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Murphysboro Coal, Jackson and Perry Counties: resources with low to medium sulfur potential

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Illinois Department of Energy and Natural Resources
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Illinois Mineral Notes 85/1983

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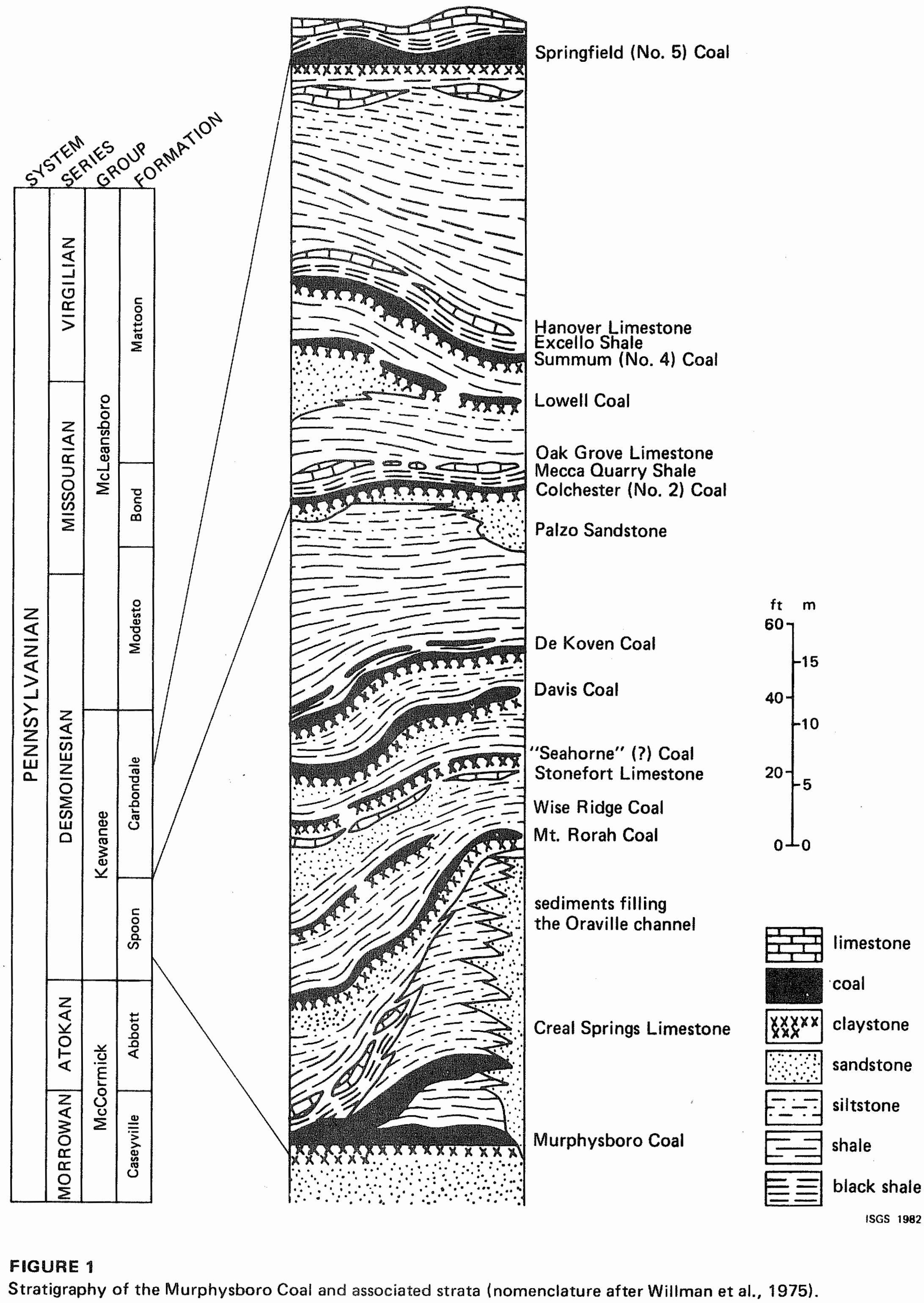


FIGURE 1
Stratigraphy of the Murphysboro Coal and associated strata (nomenclature after Willman et al., 1975).

Murphysboro Coal

ABSTRACT

For many years it has been known that thick deposits of Murphysboro with a low to medium sulfur content (1% to 2.5%, dry basis) exist in the vicinity of Murphysboro, Jackson County. These thick deposits appeared to have been largely mined out by the early 1900s. Recent work has shown that the low-sulfur deposits lie beneath thick wedges of silty, gray nonmarine shale (probably crevasse-splay sediments) located along the margins of a sandstone-filled channel of an ancient stream. This channel, named the Oraville channel, was contemporaneous with the accumulation of peat, and for a time, survived the peat swamp. Mapping for this report confirms that the channel extends into south-central and western Perry County.

The Murphysboro Coal Member of the Spoon Formation, which occurs 200 to 400 feet below the widely mined Springfield (No. 5) Coal Member of the Carbondale Formation, ranges in depth from less than 50 feet to over 600 feet. The Murphysboro contains shale partings, most of which are minor. Near the town of Murphysboro, however, one shale parting varies from a few inches thick about 2 miles away from the channel to 35 feet thick less than ½ mile from the channel. The thick areas of coal, up to 7½ feet, appear to lie mainly along the margins of the Oraville channel.

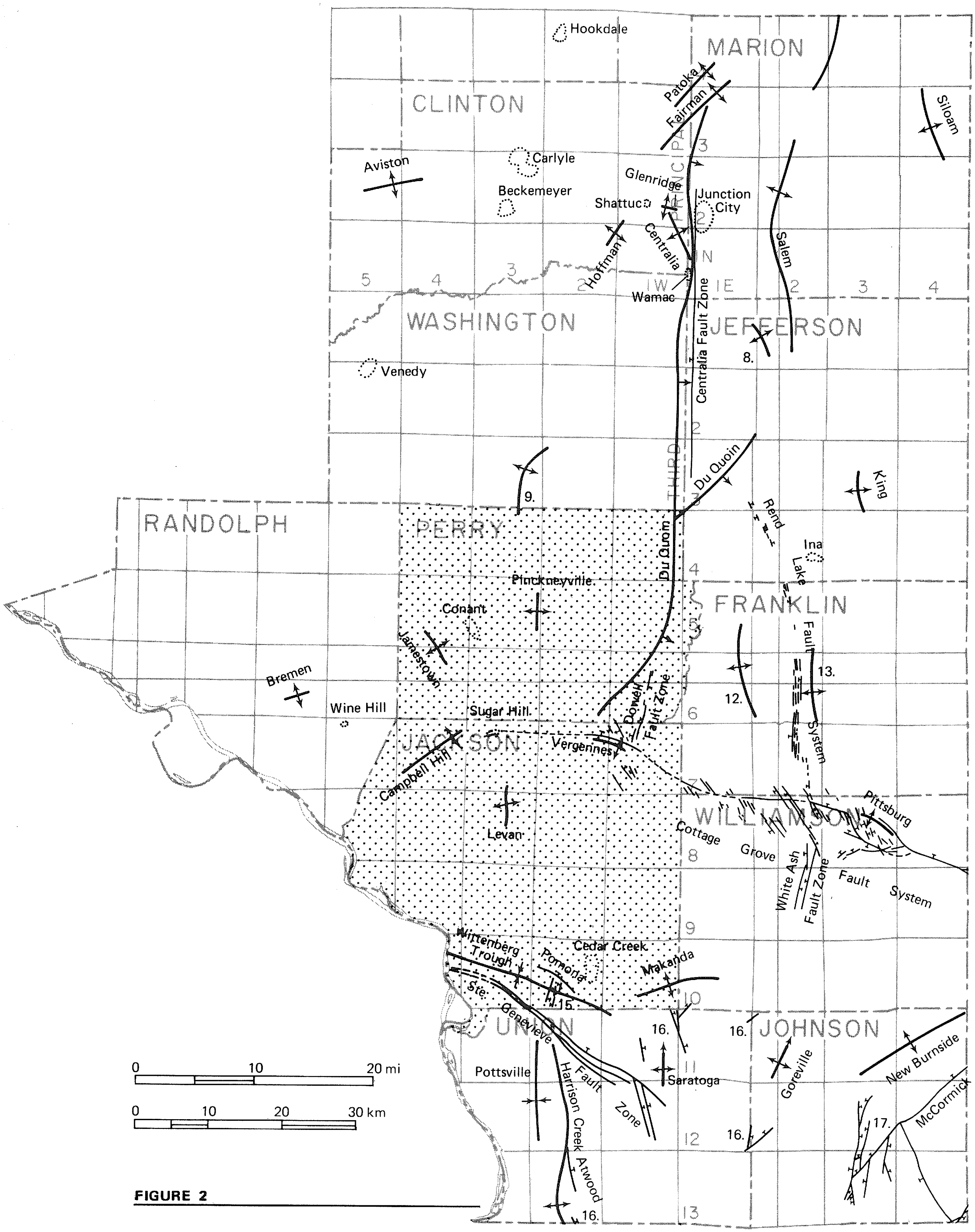
Resources of in-place Murphysboro along the Oraville channel are calculated to be about 650 million tons, with about 480 million tons classified as deep minable (> 28 in. thick and > 150 ft deep) and about 160 million tons as surface minable (> 18 in. thick and < 150 ft deep). Low- to medium-sulfur deposits beneath gray-shale wedges along the channel in Jackson County are estimated to be more than 30 million tons. As it is probable that more gray-shale wedges overlie the thick coal along the channel in Perry Couunty, more low- to medium-sulfur deposits may occur in these locations.

