,064,679	152,612	14.3	0
Colchester (No. 2)	1,605,781	344,368	21.4	0
Total	4,017,163	891,681	22.2	0

<sup>a</sup>Data from Smith, 1961, and Nance, in preparation.

this coal. one has 118 million tons, but the rest have less than 40 million tons. Blocks in several parts of the area are less than the minimum size required to be classified as reserves; nevertheless, these blocks may be of interest to small operators or to large operators with equipment already in the area.

Excessive thickness of overburden is the reason for classifying only a small amount of Colchester Coal as a reserve. Because most of the coal is less than 30 inches thick, 50 feet is the maximum overburden thickness for the reserves, according to our criteria; however, some exceptions to this limit were made where large blocks of coal less than 30 inches thick lie at depths of 50 to 60 feet. The overburden in this area is relatively unconsolidated and contains little or no limestone; even greater stripping depths may prove economical.

The Rock Island (No. 1) Coal ranges in thickness from 0 to 52 inches over a short distance. Data are insufficient to map strippable reserves for this coal.

**Area 5. (Fulton, Henry, Knox, Peoria, Stark, Tazewell, Bureau, Marshall, Mercer, and Rock Island Counties)**

Area 5 has the largest strippable resources (7,644 million tons) and the largest strippable reserves (2,453 million tons) of any area in Illinois (table 10). Strip mines have been active in this area since 1924; however, in 1975 there were only seven mines producing a total of 5 million tons, 18 percent of the state's total coal production. Only one

small (less than 500,000 tons per year) mine operated in this area in 1975. In addition to excessive thickness of overburden, urban developments around Peoria, Galesburg, and along I-74, which either overlie the coal or divide it into small blocks, led to exclusion of large amounts of resources from reserves.

Clay-filled intrusions, called horsebacks or clay dikes, have been found in all coals in this area. In some cases, these features are so abundant that they reduce the quality of coal significantly and make the coal less desirable for mining.

The Danville (No. 7) Coal is present in the eastern half of area 5. It ranges in thickness from 18 to 30 inches and in most cases is too deep to be a strippable reserve. Data on thickness are insufficient to assess reserves in several large parts of the Danville Coal in Henry, Stark, and Peoria Counties, where additional small reserve blocks may be found. The eight reserve blocks mapped range in size from 6 to 68 million tons, but are generally less than 10 million tons. Several blocks are too small to constitute a reserve, but could be mined in conjunction with the underlying Herrin (No. 6) Coal or by a small, mobile operation.

There are several large outliers of Herrin Coal in this area. This coal ranges in thickness from 18 to 54 inches (averaging 48 inches) and is the most extensively mined coal in the area. There is a large area of Herrin Coal in Stark, Marshall, and northeastern Peoria Counties which has not been mapped because of insufficient data.

TABLE 9. Resources and reserves of strippable coal in area 4, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Springfield (No. 5)	107,895	84,663	78.5	0
Colchester (No. 2)	2,801,058	359,547	12.8	0
Rock Island (No. 1)	39,000	0	0	0
Total	2,947,953	444,210	15.0	0

<sup>a</sup>Data from Smith and Berggren, 1963; Reinertsen, 1964; and Searight and Smith, 1969.

TABLE 10. Resources and reserves of strippable coal in area 5, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Danville (No. 7)	763,921	140,901	18.4	0
Herrin (No. 6)	2,520,811	1,257,776	50.4	4
Springfield (No. 5)	1,979,541	635,917	32.1	2
Colchester (No. 2)	2,213,782	418,236	18.9	1
Rock Island (No. 1)	165,756	0	0	0
Total	7,643,811	2,452,830	32.1	7

<sup>a</sup>Data from Smith and Berggren, 1963, and Searight and Smith, 1969.

The 34 reserve blocks of Herrin Coal range from 6 million to 228 million tons. Although many of the blocks contain less than 35 million tons, they are close to each other and could be mined in a single operation.

The Springfield (No. 5) Coal is present over the eastern two-thirds of this area. The Springfield Coal is not mapped in Marshall, Bureau, Henry, and northern Stark Counties because of a lack of data, but is believed to be thin. What little data are available in northern Knox and southern Stark Counties indicate that the coal is less than 18 inches thick. In the rest of this area, the Springfield Coal ranges in thickness from 18 inches in Knox County to 72 inches in southern Fulton County.

Most of the 23 reserve blocks of Springfield Coal contain less than 20 million tons of coal. As with the Herrin Coal, the reasons for exclusions are primarily excessive thickness of overburden and the obstacles caused by cultural development. The Springfield Coal is 50 to 80 feet below the Herrin Coal. Although it represents an uncommon practice in this area, at least one mine has produced both coals in a dual-seam operation.

The Colchester (No. 2) Coal averages 24 to 30 inches thick and underlies most of area 5, but is shallow enough for stripping only in the western part. The primary reason for exclusion of Colchester Coal resources from strippable reserves is excessive thickness of overburden; however, as was noted for area 4, the composition of the overburden may permit economical strip mining at greater depths. For some parts of Henry County which may contain potential reserve blocks of Colchester Coal, data are insufficient.

Although the largest reserve block of Colchester Coal has reserves of 52 million tons, most blocks contain 20 million tons or less. Many of these blocks are sufficiently close together to permit the mining of several blocks in one operation.

The Rock Island (No. 1) Coal crops out in the western part of this area. The coal is highly variable in thickness and is not identified in any area in sufficient quantity to constitute a strippable reserve block.

#### Area 6. (La Salle, Livingston, Grundy, Kankakee, and Will Counties)

Some of the earliest mining in the state took place in area 6. Strip mining has been generally restricted to the eastern part of the area where the overburden is thinnest. The best sites for strip mining have been mined out and no mines currently operate in the area (table 11).

The Danville (No. 7) Coal, although probably present over a large part of the area, is mapped only in a small part of the area south of Streator in Livingston County, where the coal ranges in thickness from 18 to 30 inches. Tonnage of Danville Coal is insufficient to be classified as reserves.

The Herrin (No. 6) Coal has been mapped only in a small part of area 6 near Streator. Although fairly shallow and only 48 to 60 inches thick, much of the Herrin Coal is rendered unminable by cultural features near Streator and terrain associated with the Vermilion River. Further exploration in this area could reveal additional strippable coal.

The Sumnum (No. 4) Coal is found in Grundy, Livingston, and Kankakee Counties in several small deposits, some of which were mined during the 1960s and early 1970s. The coal ranges in thickness from 18 to 60 inches, but in most of the area it is generally not of minable thickness. Only one block is of sufficient size to be classified as a reserve.

The Colchester (No. 2) Coal outcrops in an eastward-trending belt along the Illinois River. Most of this coal, which ranges from 18 to 36 inches thick, is too deep to be classified as a reserve. Cultural development and terrain limitations associated with the Illinois River also make this coal unattractive for strip mining.

#### Area 7. (Vermilion and Edgar Counties)

Area 7 has been the site of strip-mining activity since the mid-1800s. Since 1970, only an occasional small strip-

TABLE 11. Resources and reserves of strippable coal in area 6, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Danville (No. 7)	10,362	0	0	0
Herrin (No. 6)	99,248	40,557	40.9	0
Sumnum (No. 4)	62,222	7,408	11.9	0
Colchester (No. 2)	543,484	17,458	3.2	0
Total	715,316	65,423	9.1	0

<sup>a</sup>Data from Smith, 1968.

mining operation has produced coal. Danville and surrounding suburbs render some of the best remaining coal in the area unminable. Excessive thickness of overburden is also a major factor in eliminating resources from classification as reserves (table 12).

The Danville (No. 7) Coal varies greatly in thickness in the area. Its thickness averages 72 inches in the northern one-third of the area, 30 to 42 inches in the central portion, and 48 to 60 inches in the southern one-third. Nearly all of the blocks of strippable reserves are smaller than 25 million tons.

The Herrin (No. 6) Coal is classified here as a strippable reserve only in the central part of area 7 where the coal ranges from 36 to 84 inches thick at depths generally greater than 100 feet. Herrin Coal, which is relatively low in sulfur, has been mined northwest of these reserves; however, no data on the sulfur content of the coal in the reserve block are available. A few blocks northwest of Danville are too small to be classified as strippable reserves as defined in this study. Throughout the rest of the area, the Herrin Coal is too thin or too deep for strip mining. An area of several square miles in northern Edgar County has not been mapped because data are insufficient.

**Area 8. (Crawford, Cumberland, Effingham, Fayette, Franklin, Jefferson, Richland, Shelby, and Wabash Counties)**

Area 8 includes central and eastern portions of Illinois where thick coal seams of the Carbondale Formation are generally several hundred or more feet deep. The only strippable coals in this area are coals from the Bond and Mattoon Formations. These coals are characteristically thin, and limited data has prohibited extensive mapping. Most of the northern portion of area 8 contains unconsolidated surficial sediments (drift) in excess of 100 feet and has therefore been eliminated from study. Only small mining operations have produced coal in this area; however, a large strip mine, operated by Eads Coal Company, has been stripping the Opdyke Coal in Jefferson County since 1971. Because cultural development in this

area is not extensive and most of the coal mapped is less than 50 feet deep, a large percentage of the resources have been classified as reserves (table 13).

The Trowbridge Coal has been mapped only in a small area of southeastern Shelby and northwestern Cumberland Counties where the coal averages 28 inches thick and is generally less than 50 feet deep. One block of this coal has been classed as a strippable reserve. Additional reserves may exist north and south of the area.

The Calhoun Coal ranges from 12 to 30 inches in thickness where it is mapped in Richland County. The tonnage of resources mapped is insufficient to constitute a strippable reserve.

The Shelbyville Coal has been mapped in small areas of Effingham, Fayette, and Shelby Counties. The only block that met the criteria for strippable reserves is located in Shelby County, where the coal averages 18 inches thick.

The Opdyke Coal is the only seam in area 8 currently being strip-mined on a large scale. The mine and the reserve blocks are in eastern Jefferson County. The Opdyke Coal there averages 18 to 20 inches thick.

Near Belle Rive, an unnamed coal lies about 30 to 40 feet below the Opdyke Coal. Where it has been mined in the vicinity of Belle Rive in Jefferson County, it averages 18 inches thick. Resources are insufficient to constitute a strippable reserve.

An unnamed coal has been mapped in a very small part of Loudon Township, Fayette County. The coal averages 18 inches in thickness. Tonnages of this coal are insufficient to constitute a strippable reserve.

The Friendsville Coal has been mapped in Wabash County, where the coal ranges from 30 to 48 inches thick. Three reserve blocks have been mapped, and several other places in Wabash County may contain additional reserves of strippable coal. Some reserves may be found to the north in Lawrence County; however, the coal is thought to thin northward and may be too thin outside of Wabash County to mine.

The Friendsville Coal is believed to lie near the base of the Mattoon Formation (see frontispiece); however, the coal may correlate with the coal near Bristol Hill in the Bond Formation (Nance, 1977, personal communication).

