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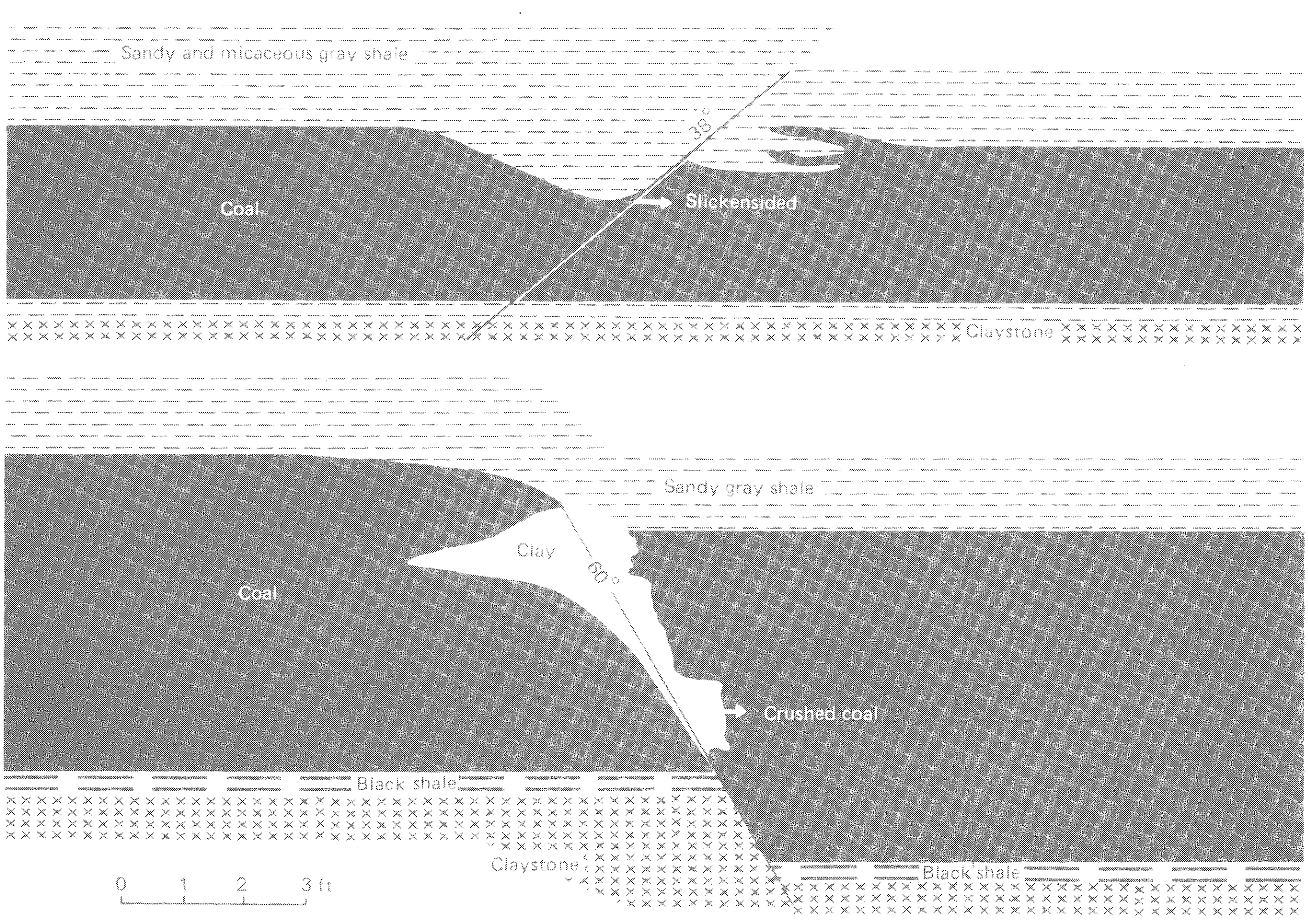
COAL RESOURCES OF GRUNDY, LA SALLE, AND LIVINGSTON COUNTIES, ILLINOIS

R. J. Jacobson



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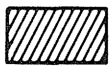
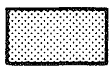
 Underground mined-out area

 Surface mined-out area

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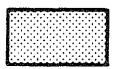
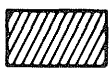
 Underground mined-out area