INTRODUCTION

In recent years, the search for additional low- to medium-sulfur coal (< 2.5% S) in Illinois has intensified because these coals are more marketable than high-sulfur coal (> 3% S). Most of the known resources of such low- to medium-sulfur coal are located either in the Herrin (No. 6) or in the Springfield (No. 5) Coal Members of the Carbondale Formation (fig. 1). For many years they have been preferentially mined. Other deposits, particularly those lying below the Springfield Coal, are potential sources for low- to medium-sulfur coal; some have been mined in the past, including the Murphysboro Coal Member of the Spoon Formation (fig. 1).

PREVIOUS INVESTIGATIONS

Worthen (1868) named the Murphysboro Coal for exposures near the town of Murphysboro in central Jackson County. Shaw and Savage (1912) first noted that the sulfur content of the Murphysboro Coal was fairly low. Cady (1917), Lamar (1925), and Cady (1952) reported on mining conditions and mapped some resources. Smith (1958) mapped strippable resources of Murphysboro in Jackson County.



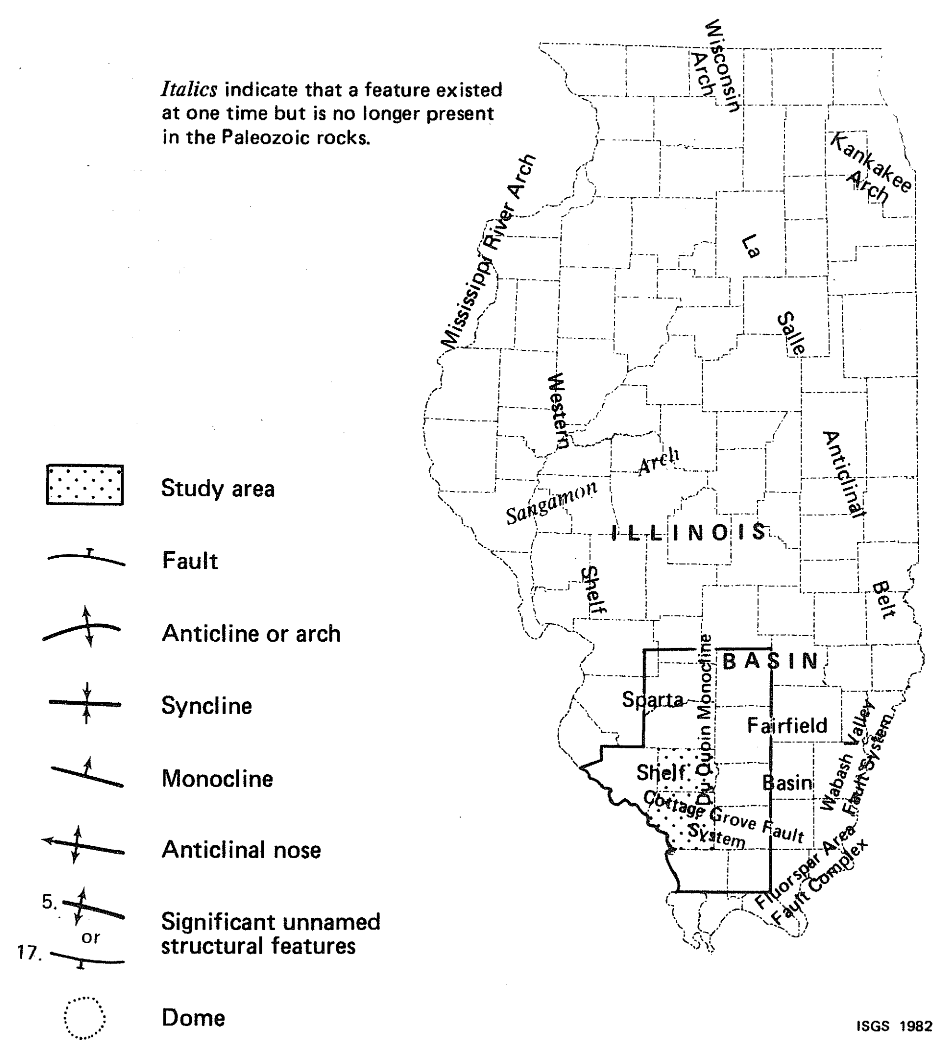
MARION
CLINTON
WASHINGTON
JEFFERSON
RANDOLPH
PERRY
FRANKLIN
JACKSON
WILLIAMSON
UNION
JOHNSON
Hookdale
Patoka
Fairman
Siloam
Aviston
Carlyle
Beckemeyer
Glenridge
Shattuc
Junction City
Centralia
Hoffman
Salem
Wamac
Centralia Fault Zone
Venedy
8.
9.
Du Quoin
King
Rend
Ina
Lake
Pinckneyville
Conant
Jamestown
Bremen
Wine Hill
Sugar Hill
Dowell
Fault Zone
12.
13.
Fault
System
Vergennes
Campbell Hill
Levan
Cottage
Grove
Fault
System
Pittsburg
White Ash
Fault Zone
Wittenberg
Trough
Pomona
Cedar Creek
Makanda
15.
Ste. Genevieve
Fault
Zone
16.
Pottsville
Harrison Creek
Atwood
Saratoga
Goreville
New Burnside
McCormick
17.
THIRD PRINCIPAL
0 10 20 mi
0 10 20 30 km

FIGURE 2

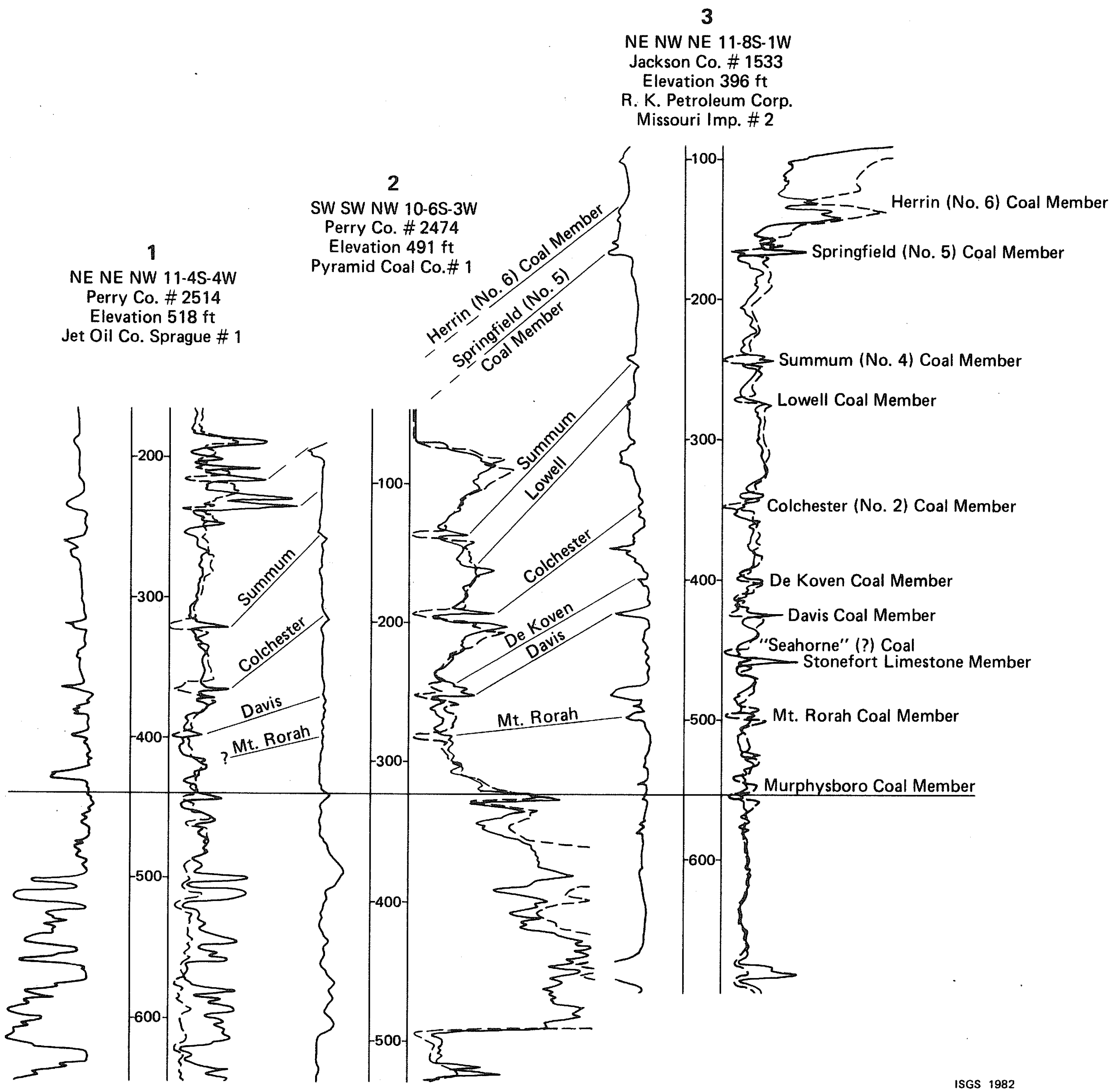
GEOLOGIC SETTING AND STRATIGRAPHY

The study area is located in southwestern Illinois (fig. 2) on the Sparta Shelf, which is separated from the Fairfield Basin on the east by the Du Quoin Monocline and from the Ozarks on the southwest by the Ste. Genevieve Fault Zone. The most important structural features affecting Pennsylvanian strata within the report area are the Cottage Grove Fault System (Nelson and Krausse, 1981) and associated Campbell Hill and Vergennes Anticlines (fig. 2). Minor flexures and domes are scattered throughout the area (fig. 2).