TABLE 12. Resources and reserves of strippable coal in area 7, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Danville (No. 7)	537,039	164,383	30.6	0
Herrin (No. 6)	220,818	46,167	20.9	0
Total	757,857	210,550	27.8	0

<sup>a</sup>Data from Bengal and Jacobson, in preparation.

TABLE 13. Resources and reserves of strippable coal in area 8, in thousands of tons

Coal member	Resources <sup>a</sup>	Reserves	Percentage of resources	Number of large mines operating in 1975
Trowbridge	19,138	16,369	88.5	0
Calhoun	7,401	0	0	0
Shelbyville	70,370	13,539	19.2	0
Opdyke	24,609	22,616	91.9	1
Unnamed coal near Belle Rive, Jefferson County	9,747	0	0	0
Unnamed coal in Loudon Township, Fayette County	1,400	0	0	0
Friendsville	167,232	136,306	81.5	0
Unnamed coal near Bristol Hill, Crawford County	43,161	21,305	49.4	0
Total	343,058	210,135	61.3	1

<sup>a</sup>Data from Nance, in preparation.

The coal mapped in the vicinity of Bristol Hill in southern Crawford County varies from 12 to 36 inches thick. East of Flat Rock, a block of strippable reserves in which this coal is estimated to average 18 to 20 inches thick has been mapped. Additional strippable reserves may exist there.

## CONCLUSION

Six billion tons of coal in the ground in Illinois have been classified as strippable reserves, i.e., coal considered to be economically and legally minable at the present time according to the criteria used in this report. This reserve represents about 30 percent of the 20 billion tons of potentially strippable coal in Illinois mapped by previous studies of the Illinois State Geological Survey.

Large strippable reserves have been found in western, southwestern, and southern Illinois. The reserves in southwestern and southern Illinois are generally more suited for surface mining than other regions because land costs are lower, the heating value of coal is greater, and coal tonnage recoverable per acre is higher. These reserves are and will continue to be the major source of surface-mined coal in the state throughout the near future. Because a large part of these reserves are probably committed to existing or planned mines, opportunities for new acquisition of strippable reserves are limited and are more likely to be available in other parts of the state.

Seventy-one percent of the state's surface-minable reserves are in the No. 6 and No. 5 Coals, which are currently the largest sources of the state's production of coal by strip mining (90 percent in 1975). Because these two coals con-

stitute large reserves of strippable coal that is of favorable depth and thickness, they will probably continue to be the major surface-mined coals. As the best blocks of No. 6 and No. 5 Coal become unavailable or mined out, mining will ultimately shift to other coals that are generally thinner and have larger stripping ratios.

Thirty-eight percent of the strippable reserves are coals greater than 4 feet thick. This reserve contrasts sharply with production of coal by strip mining in 1975, when 69 percent of the tonnage came from coals greater than 4 feet thick. In the future, limited availability of reserves may force surface mining of the thinner coal reserves or of thicker seams at greater depths than projected in this report.

How future political, economic, and technical developments will affect the conclusions of this report is difficult to assess. New reclamation laws and high land values may cause areas of strippable reserves in western and central Illinois to be less desirable than reserves in southern Illinois. New technical developments and increasing demands for sources of energy may make strip mining of thinner or deeper coal profitable. As major developments take place, new evaluations of strippable coal reserves in Illinois will be necessary.

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## APPENDIXES

**APPENDIX 1. Mapping procedure**

Reserves of strippable coal were delineated by using the base maps constructed by previous resource studies. The mined-out areas on these maps were updated to July 1, 1975, and some minor corrections of subcrop lines were made. The original base maps showed only 50-foot, 100-foot, and 150-foot overburden thickness lines; 75-foot and 125-foot thickness lines were added where needed. The criteria determined for this study were then used to outline reserve blocks.

The accuracy of the coal outcrop lines and overburden lines and the coal thicknesses indicated on these maps depends on the number and distribution of drill holes, mines, and outcrops; the local topography; and the degree of glaciation the area has undergone. In some areas these lines are generalized and outcrop lines may be inaccurate by several hundred feet, or even a mile or more in extreme cases. These inaccuracies will not alter the regional picture of surface-minable coal, but are important considerations for evaluating individual blocks.

An example of one of the work maps used is shown in figure A. The coal in the lower right is not reliably substantiated by data and so is excluded from the estimate of reserves. Boundaries of excluded cultural areas, in this case the town of Atkinson and Interstate 80, were taken from plat books. No coal was excluded where the railroad might be an obstacle, because the line is not an insurmountable barrier to surface mining and the amount of coal directly beneath it cannot be accurately calculated at the scale of this study. In this example, the coal is 30 inches thick, so the maximum thickness of overburden allowed by the reserve criteria is 75 feet. The areas of limiting terrain are too small and irregular for recovery of coal by large mining operations and have been excluded from our estimate of reserves.

All 185 blocks classified as strippable reserves by this study are shown on work maps similar to figure A and are available on open file for reference at the Illinois State Geological Survey in Urbana.

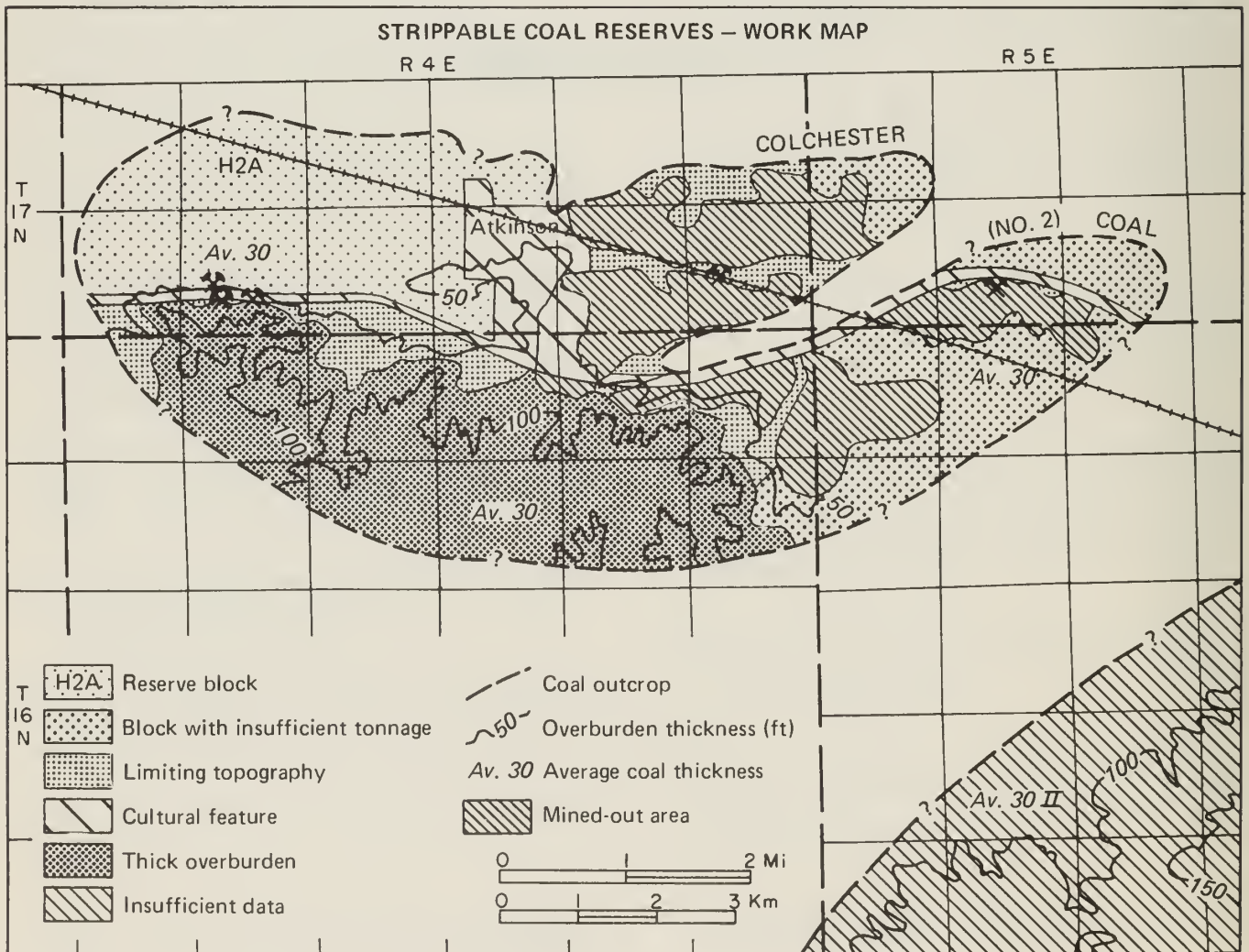


Figure A

APPENDIX 2. Descriptions of reserve blocks by county

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage			Overlap		Page reference to map (app. 3)	Remarks			
			By thickness		By depth		Block number			Coal member		
			Acreage (in. )	Percentage of total	(ft)	Percentage of total					County	Percentage of total
Adams County												
66	No. 2	118,782	26,250	24	5	0-50	31	Adams	55	38	About 7 mi <sup>2</sup> of 30-in. No. 2 coal beneath 75 to 85 ft of overburden lies south of block 66.	
				30	90	50-75	69	Hancock	17			
				36	5			Schuyler	28			
67	No. 2	10,042	2,790	24	100	0-50	99			38	Sugar Creek runs through block 67.	
						50-60	1					
Bureau County												
4	No. 7	6,660	1,480	30	100	0-50	52			37		
						50-75	48	108	No. 6	630		
5	No. 7	10,103	2,250	30	100	0-50	53			37		
						50-75	47	109	No. 6	1,070		
6	No. 7	9,489	2,640	24	100	0-50	99			37, 39		
						50-60	1	110	No. 6	2,310		
7	No. 7	See Henry County.										
108	No. 6	5,956	830	48	100	0-50	12			40		
						50-100	88	4	No. 7	630		
109	No. 6	18,163	2,240	54	100	0-50	46			40		
						50-100	54	5	No. 7	1,070		
110	No. 6	35,585	4,430	48	7	0-50	36			40		
				54	93	50-100	63	6	No. 7	2,310		
						100-125	1					
111	No. 6	See Henry County.										
113	No. 6	9,987	1,310	48	49	0-50	27			40		
				54	51	50-100	73	Bureau		970		
114	No. 6	64,872	8,890	48	88	0-50	2	Henry		40		
				54	12	50-100	98	Bureau		5,470		
Cass County												
74	No. 2	See Morgan County.										
Crawford County												
182	Unnamed coal near Bristol Hill	21,305	7,420	18	100	0-50	100			44		
Cumberland County												
185	Trowbridge	See Shelby County.										
Edgar County												
99	No. 7	19,336	1,970	48	15	0-50	33			37	Areas of untested coal lie north and south of block 182.	
				60	18	50-100	61					
				72	58	100-125	6					
100	No. 7	24,446	3,370	36	3	0-50	14			37		
				48	87	50-100	86					
				60	10							