 Surface mined-out area

COAL RESOURCES OF GRUNDY, LA SALLE, AND LIVINGSTON COUNTIES, ILLINOIS

ILLINOIS STATE GEOLOGICAL SURVEY
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COAL RESOURCES OF GRUNDY, LA SALLE, AND LIVINGSTON COUNTIES, ILLINOIS

ABSTRACT

Coal resources for three counties in the northeastern part of the Illinois Basin Coal Field were evaluated for this report. These coals occur mostly in the Carbondale Formation, but the underlying Spoon Formation contains a few lenticular coals that have been mined locally. The overlying Modesto and Bond Formations contain coals that are too thin and discontinuous to mine. Structurally, the area is an integral part of the La Salle Anticlinal Belt, which crosses La Salle and Livingston Counties. Included in this report are deep-minable resources (coal 28 inches or more in thickness and having overburden depths of 150 feet or greater) and surface-minable resources (coal 18 inches or more in thickness and having overburden not exceeding 150 feet).

Distribution of the coal thicknesses in much of the report area has a significant relationship to geological structure. For the Colchester (No. 2) and the Danville (No. 7) Coal Members, and part of the Herrin (No. 6) Coal Member, the thickest coal is largely restricted to the synclinal troughs of the La Salle Anticlinal Belt. Thinner coal primarily occurs on anticlinal crests.

Large areas of Livingston County, previously unmapped, contain significant resources of the Danville (No. 7) Coal at surface-minable and deep-minable depths. Deep-minable resources of the Danville Coal that total 1,498 million tons were estimated for La Salle and Livingston Counties, 60 percent more than previous published estimates. Surface-minable resources of this coal were estimated at 717 million tons, considerably greater than earlier estimates.

In addition, surface-minable resource estimates were also notably increased for the Houchin Creek (No. 4) Coal Member.

Throughout most of the three counties, large areas of the Herrin (No. 6) Coal, previously mapped as areas of insufficient data, contain coal that is too thin for mining. However, total resource estimates of this coal increased slightly, to 402 million tons, 7 percent more than reported in earlier studies.

On the basis of revisions of earlier mapping, some significant changes were also made in the estimates of resources of the Colchester (No. 2) Coal. Earlier studies indicated that the Colchester averaged 2½–3 feet in the three-county area. This study showed that the thickness variations are greater; hence, the previous estimate of deep-minable resources was reduced by 30 percent to 2,894 million tons. The estimate of surface-minable resources was increased to 569 million tons, a 9 percent increase.

Although major changes have been made in the individual estimates for each coal, the total change in resources for this area has been minor. Total resources estimated in this report are 6,310 million tons, 5 percent more than the previous estimates for the area. Of this figure, 1,790 million tons are classified as surface-minable and 4,520 million tons as deep-minable. Of the last two figures, only 254 million tons (14%) of the total surface-minable resources and 422 million tons (9%) of the deep-minable resources have high development potential.

INTRODUCTION

The report area lies in the northeastern part of the Illinois Basin Coal Field (fig. 1); the Illinois River traverses the northern portion of the area. This area was selected for study primarily to fill in gaps and to supplement data presented in earlier reports.

The first documented discovery of coal in the United States was in La Salle County. According to Bement (1929, p. 13), Father Louis Hennepin was travelling on the Illinois River in 1668 when he noted in his journal a "cole mine" near the present site of Ottawa. Because the coal deposits of Grundy, La Salle, and Livingston Counties were shallow, easily accessible, and close to the Chicago market, these counties developed a thriving coal industry during the late 1800s. Between 1882 and 1892 La Salle, Grundy, and Livingston Counties ranked third, fifth, and fourteenth among Illinois counties in total coal production; between 1892 and 1902, they ranked fifth, sixth, and twenty-second. After that, production diminished because increased development of the railroads caused the mining of the thick coal seams of southern Illinois to become more profitable.

Surface mining in the three-county area began about 1928, but the total amount of coal produced declined because of the competition from the coal produced in southern Illinois. In 1974 the last surface mine, the Northern Mine of Peabody Coal Company (which had operated in Grundy and Kankakee Counties, but was only operating in Kankakee County at the time) closed. When the thicker seams of southern Illinois are mined out, attention may again turn to the several billion tons of resources that remain in the three counties.