In the study area, the Murphysboro Coal Member lies 200 to 400 feet below the Springfield (No. 5) Coal Member of the Carbondale Formation and 75 to 200 feet below the Colchester (No. 2) Coal Member, which is the base of the Carbondale Formation (figs. 1 and 3). Most Pennsylvanian units on the western shelf are substantially thinner than they are to the east of the Du Quoin Monocline (fig. 2 and 3a).



Structural setting of the Murphysboro Coal and associated strata (from J. Treworgy, 1981).



3a

FIGURE 3
Typical drill hole data showing the Murphysboro Coal and associated strata.

3a Spontaneous potential/resistivity logs illustrating Murphysboro Coal and associated strata. (In log 3, note the greater thickness of associated strata occurring east of the Du Quoin Monocline.)

3b Spontaneous potential/resistivity logs in the Oraville channel.

3c Core showing Murphysboro Coal and associated strata.

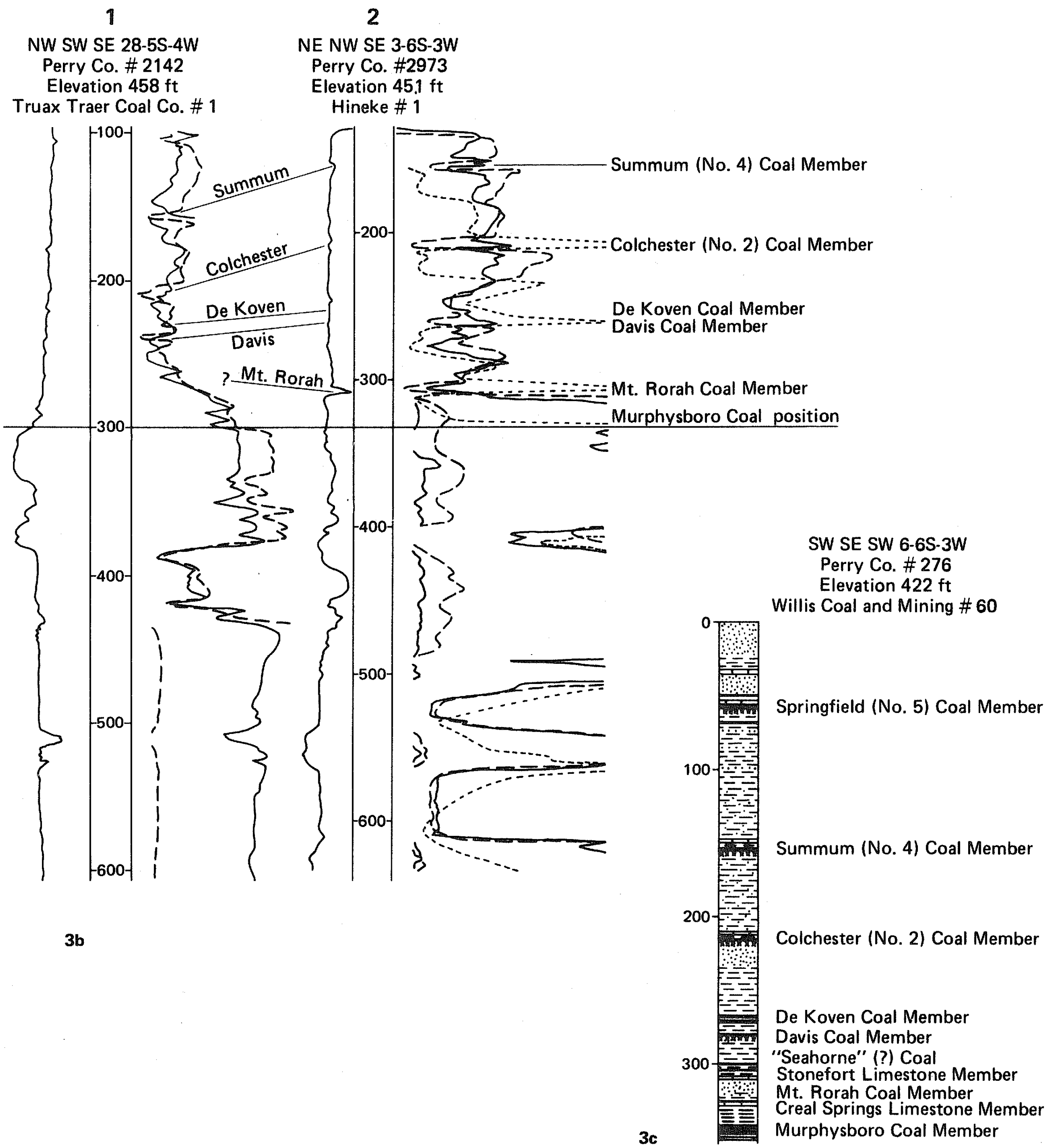
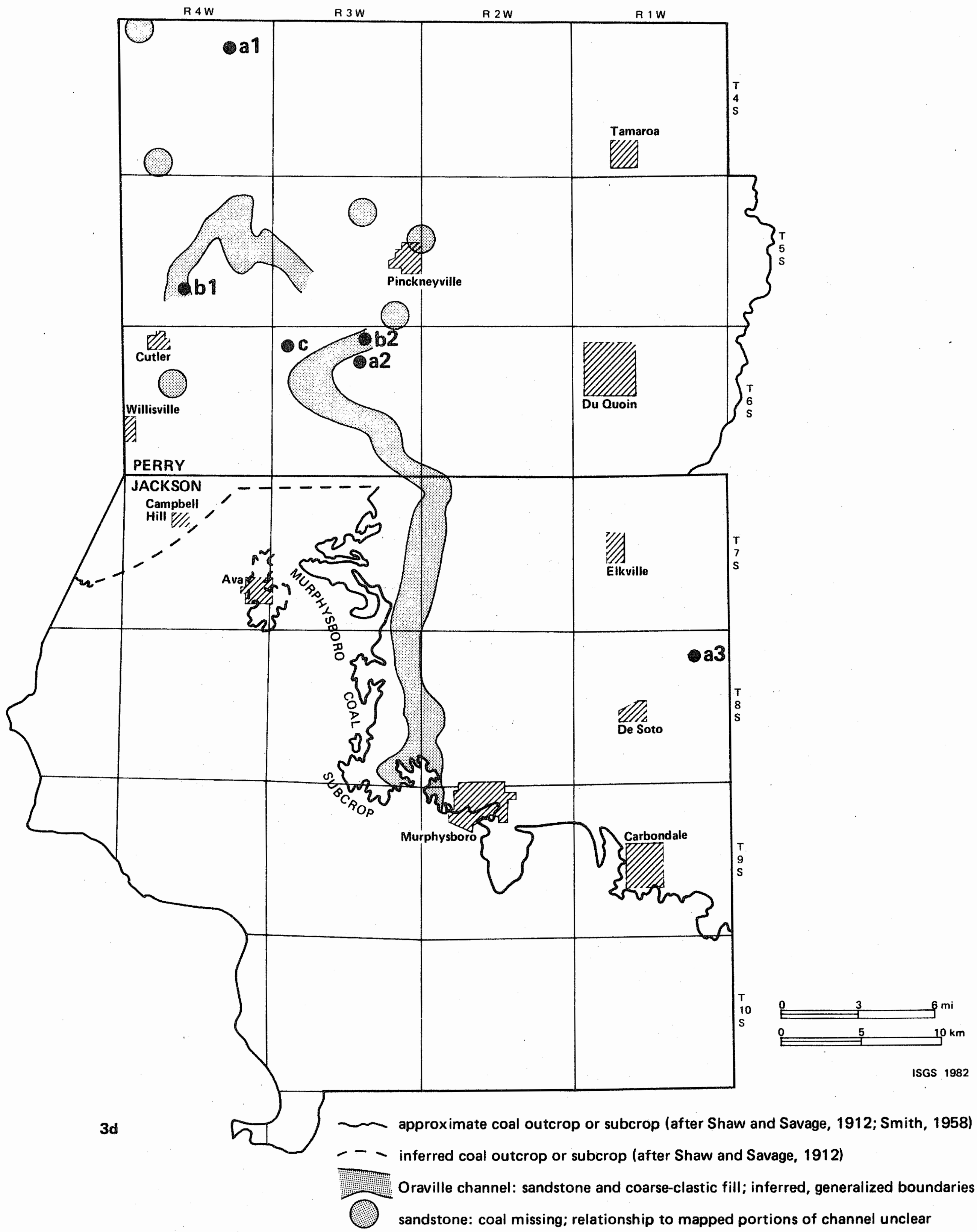


FIGURE 3

Continued on page 6—



3d

FIGURE 3—continued

3d Location of drill holes for data presented in figures 3a-3c.