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Reserves			Distribution of tonnage			Overlap			Page reference to map (app. 3)	Remarks
			Acreage (in.)	By thickness		(ft)	By depth		Block number	Coal member	Acreage		
				Percentage of total	Percentage of total		Percentage of total	Percentage of total					
Edgar County—Continued													
101	No. 7	20,269	3,570	36	81	4	0-50	4				37	A small area of untested No. 7 coal lies on the north side of block 101.
Fulton County													
14	No. 7	See Peoria County.											
133	No. 6	See Knox County.											
134	No. 6	126,266	16,840	36	1	26	0-50	26	Fulton	No. 5	1,390	40	Block 134 contains about 3 mi <sup>2</sup> of 18-in. No. 7 coal that has not been classified as a reserve. The interval between the No. 6 and No. 7 coals is 30 to 40 ft thick. An 8-in. pipeline passes through block 134.
135	No. 6	11,875	1,540	36	6	6	0-50	6	Fulton			40	
				48	12	94	50-100	94	Peoria				
				54	82								
15	No. 5	See Knox County.											
37	No. 5	12,057	1,680	48	100	14	0-50	14		No. 6	290	39	Active surface mine.
38	No. 5	77,262	10,520	48	82	86	50-100	86				39	
				54	18	20	0-50	20		No. 6	400		A few small abandoned underground mines lie in the southern part of block 38.
				54	18	80	50-100	80					
39	No. 5	50,052	6,180	54	100	13	0-50	13		No. 6	700	39	
				54		87	50-100	87					
40	No. 5	21,442	2,650	54	100	13	0-50	13				39	
				54		87	50-100	87					
41	No. 5	19,616	2,420	54	100	4	0-50	4				39	Active surface mine.
				54		96	50-100	96					
42	No. 5	6,310	700	60	100	39	0-50	39				39	
				60		61	50-100	61					
43	No. 5	7,286	900	54	100	7	0-50	7				36	Active surface mine.
				54		93	50-100	93					
44	No. 5	14,382	1,600	60	100	26	0-50	26				39	A state highway and an 8-in. gas pipeline pass through the middle of block 44. Circular 348 (Smith and Berggren, 1963) shows a portion of block 44 as mined out; however, we can find no evidence that the area has been mined.
				60		74	50-100	74					
45	No. 5	6,467	800	54	100	99	0-50	99				39	
				54		1	50-100	1					
46	No. 5	6,636	820	54	100	100	0-50	100				39	
53	No. 5	11,381	1,150	66	100	100	0-50	100				36	
32	No. 2	See Knox County.											
47	No. 2	8,986	2,000	30	100	96	0-50	96				39	
				30		4	50-75	4					
48	No. 2	10,034	2,790	24	100	23	0-50	23				39	
				24		77	50-60	77					
49	No. 2	12,911	2,870	30	100	31	0-50	31				39	
				30		69	50-75	69					
50	No. 2	37,934	8,480	24	9	52	0-50	52	Fulton			39	An 8-in. gas pipeline passes through block 50.
				24	9	48	50-75	48	McDonough				

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage				Overlap	Page reference to map to app. 3)	Remarks		
			By thickness		By depth					By county	
			Acreage (in. of total)	Percentage of total	(ft)	Percentage of total				County	Block number
Fulton County—Continued											
51	No. 2	17,054	3,810	24	2	0-50	47	Fulton	98	36	A large area of untested No. 2 coal lies southwest of block 51.
				30	98	50-75	53	McDonough	2	36	
52	No. 2	11,972	2,680	24	3	0-50	34			36	
				30	97	50-75	66			36	
54	No. 2	22,699	5,050	30	100	0-50	48			36	
				30	100	50-75	52			36	
55	No. 2	52,444	11,650	30	100	0-50	42			36	
				30	100	50-75	58			36	
56	No. 2	14,236	3,170	30	100	0-50	47			36	A 22-in. crude-oil pipeline passes through block 56.
				30	100	50-75	53			36	
57	No. 2	7,855	1,750	30	100	0-50	45			36	
				30	100	50-75	55			36	
58	No. 2	17,516	3,890	30	100	0-50	51			36	
				30	100	50-75	49			36	
59	No. 2	See Schuyler County.								36	
60	No. 2	21,529	4,780	30	100	0-50	32			36	Active surface mine.
				30	100	50-75	68			36	
61	No. 2	See McDonough County.									
62	No. 2	See Schuyler County.									
Gallatin County											
172	No. 6	23,582	4,000	36	67	0-50	66	Gallatin	76	44	A fault lies on the east side of block 172.
				48	33	50-100	34	Saline	24	44	
175	No. 6	24,714	2,830	48	12	0-50	59	Gallatin	74		
				60	88	50-100	41	Saline	26		
176	No. 6	9,627	1,340	48	100	0-50	15			44	
				48	100	50-100	85			44	
97	No. 5	See Saline County.									
98	No. 5	See Saline County.									
Greene County											
141	No. 6	16,801	3,340	30	36	0-50	50			42	
				36	64	50-75	50			42	
142	No. 6	11,614	1,080	72	100	50-100	37			42	
				72	100	100-125	63			42	
143	No. 6	See Macoupin County.								38	
79	No. 2	15,322	3,410	30	100	0-50	86			38	
				30	100	50-75	14			38	
80	No. 2	85,854	19,080	30	100	0-50	59			38	
				30	100	50-75	41			38	
81	No. 2	46,242	10,380	24	4	0-50	60			38	An 8-in. gas pipeline passes through block 81.
				30	96	50-75	40			38	
82	No. 2	26,475	5,880	30	100	0-50	41			38	
				30	100	50-75	59			38	

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage				Overlap	Page reference to map (app. 3)	Remarks										
			By thickness		By depth														
			Acree (in. of total)	Percentage of total	(ft)	Percentage of total				County	Percentage of total	Block number	Coal member	Acree					
Grundy County																			
1	No. 4	7,408	1,650	30	100	0-50	2											37	
						50-75	98												
2	No. 2	10,808	2,400	30	100	0-50	48												37
						50-75	52												
3	No. 2	6,650	1,480	30	100	0-50	18												37
						50-75	82												
Hancock County																			
65	No. 2	9,087	2,020	30	100	0-50	96	Hancock			90								38
66	No. 2	See Adams County.				50-75	4	Schuyler			10								
Henry County																			
7	No. 7	68,658	15,800	24	14	0-50	60	Bureau			42	111	No. 6	8,800					39
						50-75	40	Henry			58	112							
												113							
111	No. 6	23,184	2,860	54	100	0-50	16	Stark			<1	114							40
						50-100	84	Bureau			4	7	No. 7	1,330					
112	No. 6	11,409	1,580	48	100	0-50	23	Henry			96								40
						50-100	77												
113	No. 6	See Bureau County.																	
114	No. 6	See Bureau County.																	
115	No. 6	See Stark County.																	
117	No. 6	25,484	4,050	42	100	0-50	95												40
						50-60	5												
8	No. 2	11,997	2,670	30	100	0-50	98												39
						50-75	2												
9	No. 2	7,745	1,720	30	100	0-50	20												39
						50-75	80												
Jackson County																			
156	No. 6	See Perry County.				0-50	21					91	No. 5	490					41
163	No. 6	32,892	2,450	84	50	50-100	42												
						100-125	36												
165	No. 6	38,461	2,720	84	12	0-50	6	Jackson			69	91	No. 5	30					41
						50-100	52	Williamson			31								
						100-125	42												
90	No. 5	See Perry County.																	
91	No. 5	40,624	5,620	48	96	0-50	33					163	No. 6	520					38
						50-100	67					165							

Block 7 is adjacent to Kewanee. A large area of untested No. 7 coal lies south of block 7.

Block 112 contains numerous small, un-mapped, abandoned mines.

Several small abandoned mines lie in block 117. Block 8 is adjacent to Atkinson.

A large area of untested No. 2 coal lies north of block 9.

Active surface mine.

Active surface mine; block 165 is adjacent to Hurst in Williamson County.

Active surface mine; an area of untested No. 5 coal lies north of block 91.

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	By thickness			By depth			By county			Overlap	Page reference to map (app. 3)	Remarks
			Acreage (in. )	Percentage of total	(ft)	Percentage of total	County	Percentage of total	Block number	Coal member	Acreage			
Jackson County—Continued														
159	Unnamed coal near Campbell Hill	9,801	1,360	48	100	0-50 50-60	98 2						41	
160	Murphysboro	35,254	3,630	48	22	0-50 50-75	97 3						41	Block 160 is pocketed by several small abandoned mines. The Murphysboro Coal has not been mapped in the area around block 160 because of insufficient data. Block 161 is adjacent to Murphysboro.
161	Murphysboro	13,278	1,890	36	54	0-50 50-100	76 24						41	
162	Murphysboro	17,573	1,720	48	22	0-50 50-100	68 32	Jackson Williamson	74 26				41	Block 162 is adjacent to Carbondale and Crab Orchard Lake Wildlife Refuge.
Jefferson County														
177	Opdyke	16,296	5,640	18	100	0-50	100						44	Active surface mine; large areas of untested Opdyke Coal surround block 177.
178	Opdyke	6,320	2,340	18	100	0-50	100						44	Large areas of untested Opdyke Coal surround block 178.
Jersey County														
144	No. 6	30,765	4,850	24	< 1	0-50 50-100	39 61						42	Piasa Creek divides block 144. A large area of untested No. 6 coal lies north of block 144.
83	No. 2	29,357	6,520	30	100	0-50 50-75	80 20						38	
84	No. 2	23,627	5,250	30	100	0-50 50-75	59 41						38	Some small areas of cultural development lie within block 84.
85	No. 2	See Madison County.												
Knox County														
14	No. 7	See Peoria County.												
118	No. 6	11,328	1,800	42	100	0-50 50-60	97 3						40	
119	No. 6	58,349	9,260	42	100	0-50 50-75	48 52						40	Active surface mine.
120	No. 6	39,734	6,310	42	100	0-50 50-75	35 65						40	
121	No. 6	25,545	4,050	42	100	0-50 50-75	56 44						40	A major railroad bisects block 121.

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage			Overlap		Page reference to map (app. 3)	Remarks	
			By thickness		By depth		Block number			Coal member
			Percentage of total	Acreage (in. of total)	Percentage of total	(ft)				
Knox County—Continued										
122	No. 6	7,271	1,160	42	100	0-50	100		40	
132	No. 6	See Peoria County.								
133	No. 6	20,708	2,560	54	100	0-50 50-100	15 85	Fulton Knox	9 91	40
11	No. 5	See Peoria County.								
15	No. 5	80,453	11,180	48	100	0-50 50-100	28 72	Fulton Knox	44 56	39
16	No. 5	26,451	5,880	30	100	0-50	54			39
17	No. 5	11,733	2,610	30	100	0-50	46			39
18	No. 5	15,036	3,350	24	1	0-50	86			39
19	No. 5	6,195	2,290	18	100	0-50	99			39
20	No. 5	11,572	3,210	24	100	0-50	100			39
21	No. 5	9,814	2,670	24	94	0-50	100			39
22	No. 5	26,645	5,700	30	78	0-50	100			39
31	No. 5	10,863	1,720	36	42	0-50	100			39
23	No. 2	6,624	1,620	24	40	0-50	45	Knox	97	39
26	No. 2	12,163	3,380	24	100	0-50	99	Warren	3	39
29	No. 2	6,930	1,930	24	100	0-50	99	Knox	51	39
30	No. 2	8,573	2,380	24	100	0-50	91	Warren	49	39
32	No. 2	36,434	8,700	24	30	0-50	71	Knox	88	39
33	No. 2	9,047	2,430	24	83	0-50	94	Warren	12	39
34	No. 2	22,018	6,050	24	95	0-50	95	Knox	99	39
35	No. 2	25,519	6,940	24	89	0-50	60	Fulton	1	39
36	No. 2	9,263	2,060	30	100	0-50	39	Knox	99	39

Active surface mine.  
An 8-in. pipeline passes through the south edge of block 15.  
A 12-in. pipeline passes through block 16.