Several of the more recent and most comprehensive reports that cover parts of this area include Smith (1968), Smith and Stall (1975), and Treworgy et al. (1978). Treworgy and Bargh (1982) summarized data from this report for La Salle and Livingston Counties. Acquiring new data and evaluating geophysical records not previously used provided information about several coals in formerly unmapped areas.

Some of the major changes and additions include mapping a previously unmapped area of the Danville (No. 7) Coal Member in Livingston County; reducing the estimated thickness of the Colchester (No. 2) Coal Member in parts of previously mapped areas, hence decreasing the estimated total tonnage of Colchester Coal; and changing the area of insufficient data of the Herrin (No. 6) Coal Member that had been mapped by Smith and Stall (1975) to an area consisting primarily of thin coal.

Depth, thickness, and areal extent of the minable coals were obtained mostly from electric logs of oil and structure tests in areas in which the coals were relatively deep. Along the subcrops of the coals and in scattered parts of the deeper areas, more reliable data from coal shafts, diamond drill cores, and drill logs from coal-test holes were used in the mapping of these coals. These data were also useful in calibrating the electric logs so that more reliable thickness estimates could be made. Methodology for preparing resource estimates and reliability classifications followed that of earlier reports of the Illinois State Geological Survey (Smith, 1968; Smith and Stall, 1975; Treworgy et al., 1978; Treworgy and Bargh, 1982). The methodology is summarized in appendix A.

Coal thickness data were plotted on work maps (plates 1–4) at a scale of 1 inch to 1 mile. The information on these maps was digitized and the resulting data were processed to calculate the resources for each minable coal. In addition, other drill hole information used in this study was entered into a computer file, and the depth and interval maps in figures 5, 6, and 8-14 were generated. To develop the overburden maps, the depth maps shown in figures 5, 8b, 11, and 14 were interfaced with the glacial thickness map of Piskin (Piskin and Bergstrom, 1975) (figs. 23-25).

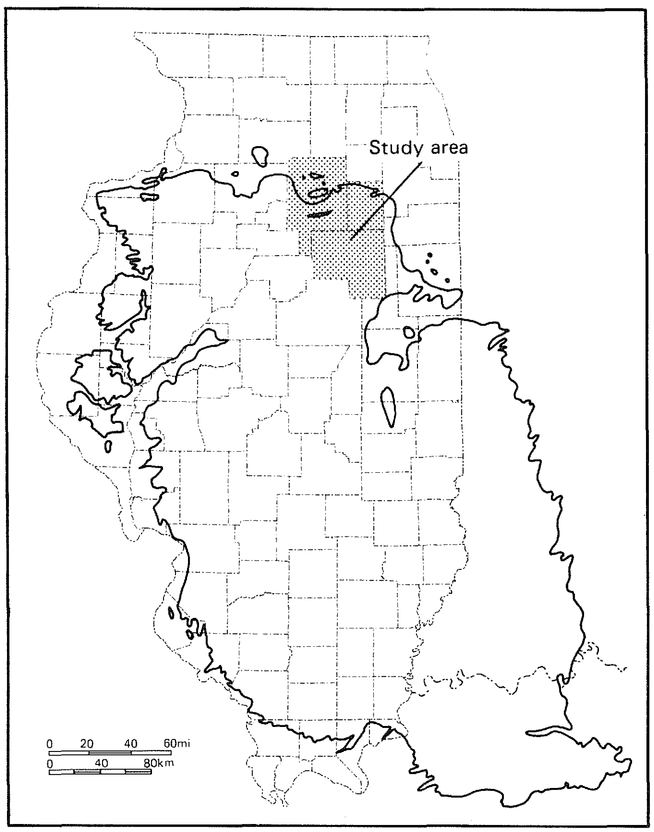


Figure 1
Study area in relation to Illinois Basin Coal Field.