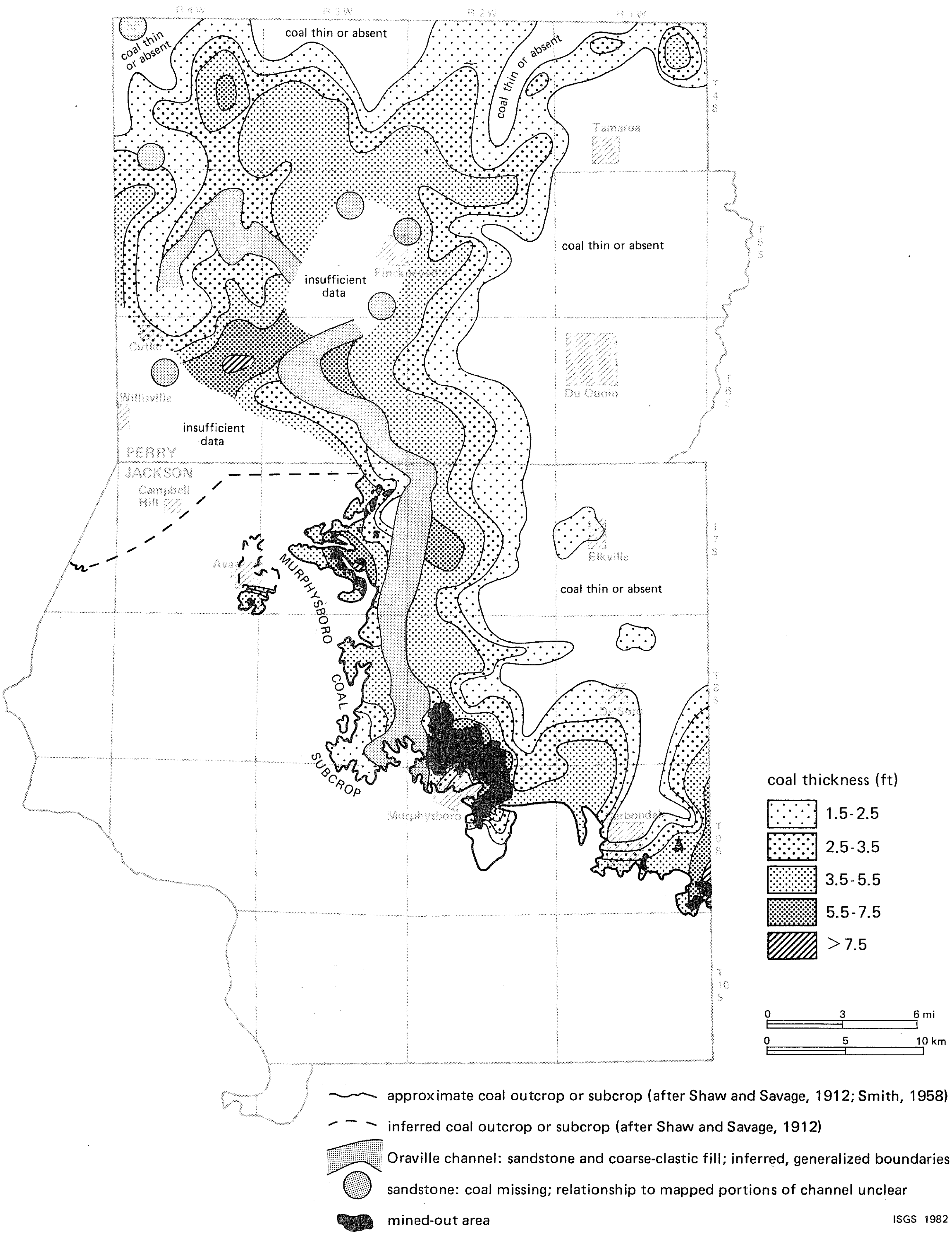
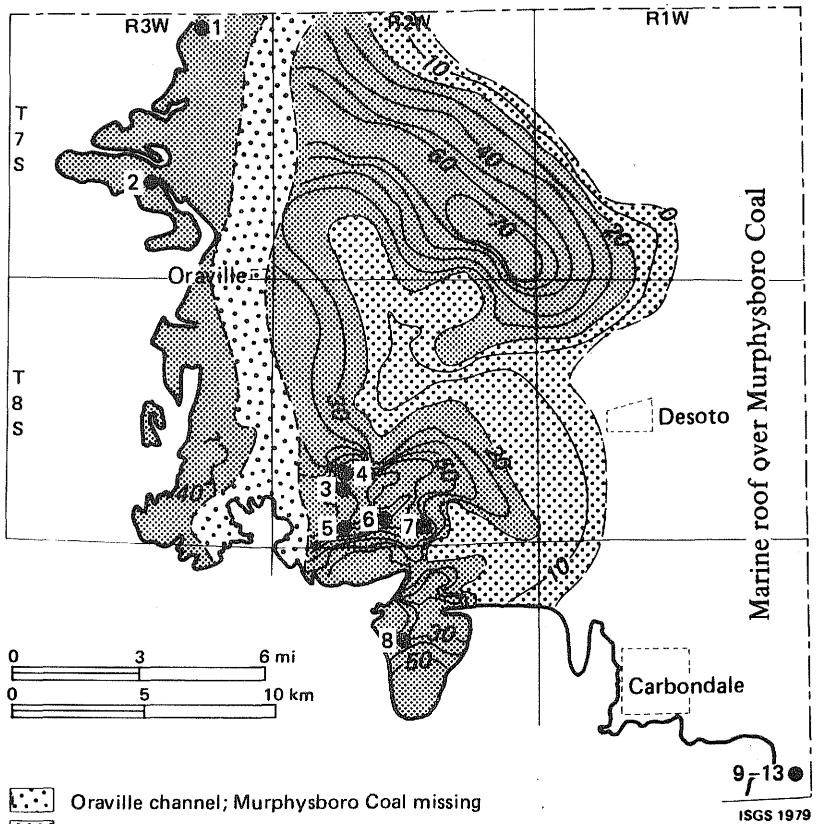


FIGURE 4
Thickness of the Murphysboro Coal in Jackson and Perry Counties.



Oraville channel; Murphysboro Coal missing
Splay deposits 0-6 m (0-20 ft) thick
Splay deposits >6 m (20 ft) thick
3● Sample locations for chemical analyses of the deposits (table 1)
40 Contour; interval 3 m (10 ft)
Subcrop of Murphysboro (approx.) from W. H. Smith, 1958

FIGURE 5
Thickness of crevasse-splay deposits (from Treworgy and Jacobson, in press).

DATA FOR MAPPING COAL THICKNESS AND CHANNEL LOCATION

For the vicinity of Carbondale and Murphysboro as well as along the outcrop line west of the Oraville channel in Jackson County (fig. 4), abundant data were available from coal-test holes and mine and outcrop descriptions. Only a few coal tests were available for the remainder of the study area (fig. 3c), and most of these were drilled no deeper than the Herrin or Springfield Coals. Geophysical logs from oil-test holes provided most of the data for mapping, although their information is not as reliable as drillers' logs or diamond cores from coal-test holes. (Uncertainties of about ± 1 foot for thickness estimates are probable.) However, geophysical logs permit delineation of thickness trends and depths of coal and other stratigraphic units in unexplored areas. They also were useful in mapping the Oraville channel in Perry County (fig. 4; fig. 3b; holes 1 and 2). Most of the more than 100 available geophysical logs consist of the standard spontaneous-potential (SP) resistivity logs from oil-test holes. Figure 3 provides typical examples.

For an earlier study, Treworgy and Jacobson (in press) mapped crevasse-splay, wedge-shaped deposits along the Oraville channel (fig. 5). Mapping was not extended in this investigation.

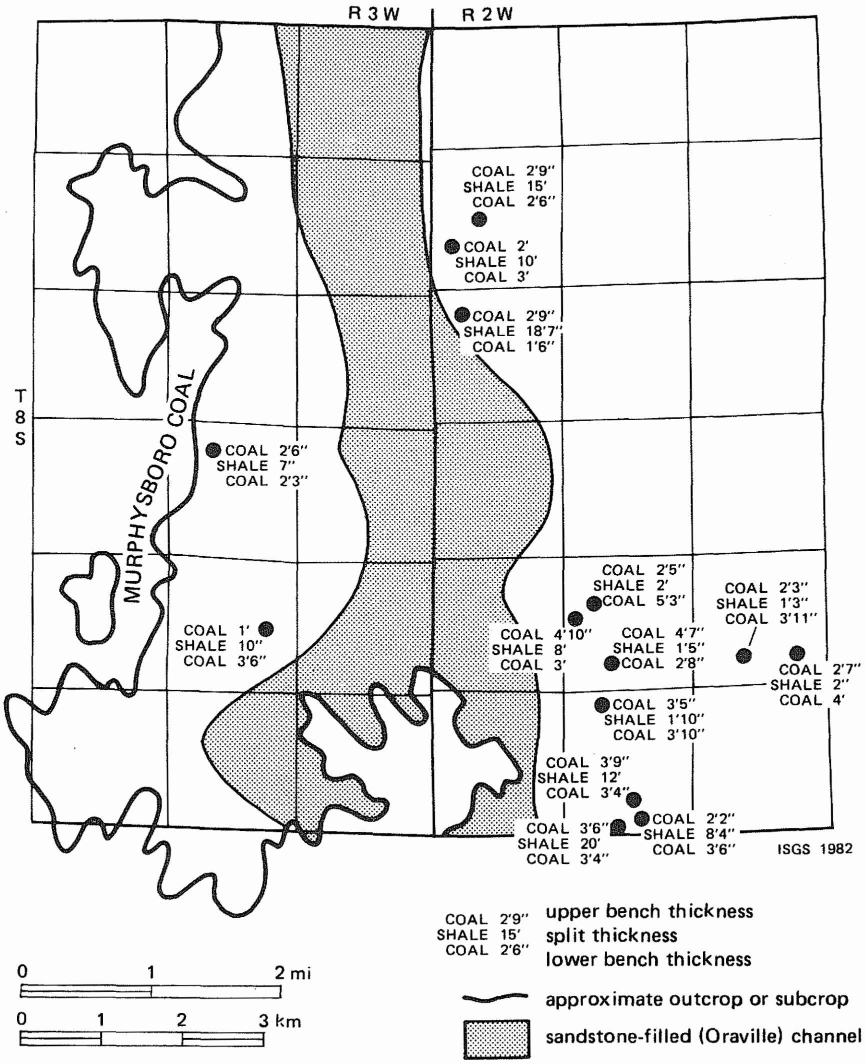


FIGURE 6
Drill holes showing variable thickness of a major parting in the coal near the channel.