Areas of untested No. 5 coal lie north and west of block 19.

Block 21 is adjacent to Galesburg.

Block 22 is adjacent to Galesburg and Knoxville. Five pipelines pass through block 22.

A small creek runs through block 26.

A small creek runs through block 29.





APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage			Overlap		Page reference to map (app. 3)	Remarks	
			By thickness		By depth		Block number			Coal member
			Percentage of total	Percentage of total	Percentage of total	Percentage of total				
Madison County—Continued										
148	No. 6	25,186	2,330	72	100	50-100	60	42	Five major pipelines pass through block 148.	
						100-125	40			
85	No. 2	10,699	2,380	30	100	0-50	63	38	Block 85 borders Alton.	
						50-75	37			
86	No. 2	23,918	5,130	30	79	0-50	50	38	Block 86 borders Alton.	
						50-75	50			
Menard County										
73	No. 5	See Sangamon County.								
Morgan County										
140	No. 6	11,190	1,790	24	2	0-50	19	42		
						50-75	81			
74	No. 2	11,090	2,460	30	100	0-50	58	36		
						50-75	42			
75	No. 2	42,164	9,370	30	100	0-50	49	36		
						50-75	51			
Peoria County										
10	No. 7	25,091	5,850	24	20	0-50	72	39	Areas of untested No. 7 coal lie to the north, south, and southwest.	
						50-75	28			
13.	No. 7	13,256	4,910	18	100	0-50	100	39		
14	No. 7	7,644	2,920	18	100	0-50	100	39		
123	No. 6	207,152	31,660	18	1	0-50	33	40	Four pipelines—one 8-in., two 12-in., and one 20-in.—pass through block 123.	
						50-100	66			
124	No. 6	6,497	1,030	42	100	0-50	86	40		
						50-75	14			
125	No. 6	12,371	1,720	48	100	0-50	22	40		
						50-100	78			
126	No. 6	19,926	2,770	48	100	0-50	23	40		
						50-100	77			
127	No. 6	29,439	3,630	54	100	0-50	22	40	Adjacent to Peoria suburbs; contains some small areas of culture. An 8-in. gas pipeline passes through the block.	
						50-100	78			
128	No. 6	12,716	1,770	48	100	0-50	35	40		
						50-100	65			
129	No. 6	8,922	1,240	48	100	0-50	26	40	Active surface mine.	
						50-100	74			
130	No. 6	17,483	2,430	48	99	0-50	32	40	Active surface mine.	
						50-100	68			
131	No. 6	16,772	2,330	48	100	0-50	56	40	Active surface mine.	
						50-100	44			

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage			Overlap		Page reference to map (app. 3)	Remarks					
			By thickness		By depth		Block number			Coal member				
			Percentage of total	Acree (in.)	Percentage of total	County					Percentage of total	County		
Peoria County—Continued														
132	No. 6	37,758	4,660	54	100	0-50	50	Knox	16	11	No. 5	3,730	40	Active surface mine.
			50-100		50	50-100	50	Peoria	84	14	No. 7			
134	No. 6	See Fulton County.				0-50	21			13	No. 7	4,700	40	
135	No. 6	See Fulton County.				50-100	79							
136	No. 6	53,189	7,390	48	100	0-50	23							
						50-100	77							
137	No. 6	19,503	2,710	48	100	0-50	20							Adjacent to Peoria suburbs.
						50-75	80							
138	No. 6	6,349	1,180	36	100	0-50	6							
						50-100	94							
139	No. 6	10,603	1,310	54	100	0-50	33	Knox	30	131,	No. 6	2,280	39	Adjacent to Glasford and to Kingston Mines.
						50-100	66	Peoria	70	132				Block 11 surrounds Elmwood; a large area of untested No. 5 coal lies to the north; active surface mines. One 12-in. and two 8-in. gas pipelines pass through block 11.
11	No. 5	194,278	30,090	30	3	0-50	11						39	Two 6-in. and two 8-in. gas pipelines pass through block 12.
			36	20	20	50-100	89							
			42	19	48									
12	No. 5	9,986	1,390	48	100	0-50	8						41	Active surface mines. A 20-in. crude-oil pipeline passes through the west edge of block 154.
						50-100	21							
17	No. 5	See Knox County.				0-50	5						41	Active surface mine. Three large gas pipelines pass through block 155.
						50-100	71							
						100-125	24							
Perry County														
154	No. 6	374,533	35,040	60	11	0-50	8	Perry	85	88, 89,	No. 5	6,930	41	
			72	84	7	50-100	71	Randolph	15	90				
			84	7	96	100-125	21							
			96	<1										
155	No. 6	160,890	14,300	60	8	0-50	5						41	
						50-100	71							
			84	37	84	100-125	24							
			96	1										
156	No. 6	38,207	3,340	72	61	0-50	36	Jackson	29				41	
						50-100	64	Perry	71					
			84	37	96									
157	No. 6	13,999	1,370	60	29	0-50	100			90	No. 5	1,350	41	Active surface mine.
						50-100	76							
			72	71		100-125	24							
158	No. 6	10,072	950	60	7	50-100	25			154,	No. 6	7,500	37	Active surface mines; the No. 5 coal has not been mapped north and east of block 90 because of insufficient data.
						100-125	24			157				
			72	93										
89	No. 5	See Randolph County.												
90	No. 5	107,592	14,300	36	8	0-50	25	Jackson	1	154,	No. 6	7,500	37	
						50-100	75	Perry	99	157				
			48	29	63									
			54	63										
Pike County														
76	No. 2	6,861	2,190	18	45	0-50	92						38	
						50-60	8							
			24	55										
77	No. 2	8,897	3,300	18	100	0-50	93						38	
						50-60	7							

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage			Overlap		Page reference to map (app. 3)	Remarks			
			By thickness		By depth		Block number			Coal member		
			Percentage of total	(ft)	Percentage of total	County						
Randolph County												
153	No. 6	88,088	8,220	36	<1	0-50	15	87	No. 5	660	41	Two active surface mines.
			48	1		50-100	52					
			60	19		100-125	33					
			72	53								
			84	27								
154	No. 6	See Perry County.										
87	No. 5	28,539	3,730	48	47	0-50	42	153	No. 6	660	37	Active surface mine. An area of untested No. 5 coal lies north of block 87.
				54	53	50-100	58					
88	No. 5	37,377	5,730	36	13	0-50	24	154	No. 6	670	37	Active surface mine. An area of untested No. 5 coal lies to the northeast.
				42	60	50-100	76					
				48	3							
				54	24							
89	No. 5	25,530	3,150	54	100	0-50	49	154	No. 6	110	37	
						50-100	51		Perry			
									Randolph			
St. Clair County												
149	No. 6	19,591	1,550	84	100	0-50	11				41	Block 149 is in the highly developed East St. Louis-Belleville area.
						50-100	64					
						100-125	24					
150	No. 6	32,985	3,120	60	11	0-50	100				41	Block 150 contains small areas of culture and numerous small abandoned mines.
				72	89							
151	No. 6	359,206	28,630	72	10	0-50	1				41	The Kaskaskia River passes through the south end of block 151. The block is adjacent to Belleville and contains an operating surface mine and an underground mine.
				84	81	50-100	47					
				96	9	100-125	53					
				108	<1							
152	No. 6	15,351	1,260	72	19	0-50	7				41	Block 152 is adjacent to Freeburg and to an operating underground mine.
				84	81	50-100	80					
						100-125	13					
Saline County												
95	No. 7	8,471	2,350	24	100	0-50	100	171	No. 6	1,890	38	A fault lies in block 95; displacement undetermined.
171	No. 6	93,048	10,200	48	10	0-50	13				44	Active surface mine.
				60	66	50-100	65		Saline	95		
				72	24	100-125	22		Williamson	5		
172	No. 6	See Gallatin County.									44	
173	No. 6	10,476	1,340	36	10	0-50	27					
				48	35	50-100	72					
				60	55							
174	No. 6	14,387	1,760	48	39	0-50	31				44	
				60	61	50-100	69					
175	No. 6	See Gallatin County.										
97	No. 5	18,807	2,160	48	14	0-50	10		Gallatin	16	38	A fault lies in block 97; displacement undetermined.
				60	86	50-100	90		Saline	84		
98	No. 5	6,653	850	48	60	0-50	52		Galatin	40	38	
				60	40	50-100	48		Saline	60		
170	De Koven	7,707	1,430	36	100	0-50	43	96	Davis	1,430	44	Active surface mine.
						50-75	57					
96	Davis	10,120	1,610	42	100	0-50	29	170	De Koven	1,430	38	Active surface mine.
						50-100	71					

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Acreage (in.)	Distribution of tonnage			Overlap	Page reference to map (app. 3)	Remarks		
				By thickness		By county					
				Percentage of total	(ft)					Percentage of total	Block number
Sangamon County											
73	No. 5	152.611	14,250	60	4	50-100	19	Sangamon	72	36	An 8-in. gas pipeline passes through block 73. Large areas of untested coal border block 73 in Cass and Morgan Counties.
			72	96		100-125	81	Menard	28		
Schuyler County											
71	No. 5	27.929	5,890	18	32	0-50	90			36	Adjacent to Rushville. 22-in. crude-oil pipeline passes through the north edge of block 71.
				36	22	50-100	10				
				60	46						
72	No. 5	56.734	6,300	60	100	0-50	69			36	
						50-100	28				
						100-125	3				
59	No. 2	37.517	8,370	24	7	0-50	53	Fulton	48	36	
				30	93	50-75	47	Schuyler	52		
61	No. 2	See McDonough County.									
62	No. 2	36.602	8,130	30	100	0-50	44	Fulton	22	36	
						50-75	56	McDonough	10		
								Schuyler	68		
65	No. 2	See Hancock County.									
66	No. 2	See Adams County.									
68	No. 2	8.703	2,070	24	100	0-50	98			38	
						50-60	2				
69	No. 2	6.889	1,910	24	100	0-50	100			36	About 11 mi <sup>2</sup> of No. 2 coal beneath 50-75 feet of overburden lie north of block 69.
70	No. 2	12.376	3,440	24	100	0-50	61			36	A 12-in. gas pipeline passes through block 70.
						50-60	39				
Scott County											
78	No. 2	29.619	6,580	30	100	0-50	17			36	Adjacent to Winchester.
						50-75	83				
Shelby County											
185	Trow-bridge	16.369	3,900	24	100	0-50	97	Cumberland	15	43	Block 185 is bisected by the southwestern edge of Lake Mattoon.
						50-60	3	Shelby	85		
183	Shelby-ville	13.539	5,020	18	100	0-50	100			43	Block 183 is bisected by a small creek.
Stark County											
7	No. 7	See Henry County.									
10	No. 7	See Peoria County.									
114	No. 6	See Bureau County.									
115	No. 6	292.671	40,010	42	6	0-50	11	Stark	84	40	The Spoon River passes through block 115. A 16-in. gas pipeline passes through the west edge of the block. An area of untested No. 6 coal borders the southeast side of the block.
					48	50-100	89	Henry	16		
					54	100-125	< 1				