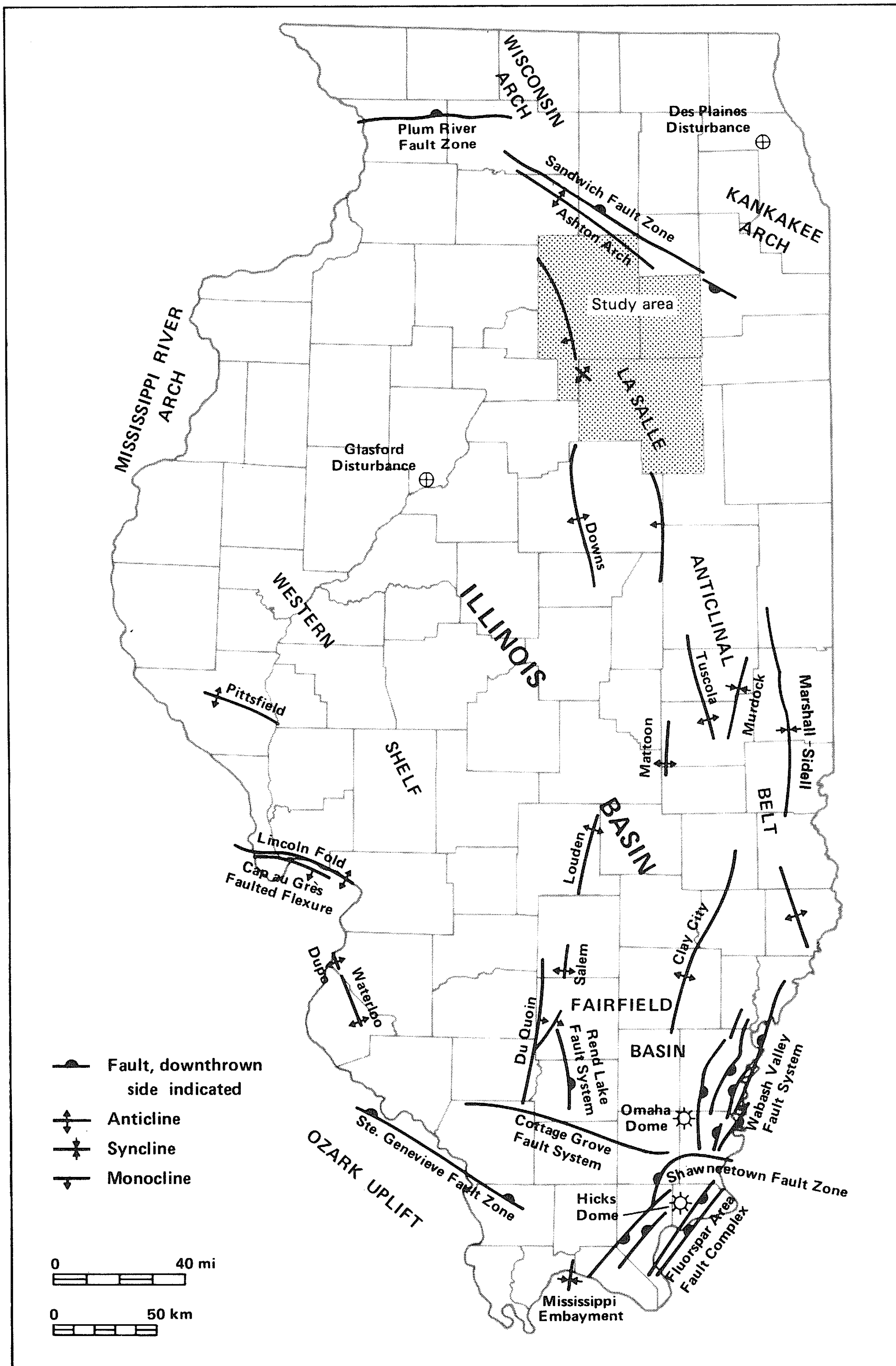


Figure 2

Principal geologic structures of Illinois (compiled by J. Treworgy, ISGS open file) and their relationship to the study area.

Estimated resources of 1,790 million tons of surface-minable coal, and 4,520 million tons of deep-minable coal were classified and mapped for the Colchester, Houchin Creek, Herrin, and Danville Coal Members in the three-county area (tables 1-10). Surface-minable coal resources as defined by Smith (1957) were tabulated according to average coal thicknesses at depths of 0 to 50, 50 to 100, and 100 to 150 feet (appendix B). The bottom limit for surface-minable resources was set at 18 inches. Resources of deep-minable coal as defined by Cady (1952) were tabulated according to average coal thickness; 28 inches was used as the lower limit of thickness (appendix C).