FEATURES OF THE ORAVILLE CHANNEL— EVIDENCE FOR LOW-SULFUR DEPOSITS

The presence of a stream, draining the peat swamp that produced the Murphysboro Coal, is a relatively new idea (Treworgy and Jacobson, in press). Related geologic features have been noted for a long time, although the reason for their presence was not understood.

Partings are common along the margins of the channel of the ancient stream (fig. 6). Probably, they represent overbank deposits and small crevasse splays formed during periodic flooding from the Oraville channel—evidence that the channel was active during accumulation of the peat that eventually formed the Murphysboro Coal Member. In fact, these partings were observed in most of the coal mines operating in the Murphysboro area (Shaw and Savage, 1912; Cady, 1917; and Smith, 1958). Most partings are only a few inches thick and consists of gray, thinly bedded, carbonaceous shale; however, one of the shale partings was observed to be continuous throughout several mines, dividing the Murphysboro Coal into two benches. This major parting varies from a knife edge to 35 feet thick.

The presence of a thick gray shale overlying the Murphysboro Coal in central Jackson County was first noted by Cady (1917). Recent work by Treworgy and Jacobson (in press) has demonstrated that the gray, locally sandy shales are actually lobes of clastic rocks up to 80 feet thick, lying along the margins of the Oraville channel (fig. 5), and probably represent crevasse splays from the channel. Clearly, the stream existed for some time after peat accumulation terminated.

As in the Herrin and Springfield Coals, the low- to medium-sulfur coal seems to be situated beneath splay deposits about 20 feet thick or more (fig. 5). The river-derived splay deposits apparently protected the peat from sulfur contamination by sea waters invading the area—an inundation that occurred many times during the Pennsylvanian Period from 325 to 285 million years ago. The record of this marine transgression is found where the Murphysboro is not overlain by the lobes of clastic rocks. In such areas the Murphysboro is directly overlain by a different roof type consisting of a marine black shale and a limestone (the Creal Springs Limestone Member).

The extent of the Oraville channel is shown in figure 4. The Jackson County portion is from Treworgy and Jacobson (in press). In many places, the boundaries are uncertain and will need correction as more data become available. The channel extends at least as far north as central Perry County, beyond which the boundaries were not drawn because of insufficient data. Instead, circles with 1-mile diameters have been drawn around drill holes where the position of the coal (missing due to erosion or nondeposition) is occupied by sandstone, indicating possible locations of the Oraville channel. In west-central Perry County, another segment of the channel 6 to 7 miles long can be traced with reasonable assurance. North of this traceable segment, three more datum points encountered sandstone at the position of the Murphysboro Coal.

The Oraville channel in Perry County meanders along a westerly to northwesterly course. As in other coal seams, thicker coal apparently lies along the margins of the channel, and therefore the channel may extend into northeastern Randolph County north of Perry County (fig. 4).

In addition to the crevasse splays mapped in central Jackson County, others probably lie along the Oraville channel in Perry County. However, the actual existence of additional splays was not verifiable with available data. The marine black shale and overlying Creal Springs Limestone are difficult to recognize on the SP resistivity logs that make up the bulk of the data available in Perry County. Hence it could not be determined whether nonmarine splay deposits occur between the Murphysboro Coal and the overlying marine black shale and Creal Springs Limestone Member near the channel margins. Future exploration by diamond drilling or a suitable type of geophysical logging will more clearly define the Oraville channel and locate any associated crevasse-splay deposits beneath which low- to medium-sulfur coal may occur.

DISTRIBUTION AND THICKNESS OF THE MURPHYSBORO COAL

Figure 4, which illustrates generalized thickness trends of the Murphysboro Coal in Jackson and Perry Counties, provides a guide for further exploration; core data are needed to confirm thickness and resources estimates derived primarily from geophysical logs of oil-test holes.

Most of the thick Murphysboro (>3½ ft) lies along the margins of the Oraville channel. Similar patterns have been noted in other coals along contemporaneous channels such as the Herrin and the Springfield (Hopkins, Nance, and Treworgy, 1979). Coal is thicker in these areas because on the floodplain, along the subsiding, topographically lower drainage system, conditions were particularly wet. Nutrient-rich freshwaters produced luxuriant swamps, which resulted in thick accumulations of peat.

Smith (1958) noted that the thickness of the Murphysboro is locally irregular. Figure 7, based on closely spaced data, illustrates the intricate, highly variable thickness trends in a small area. The coal occurs in narrow, sinuous, and irregular lenses along the channel margins. Thickness trends reflect slight topographic irregularities at the time of peat accumulation, and additional data would undoubtedly show an even more complex pattern. In some areas, the coal is directly underlain by thick sandstone, and in other areas, by 4 to 5 feet of claystone (ISGS Coal Section, unpublished mine notes). Sandstone may have compacted less than the claystone, thus producing topographic highs. Because of such variability, exploration of the Murphysboro Coal requires that drill holes be spaced more closely than is customary in Illinois.

Thickness trends shown are for coal where it includes a parting up to 1 foot thick. Areas where the main parting was thicker than 1 foot were not included in thickness mapping and resource calculations. These areas near Murphysboro are largely mined out or occur immediately to the north of the mined-out areas in close proximity to the channel margins; other areas may exist where the parting exceeds 1 foot in thickness.

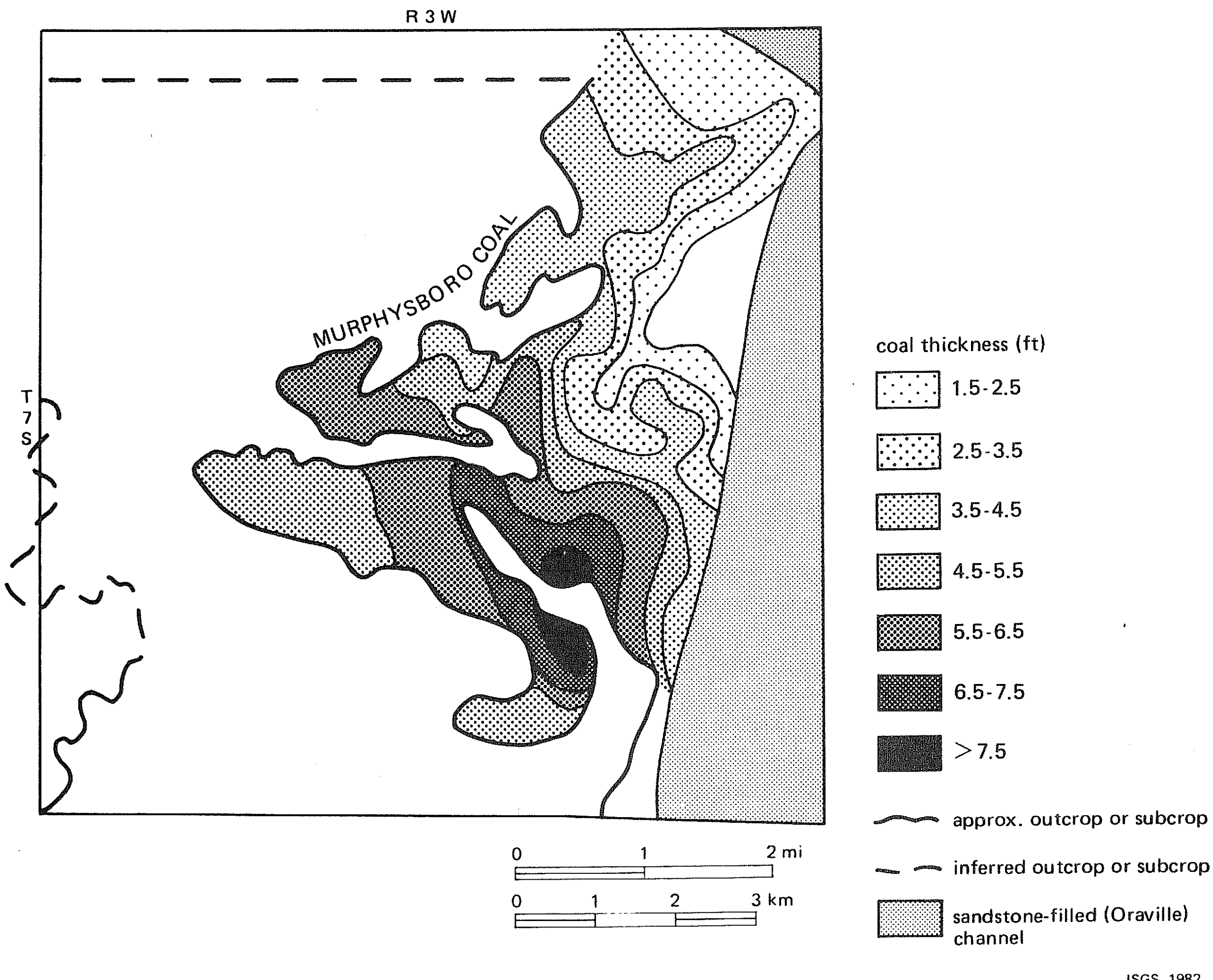


FIGURE 7
Complex thickness pattern of the Murphysboro Coal in Jackson County (an area of close data control).