APPENDIX 2—Continued

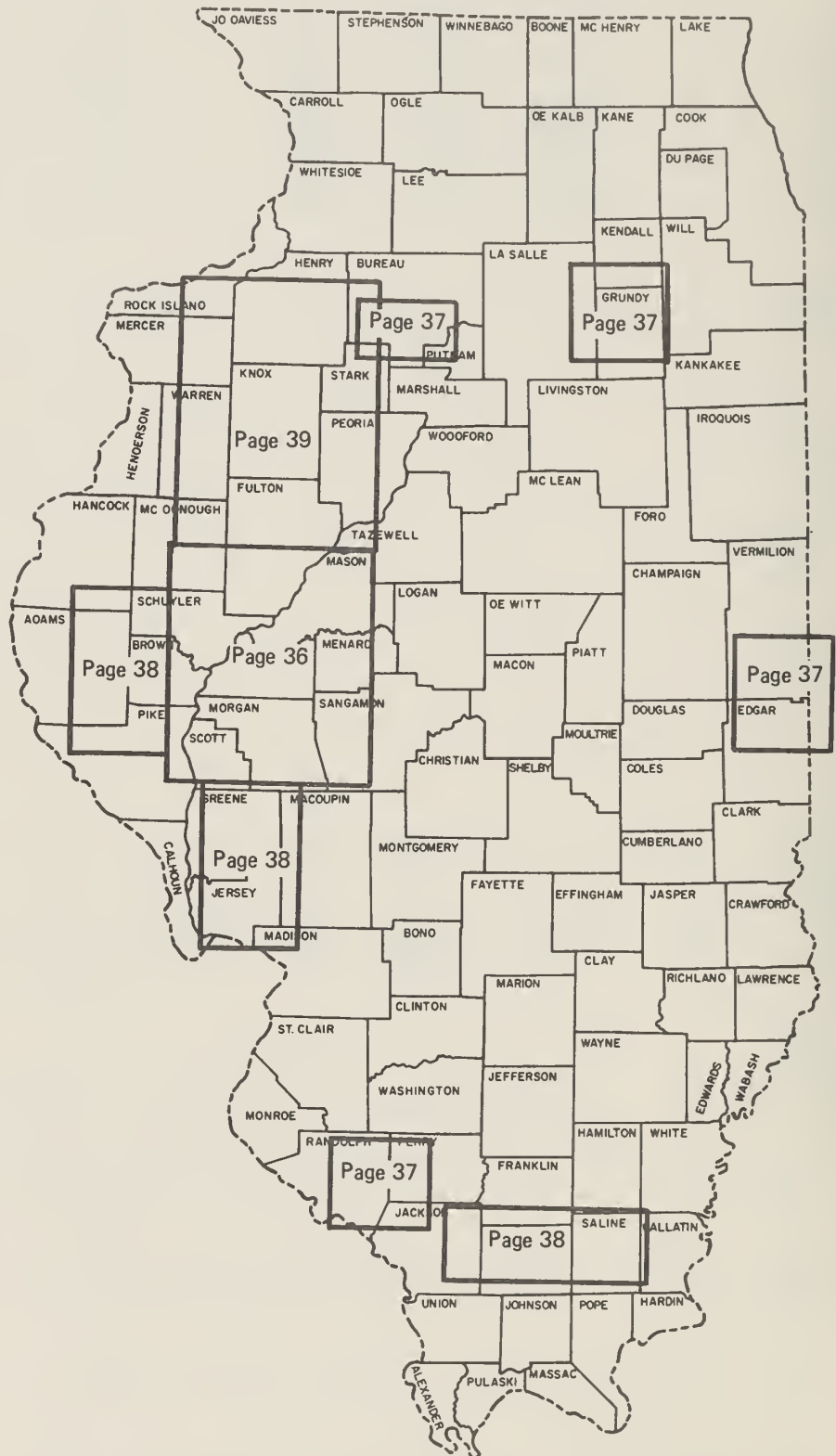
Block number	Coal member	Reserves (in millions of tons)	Acreage (in. of total)	Distribution of tonnage			Overlap	Page reference to map (app. 3)	Remarks
				By thickness		By depth			
				Percentage of total	Percentage of total				
			(ft)	of total	County	Block number	Acreage member		
Stark County—Continued									
116	No. 6	10,710	1,700	42	100	0-50	100	40	
123	No. 6	See Peoria County.							
Vermilion County									
102	No. 7	8,516	1,580	36	100	0-50	8	37	Block 102 is adjacent to Georgetown; two 12-in. gas pipelines pass through the block.
103	No. 7	18,591	2,870	36	41	0-50	92	37	Block 103 is adjacent to Westville; two 12-in. gas pipelines pass through the block.
			48	46		50-100	6		
			60	13			93		
104	No. 7	73,224	6,920	60	12	0-50	4	37	Block 104 is adjacent to Catlin and Danville; it is pocketed by numerous small underground mines and part is separated by an abandoned strip mine.
			72	86		50-100	24		
			84	2		100-125	71		
184	No. 6	46,167	5,290	36	2	0-50	21	42	
			48	43		50-100	46		
			60	11		100-125	33		
			72	34					
			84	10					
Wabash County									
179	Friendsville	19,529	3,390	36	89	0-50	48	44	Areas of untested Friendsville Coal border block 179. The block is adjacent to Belmont.
			42	11		50-75	52		
180	Friendsville	92,018	19,140	30	71	0-50	71	44	Some small oil fields are within block 180. Untested areas of Friendsville Coal lie west and north of the block.
			36	19		50-100	29		
			42	8					
			48	2					
181	Friendsville	24,759	4,520	30	49	0-50	93	44	Some small oil fields are within block 181. An untested area of Friendsville Coal lie north of the block.
			42	42		50-75	7		
			48	10					
Warren County									
23	No. 2	See Knox County.							
24	No. 2	11,865	3,300	24	100	0-50	99	39	
						50-60	1		
25	No. 2	16,168	4,490	24	100	0-50	90	39	Block 25 is adjacent to Monmouth.
						50-60	10		
26	No. 2	See Knox County.							
27	No. 2	7,832	2,180	24	100	0-50	95	39	Block 27 is adjacent to Roseville. Four-in. and 7-in. gas pipelines pass through the block.
						50-60	5		

APPENDIX 2—Continued

Block number	Coal member	Reserves (in millions of tons)	Distribution of tonnage				Overlap	Page reference to map (app. 3)	Remarks				
			By thickness		By depth					Block number	Coal member		
			Acreage (in.)	Percentage of total	(ft)	Percentage of total						County	Percentage of total
Warren County—Continued													
28	No. 2	11.672	3,240	24	100	0-50	77		39	Block 28 is adjacent to Roseville.			
29	No. 2	See Knox County.							23				
Williamson County													
164	No. 6	15.164	1,050	96	95	50-100	32		41	This block is sandwiched between the Big Muddy River and a large abandoned underground mine.			
165	No. 6	See Jackson County.											
166	No. 6	14.005	870	108	100	50-100	26		44	This block is adjacent to the communities of Energy and Carterville.			
167	No. 6	11.632	1,290	60	100	0-50	3		44	Active surface mine in this block.			
168	No. 6	9.706	980	66	100	50-100	97		44				
171	No. 6	See Saline County.											
93	No. 5	12.525	1,740	48	100	0-50	100	93	No. 5	660			
94	No. 5	16.902	2,350	48	100	0-50	51	166	No. 6	660	Block 93 borders Energy and Carterville; active surface mine.		
169	De Koven	5.042	930	36	100	50-100	49				Block 94 is adjacent to Marion.		
92	Davis	4.345	810	36	100	0-50	37	92	Davis	810			
162	Murphysboro	See Jackson County.							63	169	De Koven	810	
						50-75	46						
						0-50	33						
						50-100	67						

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- Colchester (No. 2)
- Harrisburg-Springfield (No. 5)
- Danville (No. 7)
- De Koven





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Herrin (No. 6)