Plates 1–4 show the areal extent, thicknesses, mined-out areas, and 50-, 100-, and 150-foot overburden lines for

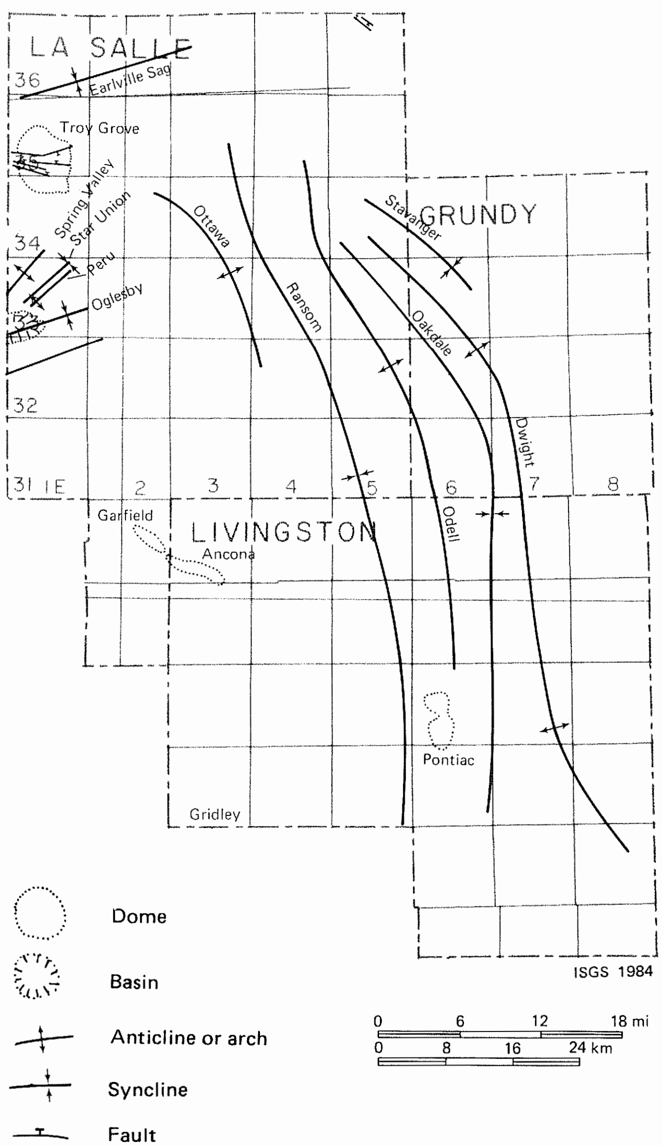


Figure 3
Named structural features in the study area (adapted from J. Treworgy, 1981).

the minable coals tabulated in this study. Cross sections (plates 5a–d) show the succession of coals and associated strata. Plate 6 shows the structure on the top of the Colchester (No. 2) Coal in the report area.

PREVIOUS INVESTIGATIONS

The first detailed reports about the geology and coal resources of the counties included in this report were written by Freeman (1868) on La Salle County and Bradley (1870) on Grundy County. Andros (1914) studied the coal mining practiced in the Longwall District. Cady (1915) described the coals of that region, including the northern half of this report area. Cady discussed the distribution and mining activity in each of the coals, and compiled estimates of the remaining resources in each county. Cady (1919), Culver (1923), and Willman and Payne (1942) detailed geology and mineral resources.

Cady (1937) summarized information about areas suitable for surface mining for parts of the area included in the present study. Cady et al. (1952) made estimates of minable coal for the entire state.

Smith (1968) made a detailed study of surface-minable coals in Bureau, Putnam, Marshall, La Salle, Livingston, Grundy, and Will Counties. Smith and Stall (1975) gave new resource estimates for the Herrin (No. 6) and Springfield (No. 5) Coals for the state. Their study covered both deep-minable and surface-minable coals, Treworgy et al. (1978) summarized the surface-minable resources of the state; Treworgy and Bargh (1982) used data from this study while it was in progress in their summary of the deep-minable resources of the state.

STRUCTURAL SETTING

The dominant geologic structure in this report is the La Salle Anticlinal Belt, composed of en echelon anticlines extending from La Salle County to the north through Lawrence County to the south (fig. 2). Many of the individual folds that make up the La Salle Anticlinal Belt in the report area are named and illustrated in figure 3.