DEPTH OF THE MURPHYSBORO COAL

The depth of the Murphysboro Coal within the study area ranges from zero along its cropline in Jackson County to over 600 feet on the flank of the Du Quoin Monocline in northeastern Jackson and southeastern Perry Counties (fig. 8). The topography of the study area is relatively level, with variations commonly of less than 40 feet in the area underlain by the Murphysboro Coal; therefore, the depths indicated on this map (fig. 8) also approximate the structure of the coal.

West of the Du Quoin Monocline the seam dips gently to the east. On the eastern flank of the monocline the coal plunges more steeply to the east. The presence of the Cottage Grove Fault System on the north flank of the Vergennes Anticline is reflected in closely spaced contours along a line running from the northwest corner to the southeast corner of T. 7 S., R. 1 W., Jackson County. The data density did not permit mapping of any faults along this trend.

QUALITY OF THE MURPHYSBORO COAL

Table 1 lists available chemical analyses of samples from the study area. The Murphysboro Coal is a high-volatile bituminous coal as defined in the American Society for Testing and Materials Standard D388, "Classification of Coals by Rank" (ASTM, 1981). Although the first two samples are probably weathered, the others rank as high-volatile A to B bituminous coal.

Samples 1 through 8 on table 1, with sulfur values of 1.1 to 2.4 percent (dry basis), all came from deposits beneath thick crevasse splays. The remaining samples with a high sulfur content, 3.7 to 6.1 percent, were from outlying areas (fig. 5).

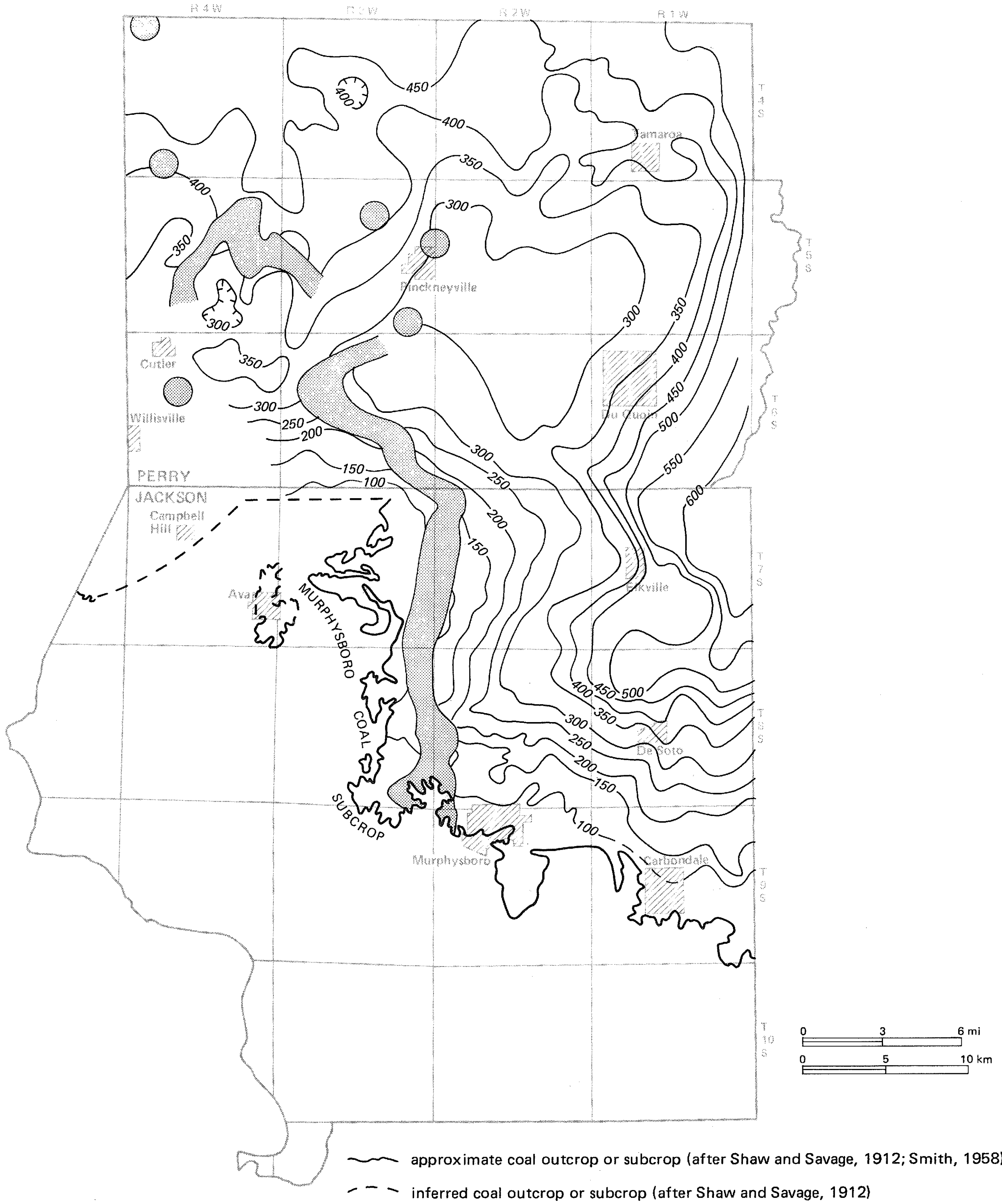
The five remaining samples, which have a significantly low moisture content and a correspondingly high heating value, were obtained east of the Du Quoin Monocline (southeast corner; fig. 5). They were probably buried more deeply than the samples west of the Monocline, which accounts for the higher values.

MINING CONDITIONS

Much of any future mining would occur in low-sulfur deposits overlain by silty gray shales. Cady (1917) reported on conditions affecting mining near Murphysboro that may typify what would be encountered in mining low- to medium-sulfur Murphysboro along the margins of the Oraville channel.

The first condition affecting mining practices would be the shale parting dividing the coal into two benches in several mines studied by Cady. In some mines, he reported that the parting was thin enough to permit simultaneous mining of the benches. However, in other mines where an attempt was made to mine both benches of the seam, the parting became so thick that operations had to be limited to the lower bench only. Similar partings may be located in the Murphysboro Coal farther north along the Oraville channel, though none were recognized in electric logs used for much of this study.

Cady (1917) reported that the roof in mines near Murphysboro consisted of a silty, thin-bedded shale containing variable amounts of carbonaceous material. It tended to fall in thin slabs. He also noted that it was common to find lenses up to 4 feet thick of a thinly laminated and highly carbonaceous shale between the top of the Murphysboro coal and the overlying silty, thin-bedded shales. He did not indicate how much roof commonly fell.



approximate coal outcrop or subcrop (after Shaw and Savage, 1912; Smith, 1958)

inferred coal outcrop or subcrop (after Shaw and Savage, 1912)

Oraville channel: sandstone and coarse-clastic fill; inferred, generalized boundaries

sandstone: coal missing; relationship to mapped portion s of channel unclear

—250— coal-depth contour (ft)

ISGS 1982

FIGURE 8
Generalized depth of the Murphysboro Coal in Jackson and Perry Counties.