Davis

Other coal members

Shelbyville

Friendsville

Trowbridge

Opdyke

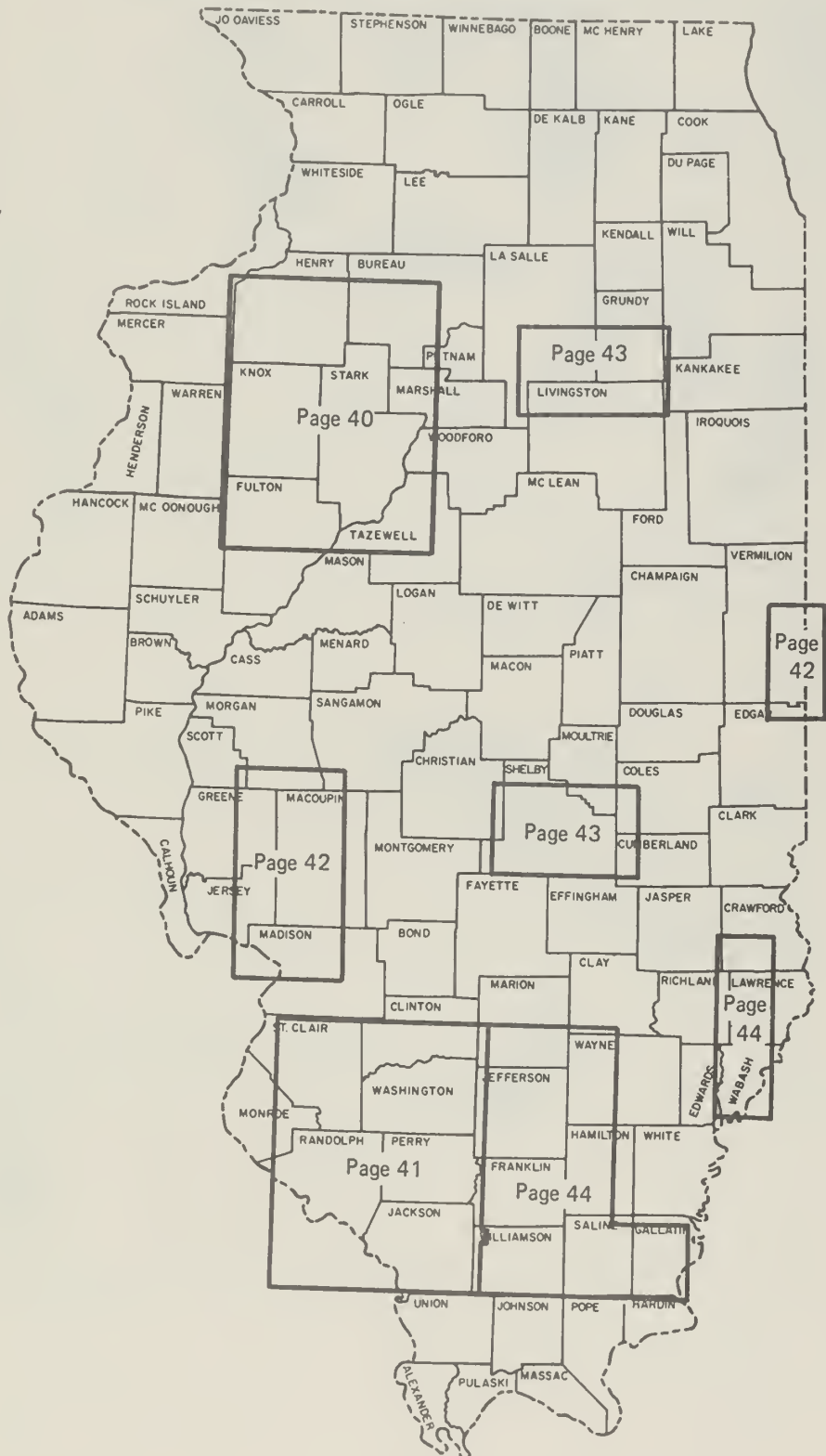
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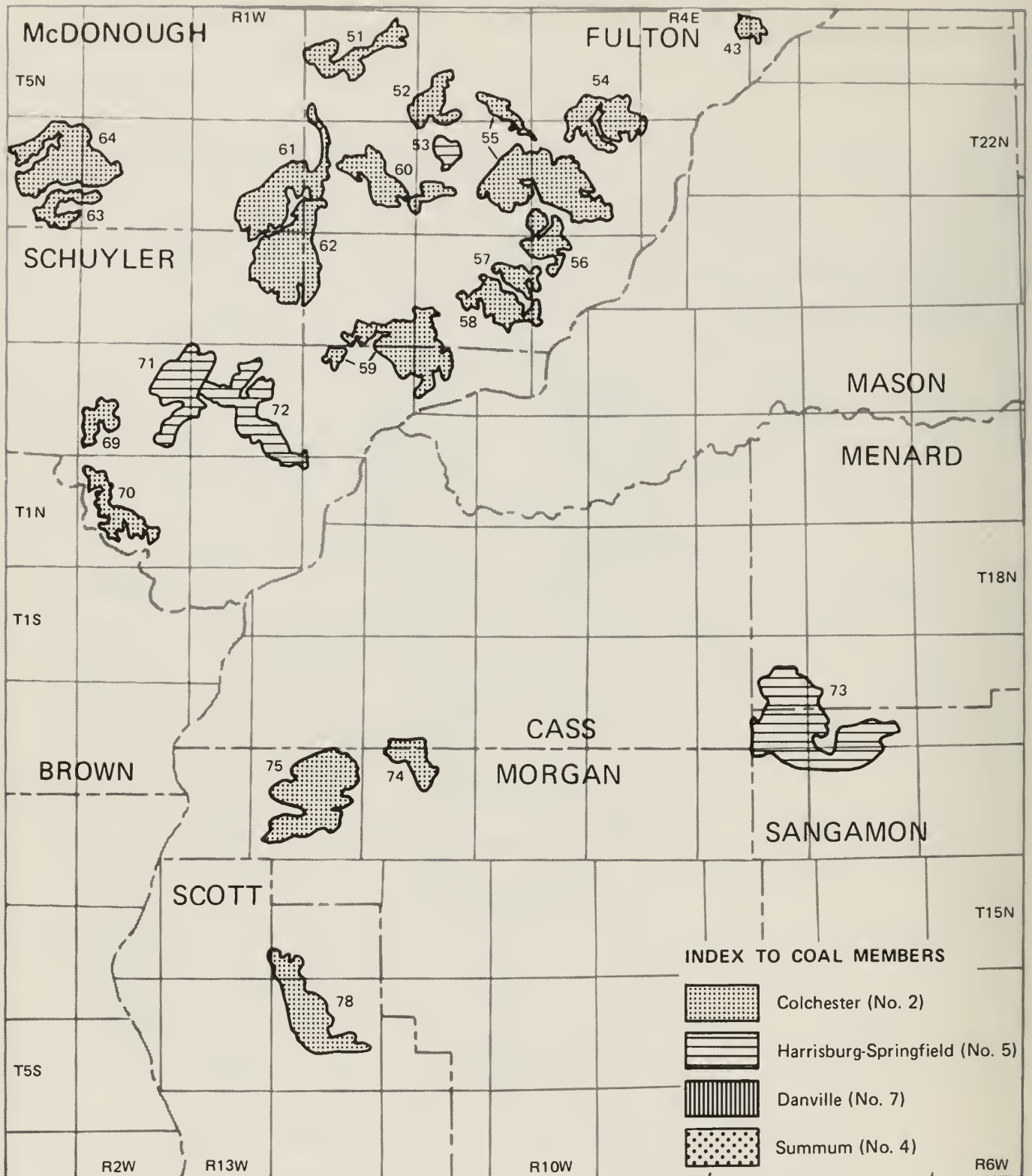
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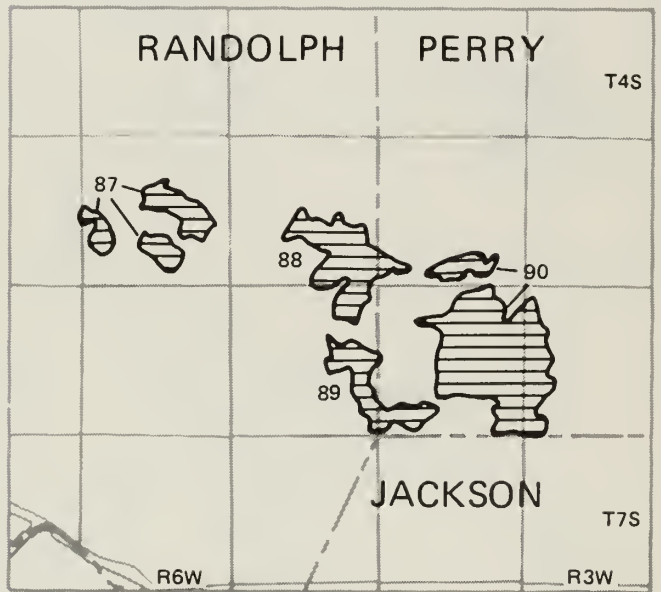
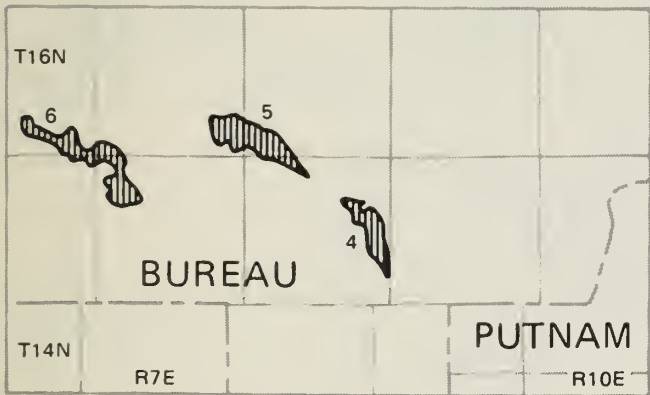
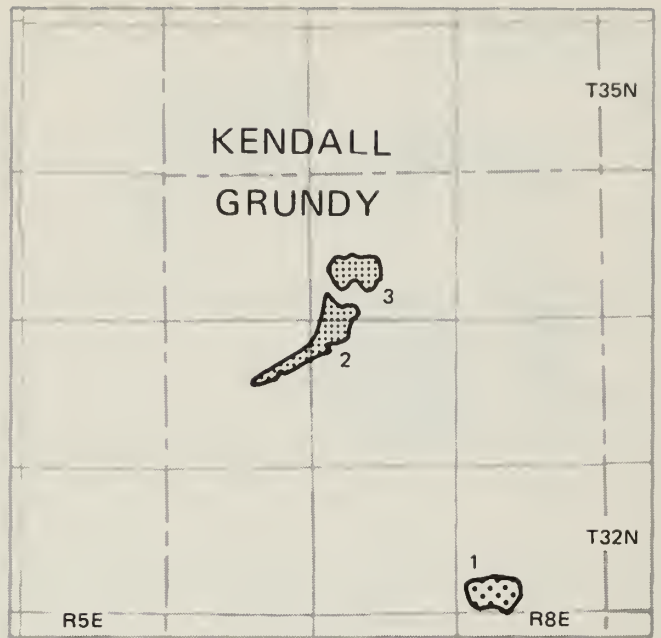
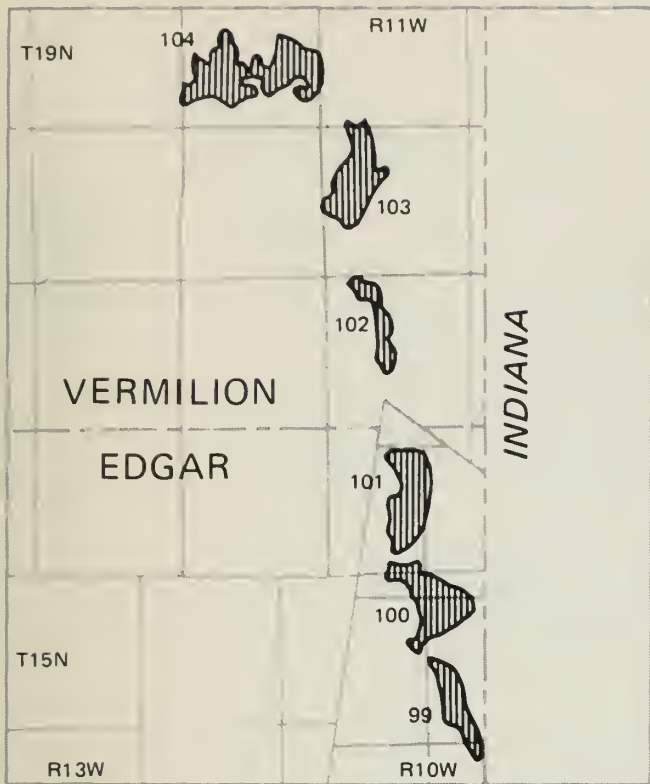
Crawford County