Folding along the La Salle Anticlinal Belt began as early as Ordovician time, and continued through Mississippian time (Clegg, 1965). Near the end of the Mississippian, a period of strong uplift and erosion began. Minor folding resumed during the Pennsylvanian, culminating in another period of fairly strong tectonic activity in either late or post-Pennsylvanian time (Clegg, 1965; Siever, 1951). The evidence for Pennsylvanian tectonic activity along the La Salle Anticlinal Belt in the three-county area evaluated for this report is best seen in the thinning of Pennsylvanian strata, including coal, on anticlinal crests and domes and thickening in synclinal troughs and basins (plates 1 and 4). This relationship can be seen in the interval maps shown in figures 6, 8a, 9, 10, 12, and 13. Immediately to the south of the study area, Clegg (1972) reported a similar thickening and thinning of the Pennsylvanian strata crossing structures in De Witt, McLean, and Piatt Counties.

The subcrop and structure of the Colchester (No. 2) Coal are shown in plate 6. This structure map is based on available logs of holes drilled for coal, oil, and water that are on file at the Illinois State Geological Survey. Named and unnamed structures are shown in figure 3 and plate 6.

COAL GEOLOGY AND STRATIGRAPHY

All of the minable coals in Illinois are within the Pennsylvanian System of strata. Commercial coals in the study area are confined to the Carbondale Formation, except for localized coals in the underlying Spoon Formation. All coal resources identified and classified in this report are in the Carbondale Formation (Kewanee Group, Desmoinesian Series). A generalized geologic section of the Pennsylvanian strata in the report area is shown in figure 4. Only strata in the Carbondale Formation associated with the minable coals will be discussed in detail; the remainder of the section will receive only a short discussion.

The Pennsylvanian System of Illinois has been divided into three groups (in descending order): the McCormick, Kewanee, and McLeansboro. In the report area only the Kewanee and McLeansboro Groups are known to be present.

KEWANEE GROUP

Strata from the top of the Bernadotte Sandstone Member to the top of the Danville (No. 7) Coal are included in the Kewanee Group (Willman et al., 1975). In the study area the Kewanee Group unconformably overlies Canadian (lower Ordovician) to Silurian strata. This group is divided into two formations (in ascending order): the Spoon and Carbondale Formations.

Spoon Formation

Near the axis of the La Salle Anticlinal Belt, the Spoon Formation consists of a few feet of claystone that rest directly on the Ordovician St. Peter Sandstone. The Spoon Formation thickens to 100 feet locally to the west and east of the La Salle Anticlinal Belt. Willman and Payne (1942) reported thicknesses of Spoon Formation strata from 2 to 34 feet in eastern La Salle County and northwestern Grundy County. Culver (1923) measured strata of the Spoon Formation up to 200 feet thick in north-central and northeastern Grundy County. In this area sandstone, shale, claystone, and a few coals that attain minable thickness primarily compose the Spoon Formation.