Table 1. Chemical analyses of the Murphysboro Coal in Jackson County

Mine, location, sample no.	Mine index no.	(Analyses averaged), lab no., date of analysis	Basis of analysis*	Proximate				Ultimate					Heat value (Btu/lb)
				Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	
Outcrop sample		(1)	ar	15.3	32.3	46.0	6.4	1.48	5.62	61.22	1.45	23.79	10,633
2-7S-3W		C-8836	d		38.2	54.2	7.6	1.74	4.62	72.27	1.71	12.06	12,559
1		(weathered)	daf		41.3	58.7		1.89	5.00	78.21	1.85	13.05	13,594
		1954†	mmmf	16.6	33.8	49.6							11,442
			dmmf		40.6	59.4							13,731
J. Morgan & Sons		(1)	ar	12.9	34.5	45.8	6.8	2.14	5.84	65.16	1.34	18.76	11,662
22-7S-3W		C-8837	d		39.5	52.7	7.8	2.45	5.07	74.78	1.54	8.40	13,384
2		(probably	daf		42.9	57.1		2.66	5.50	81.07	1.67	9.10	14,511
		weathered)	mmmf	14.1	36.2	49.7							12,631
		1954†	dmmf		42.0	58.0							14,697
Gartside C. C.	14	(3)	ar	8.6	34.2	50.2	7.0	1.5					12,420
No. 4		5225,5226,5228	d		37.4	54.9	7.7	1.7					13,580
29-8S-2W		1912**	daf		40.5	59.5		1.8					14,710
3			mmmf	9.4	36.0	54.6							13,480
			dmmf		39.8	60.2							14,860
Gus Blair Big	16	(3)	ar	9.3	34.6	50.5	5.6	1.4					12,500
Muddy C.C. No.1		5496,5497,5498	d		38.1	55.7	6.2	1.5					13,780
29-8S-2W		1912**	daf		40.6	59.4		1.6					14,690
4			mmmf	10.0	36.0	54.0							13,340
			dmmf		40.0	60.0							14,820
Gus Blair Big	12	(3)	ar	9.6	33.0	51.1	6.3	1.1					12,260
Muddy C.C. No.2		5251,5252,5253	d		36.5	56.5	7.0	1.3					13,570
32-8S-2W		1912**	daf		39.1	60.9		1.4					14,580
5			mmmf	10.4	34.6	55.0							13,180
			dmmf		38.6	61.4							14,710
Big Muddy C &	15	(3)	ar	8.7	34.8	51.3	5.2	1.4					12,650
Iron Co.		5286,5287,5288	d		38.1	56.2	5.7	1.6					13,860
Harrison No. 10		1912**	daf		40.4	59.6		1.6					14,690
33-8S-2W			mmmf	9.3	36.1	54.6							13,440
6			dmmf		39.8	60.2							14,820
Big Muddy C &	13	(3)	ar	10.2	33.4	51.9	4.5	1.0					12,610
Iron Co. No. 9		5248,5249,5250	d		37.2	57.8	5.0	1.1					14,040
34-8S-2W		1912**	daf		39.2	60.8		1.1					14,790
7			mmmf	10.8	34.5	54.7							13,290
			dmmf		38.7	61.3							14,890

Table 1—continued

Mine, location, sample no.	Mine index no.	(Analyses averaged), lab no., date of analysis	Basis of analysis*	Proximate				Ultimate					Heat value (Btu/lb)
				Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	
Templeton C. C.	604	(1)	ar	8.5	33.6	52.1	5.8	1.2	5.6	71.1	1.3	15.0	12,620
16-9S-2W		BM B39310	d		36.7	57.0	6.3	1.3	5.0	77.6	1.4	8.4	13,780
8		(composite of 3)	daf		39.2	60.8		1.3	5.4	82.9	1.5	8.9	14,720
		1939**	mmmf	9.1	35.1	55.8							13,490
			dmmf		38.6	61.4							14,830
J. P. Swofford C.C. No. 2	602	(1)	ar	5.7	33.2	52.3	8.8	3.5	5.3	70.0	1.3	11.1	12,590
36-9S-1W		BM B39379	d		35.2	55.4	9.4	3.7	4.9	74.2	1.4	6.4	13,350
9		(composite of 3)	daf		38.9	61.1		4.1	5.4	81.8	1.5	7.2	14,730
		1939**	mmmf	6.4	35.1	58.5							14,020
			dmmf		37.5	62.5							14,990
Thomas G. Philips	607	(1)	ar	4.4	37.7	46.5	11.4	4.8	5.3	67.9	1.1	9.5	12,440
36-9S-1W		BM B39589	d		39.4	48.7	11.9	5.0	5.1	71.0	1.1	5.9	13,010
10		(composite of 3)	daf		44.8	55.2		5.7	5.8	80.6	1.3	6.6	14,770
		1939**	mmmf	5.2	41.0	53.8							14,340
			dmmf		43.2	56.8							15,120
Outcrop sample		(1)	ar	6.0	36.1	48.0	9.9	4.05					12,452
NE SE 36-9S-1W		C-8206	d		38.4	51.1	10.5	4.31					13,250
11		1953†	daf		42.9	57.1		4.82					14,804
			mmmf	6.9	38.7	54.4							14,067
			dmmf		41.5	58.5							15,105
Outcrop sample		(1)	ar	4.7	38.7	43.0	13.6	5.85					12,027
NE SE 36-9S-1W		C-8205	d		40.6	45.2	14.2	6.13					12,614
12		1953†	daf		47.3	52.7		7.15					14,704
			mmmf	5.7	43.0	51.3							14,293
			dmmf		45.5	54.5							15,140
Tab Mining Co. Mine No. 1	891	(1)	ar	6.3	35.0	49.1	10.6	4.6	5.2	67.4	1.3	10.8	12,300
NE NE SE SW		C-16408	d		37.0	51.8	11.2	4.9	4.9	71.2	1.3	6.4	12,990
36-9S-1W		(composite of 2)	daf		41.6	58.4		5.5	5.5	80.2	1.5	7.2	14,630
13		1970†	mmmf	6.16	37.5	56.3							14,030
			dmmf		40.1	59.9							14,960

* ar - as received; d - dry; daf - dry, ash free; mmmf - moist, mineral matter free; dmmf - dry, mineral matter free (unit coal)
** Data from Cady (1948)
† Data from unpublished analyses in Illinois State Geological Survey files

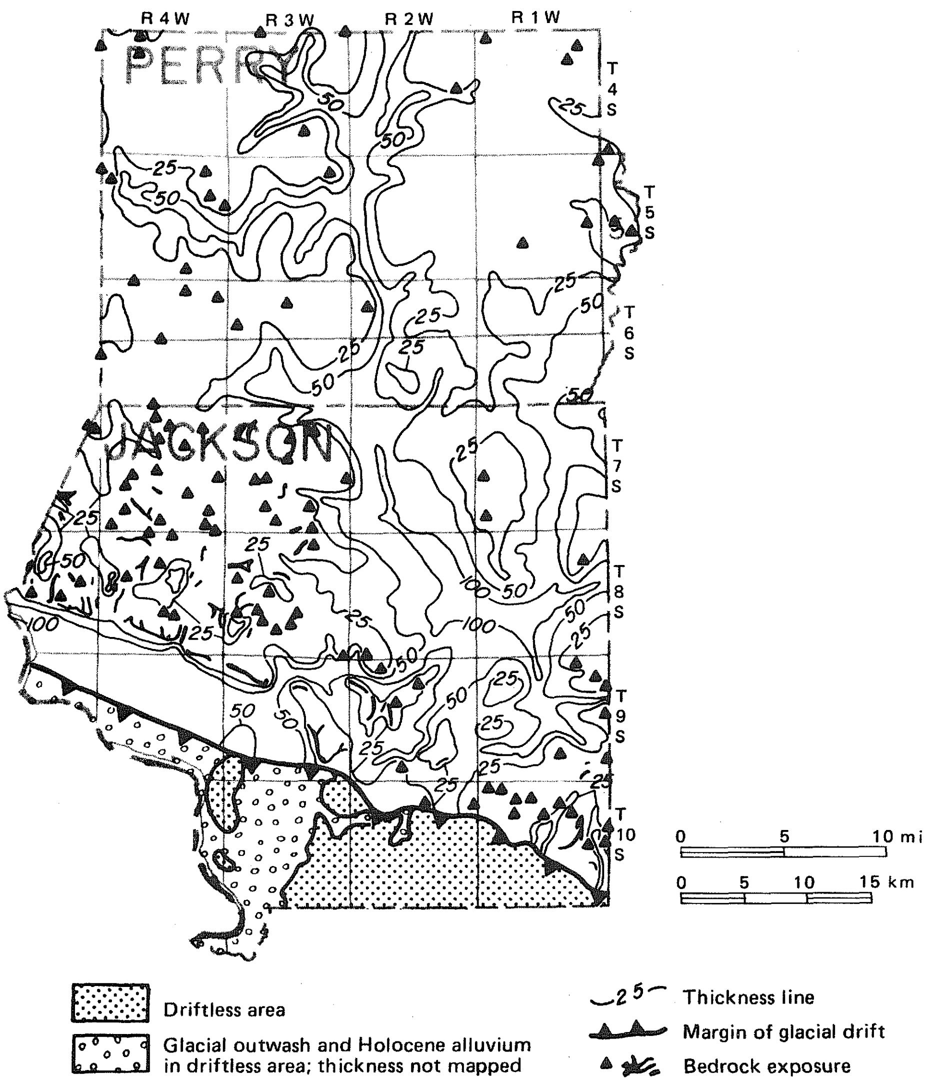
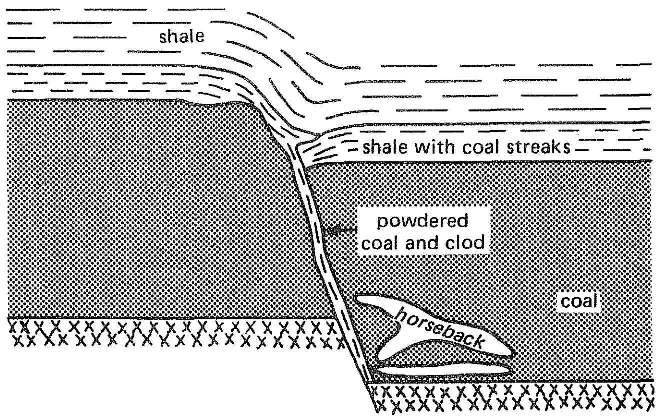
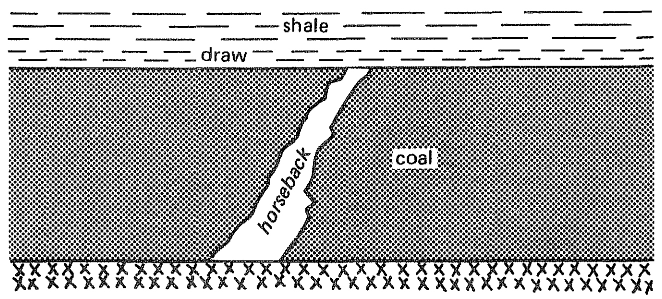


FIGURE 9
Thickness of unconsolidated overburden—pleistocene glacial drift.