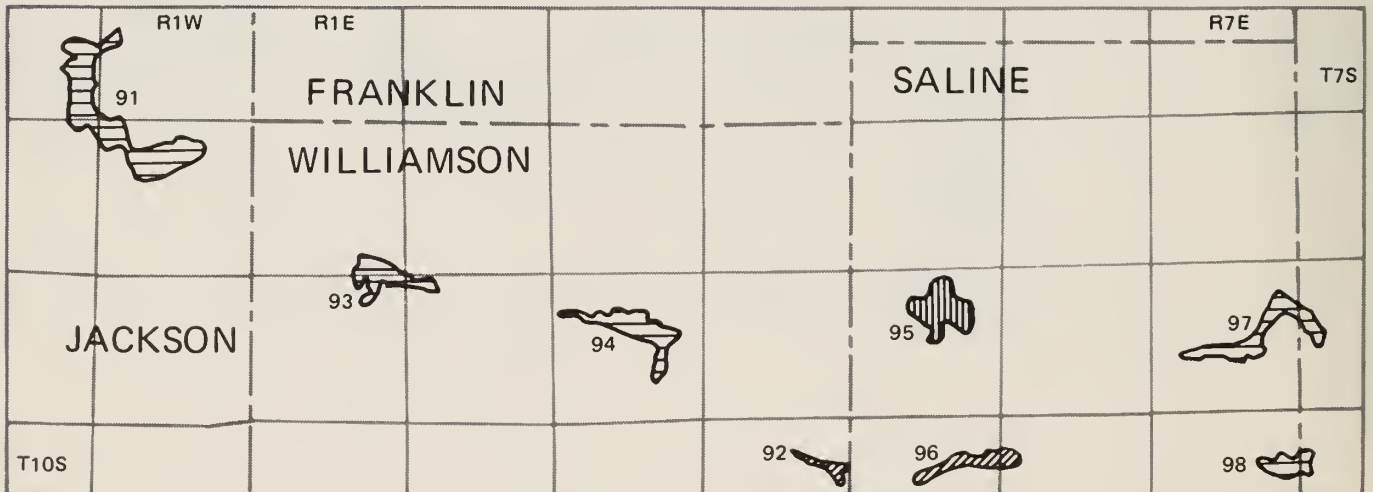
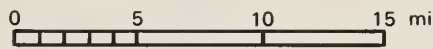
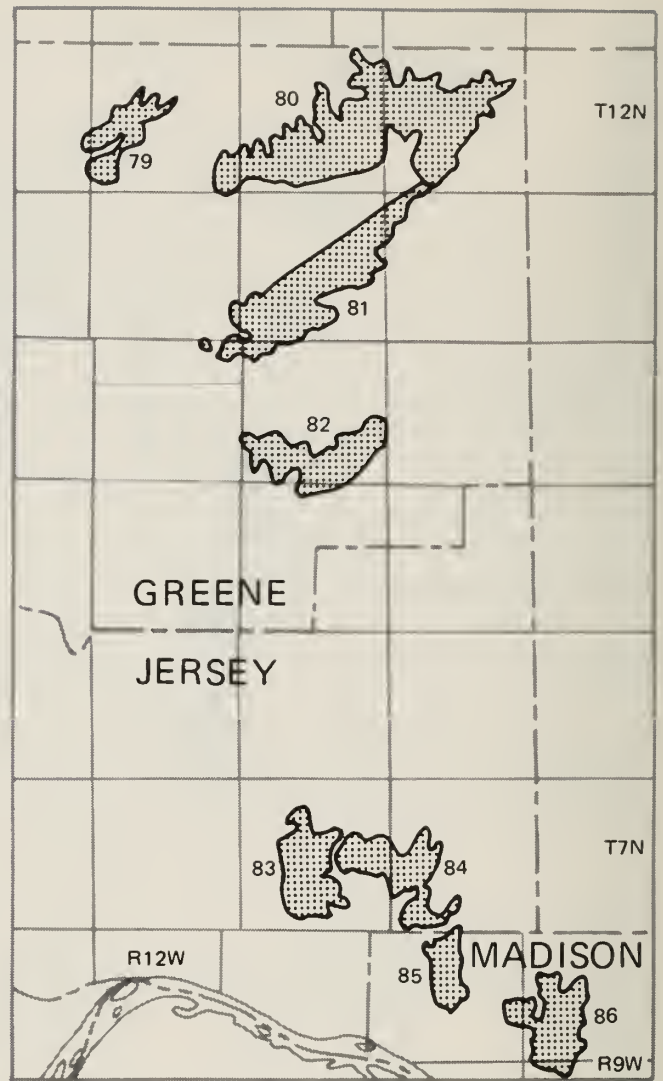
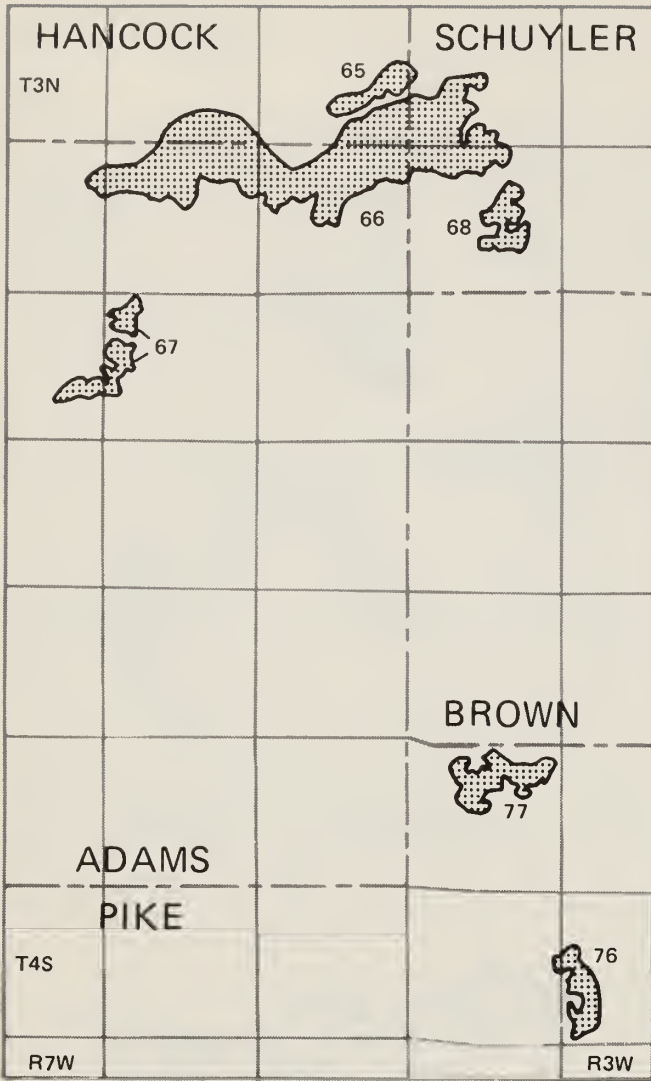
Unnamed coal near Campbell Hill,