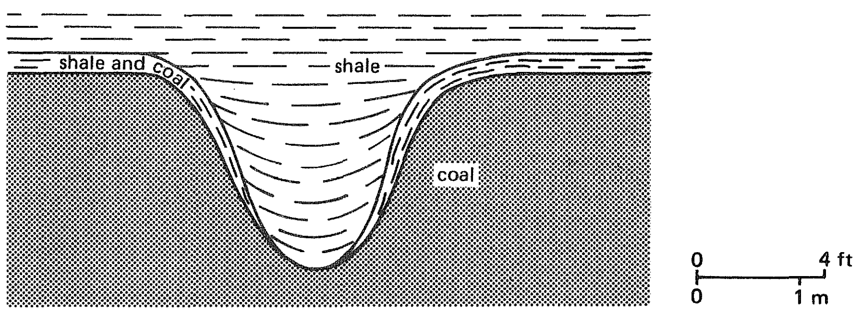
According to Cady, severe roof problems were encountered in T. 8 S., R. 2 W. (fig. 9) where silty shales lie below thicker unconsolidated materials (Pleistocene glacial drift) filling valleys cut into the consolidated shales. In these areas the thickness of unconsolidated overburden to consolidated overburden had a ratio up to 2. The valley fill was often water saturated, causing the roof to be weak and resulting in the roof falls and pit subsidence typical over shallow mines. Thickness of unconsolidated overburden is generally less than 50 feet over much of the area underlain by the thick Murphysboro Coal (fig. 9). Comparison of figures 8 and 9 indicates that over most of the area, the thickness ratio of unconsolidated to consolidated overburden is .5 or less. In other areas of Illinois where this ratio is 1 or greater, unstable roof and floor conditions (squeezes) have been experienced; fractures developing in the roof strata have allowed water to enter from the overlying unconsolidated overburden (Hopkins, Nance, and Treworgy, 1979). In the study area, central Jackson County near the town of Murphysboro is the only location exhibiting ratios indicative of potential instability. Here the unconsolidated overburden is up to 100 feet thick in valleys cut into the consolidated overburden (fig. 9).



a. Fault and associated clay dike ("horseback") in Mine No. 2, Gus Blair Big Muddy Coal Co., 32-8S-2W, Jackson County.



b. Clay dike in Mine No. 9, Big Muddy Coal and Iron Co., 34-8S-2W, Jackson County.



c. Roll in Mine No. 9, Big Muddy Coal and Iron Co., 34-8S-2W, Jackson County.

ISGS 1982

FIGURE 10
Structural irregularities in the Murphysboro Coal (from K. D. White, ISGS, unpublished mine notes).

Cady (1917) stated that the floor of the Murphysboro Coal is commonly bluish-gray sandstone and usually exceeds 5 feet in thickness. Although in some areas claystone up to 4 to 5 feet thick lies between the coal and sandstone, it apparently offers no difficulty for mining (ISGS Coal Section, unpublished mine notes). Cady also observed several deformational irregularities of the coal seam. These were scattered throughout the mines in the vicinity of Murphysboro (fig. 10) and included minor faults or *slips* (fig. 10a), clay- or sandstone-filled dikes called *horsebacks* by miners (fig. 10b), and *rolls* (fig. 10c). Such phenomena, similar to irregularities encountered in the Springfield and Herrin Coals (Krausse et al., 1979), were not so common as to be a major hindrance in mining. Where they did occur, Cady reported that there was difficulty in holding the roof.

Major structural features that would hinder mining of the thick Murphysboro Coal in north-central Jackson County are the Cottage Grove Fault System and associated Campbell and Vergennes Anticlines (fig. 2). Along the main east-west fault, vertical displacement on the downthrown (north) side may reach 200 feet (Shaw and Savage, 1912). In addition, many lesser faults are probably present, and steep dips may occur in strata adjacent to the main fault zone (Nelson, 1979).

MURPHYSBORO COAL RESOURCES

In the two-country area, resources of in-place Murphysboro greater than 1½ feet thick are estimated to be slightly more than 650 million tons (table 2)—almost 400 million tons in Perry County and more than 260 million tons in Jackson County. Of these combined resources, more than 480 million tons are classified deep minable (> 28 in. thick and > 150 ft deep), including 320 million tons in deposits over 3½ feet thick. Estimates of surface-minable, in-place coal (> 18 in. thick and < 150 ft deep) amount to more than 160 million tons.

In Jackson County, resources of low- to medium-sulfur coal, which underlie silty, gray shale 20 feet or more thick (fig. 5), are estimated to be more than 30 million tons. Over 20 million tons of this coal are considered to be surface minable and more than 1½ feet thick. Of the coal considered to be deep minable, over 10 million tons are thicker than 2½ feet, and 8 million tons are thicker than 3 feet.

FUTURE EXPLORATION FOR LOW-TO MEDIUM-SULFUR RESOURCES

Because low- to medium-sulfur deposits of the Murphysboro Coal occur beneath thick crevasse-splay deposits along the Oraville channel in Jackson County,

Table 2. Estimated resources of Murphysboro Coal (millions of tons)

	Deep minable > 150 ft deep	Surface minable < 150 ft deep	Total
Perry County			
18-28 in.	—	.6	.6
28-42 in.	149	.9	150
42-66 in.	204	7	212
66-90 in.	24		24
> 90 in.	3		31
County total	380	9	390
Jackson County			
18-28 in.		6	6
28-42 in.	40	25	65
42-66 in.	65	84	149
66-90 in.		34	34
> 90 in.		7	7
County total	105	156	261
TOTAL	485	166	651

future exploration should seek additional splays along the channel in Perry County. Splays can be expected anywhere along the channel, particularly at bends where the river was more likely to break through its natural levees.

Additional exploration is also warranted to the north and west in Randolph and St. Clair Counties, along the projected trend of the Oraville channel. Perhaps in these areas, thick Murphysboro deposits may be found along the margins of the yet unmapped portions of the Oraville channel.

Much remains to be learned about the Murphysboro Coal Member in the study area. Exploration is needed to confirm the thickness of the coal, better define the channel, delineate areas of split coal, evaluate the potential areas of low-sulfur deposits in Jackson County, examine the mining characteristics of the roof, and finally determine if addtional areas of low-sulfur coal do indeed exist along the Oraville channel.

REFERENCES

American Society for Testing and Materials, 1981, Annual Book of ASTM Standards D388077, p. 215.

Cady, G. H., 1917, Coal resources of District II (Jackson County): Illinois State Geological Survey Cooperative Coal Mining Series Bulletin 16, p. 33-49.

Cady, G. H., 1952, Minable coal reserves of Illinois: Illinois State Geological Survey Bulletin 78, p. 37-38.

Gluskoter, H. J., and J. A. Simon, 1968, Sulfur in Illinois coals: Illinois State Geological Survey Circular 432, 28 p.

Hopkins, M. E., R. B. Nance, and C. G. Treworgy, 1979, Mining geology of Illinois coal deposits, *in* J. E. Palmer and R. R. Dutcher [eds.], Depositional and Structural History of the Pennsylvanian System of the Illinois Basin. Part 2, Invited Papers: Illinois State Geological Survey Guidebook 15a, p. 142-151.

Krausse, H.-F., H. H. Damberger, W. J. Nelson, S. K. Hunt, L. T. Ledvina, C. G. Treworgy, and W. A. White, 1979, Roof strata of the Herrin (No. 6) Coal Member in mines of Illinois: Their geology and stability: Illinois State Geological Survey Mineral Notes 72, 54 p.

Lamar, J. E., 1925, Geology and mineral resources of the Carbondale Quadrangle: Illinois State Geological Survey Bulletin 48, p. 103-109, 156-158.

Nelson, W. J., and H.-F. Krausse, 1981, The Cottage Grove Fault System in southern Illinois: Illinois State Geological Survey Circular 522, 65 p.

Piskin, K., and R. E. Bergstrom, 1975, Glacial drift in Illinois: Thickness and character: Illinois State Geological Survey Circular 490, 35 p.

Shaw, E. W., and T. E. Savage, 1912, Geologic atlas of the United States, Murphysboro-Herrin folio: U.S. Geological Survey Folio 185.

Smith, W. H., 1958, Strippable coal reserves of Illinois, Part 2. Jackson, Monroe, Perry, Randolph, and St. Clair Counties: Illinois State Geological Survey Circular 260, 34 p.

Treworgy, Colin G., and Russell J. Jacobson, in press, Paleoenvironments and distribution of low-sulfur coal in Illinois: Compte Rendu, Ninth International Congress of Carboniferous Stratigraphy and Geology.

Treworgy, Janis D., 1981, Structural features in Illinois—A compendium: Illinois State Geological Survey Circular 519, 22 p.

Willman, H. B., E. Atherton, T. C. Buschbach, C. Collinson, J. C. Frye, M. E. Hopkins, J. A. Lineback, and J. A. Simon, 1975, Handbook of Illinois Stratigraphy: Illinois State Geological Survey Bulletin 95, p. 163-201.

Worthen, A. H., 1868, Geology: Geological Survey of Illinois, Vol. III, 574 p.