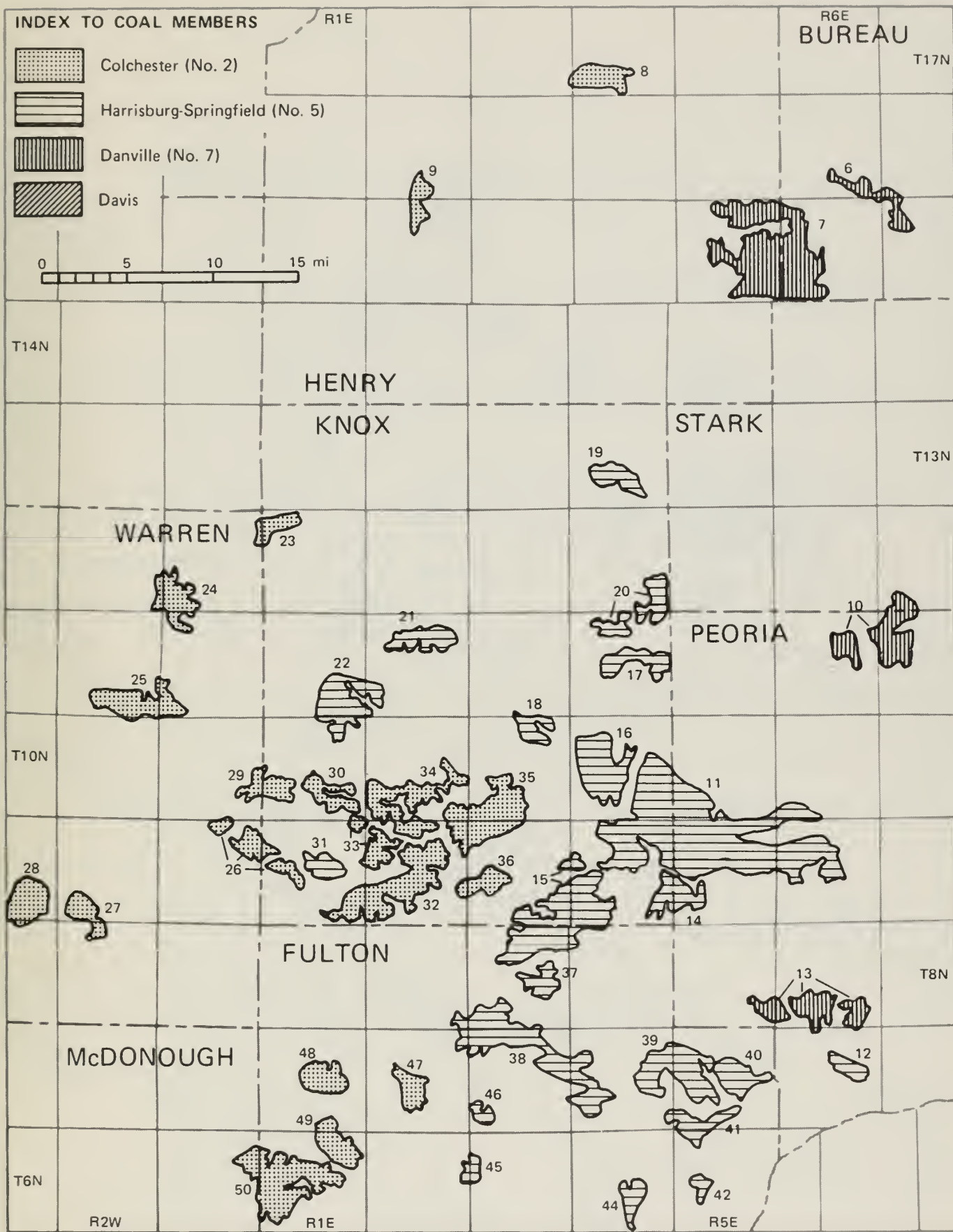
Jackson County

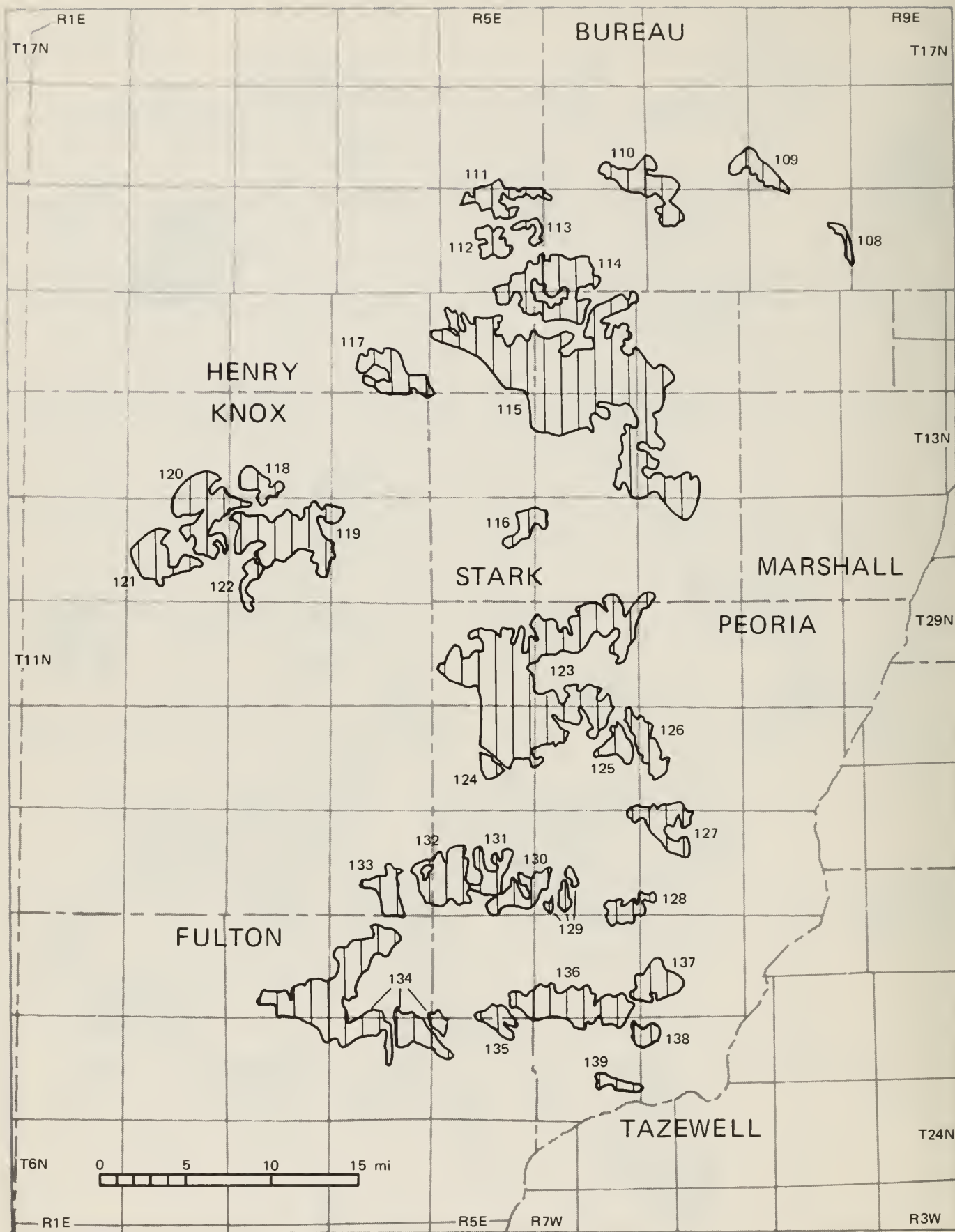


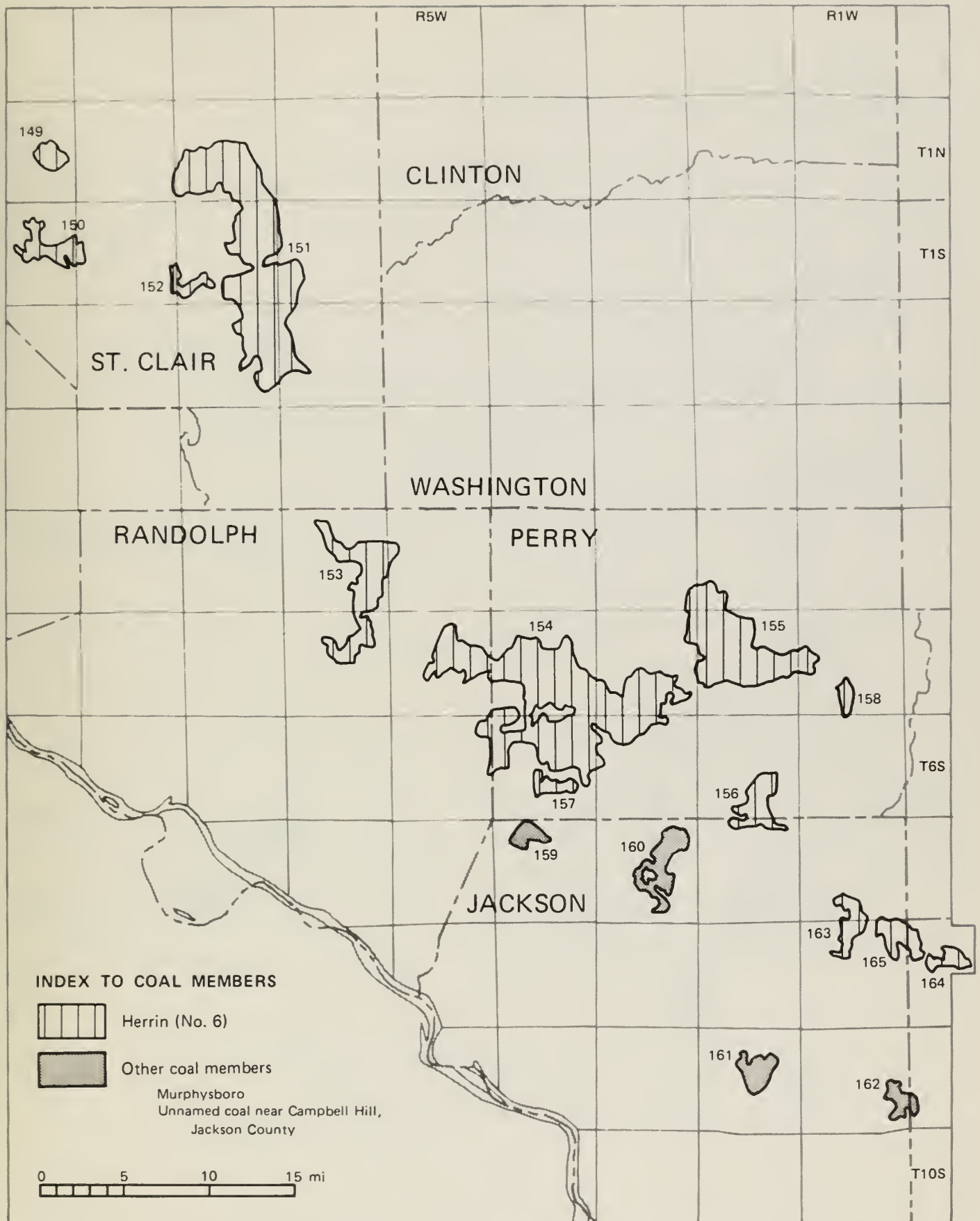


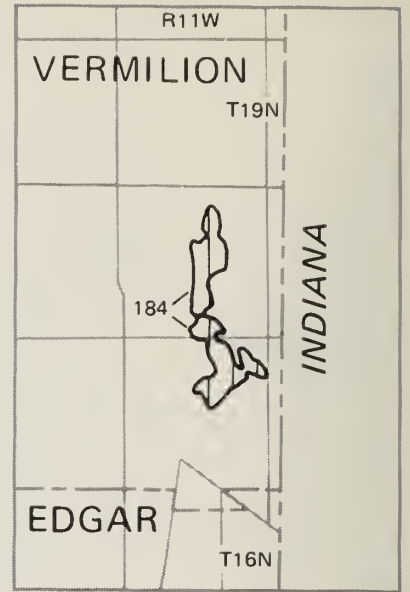
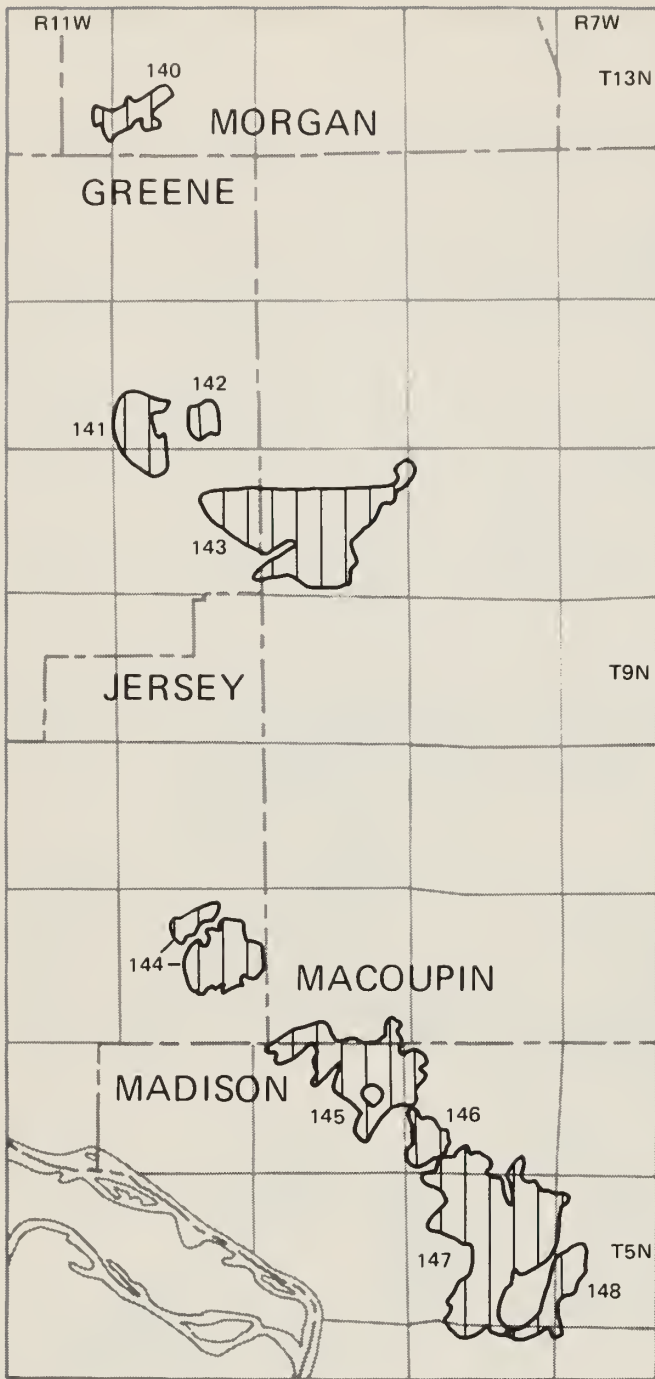














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-  Other coal members  
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Trowbridge