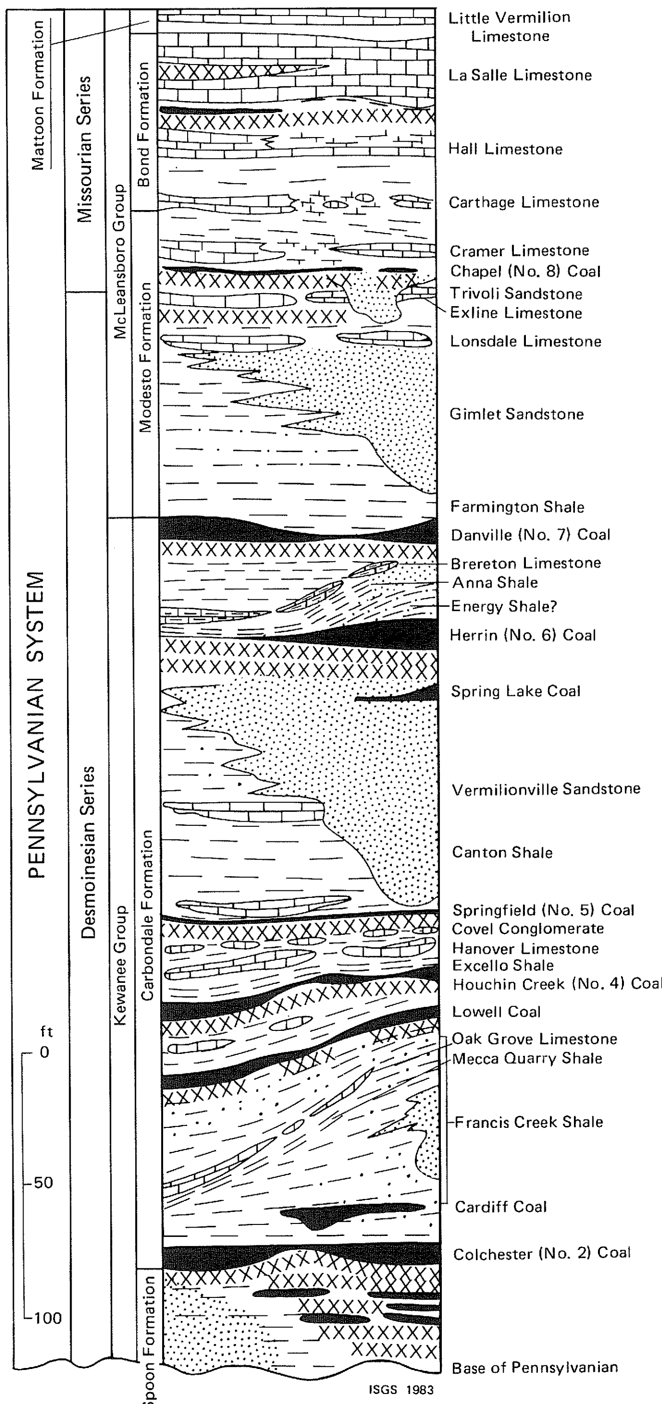


Figure 4
Generalized section of the Pennsylvanian System, showing the key members present in the study area.

Smith (1968) indicated that these lenses of thicker coal occur in northeast-southwest trending channel-like depressions. Bradley (1870, p. 210) reported the mining of one of these coals in the NW ¼ of Section 8, T. 33 N., R. 9 E., where the coal was 3 to 4 feet thick and separated from the sub-Pennsylvanian surface by a few feet of claystone. Culver (1923) reported surface mining in some of these minable coal lenses in Sections 10 and 11, T. 33 N., R. 8 E. Russel Peppers of the Illinois State Geological Survey (personal communication, 1983) used spores to identify coal that had been surface-mined in one of these channel-like depressions in Section 18, T. 33 N., R. 9 E., Will County, as equivalent to the Greenbrush Coal Member of west-central Illinois.

Carbondale Formation

The Carbondale Formation consists of strata from the base of the Colchester (No. 2) Coal to the top of the Danville (No. 7) Coal (fig. 4). Where the entire formation is present east of the La Salle Anticlinal Belt, it averages 200 feet in thickness. In most of the report area east of the belt, however, the upper part of the Carbondale has been removed by post-Pennsylvanian erosion. The formation includes the following coal members: Colchester (No. 2), Cardiff, Lowell, Houchin Creek (No. 4), Springfield (No. 5), Spring Lake, Herrin (No. 6), and Danville (No. 7) Coals. Four of these coals (Colchester, Houchin Creek, Herrin, and Danville) have significant resources; the rest are generally too thin or discontinuous to be mined.

Colchester (No. 2) Coal Member. The Colchester Coal is the most widely distributed coal in the report area. The Colchester Coal was the primary seam mined in northern Illinois, and was mined there more than in the remainder of the state. Throughout most of the area the Colchester Coal ranges from 2 to 3 feet in thickness (plate 1). Thickness patterns of the coal show an obvious relationship to geologic structures. In the synclinal troughs (fig. 3, plates 1 and 6) the Colchester reaches its greatest thickness (3 to 4 ft); however, on anticlinal crests it thins to 1 to 2 feet. This indicates that during deposition of the Colchester Coal the anticlinal crests were slightly higher topographically and the synclinal troughs were lower, wetter, and more favorable for peat accumulation. Peppers (1970) found significant variation in the flora of the Colchester Coal on the top of the Ancona and Garfield Domes (fig. 3). This variation was the result of a slightly higher elevation during the existence of the Colchester Coal swamp. These relationships indicate that tectonic uplift and subsidence might have occurred while the Colchester peat was being deposited or that the structures formed highs and lows topographically at the time of peat deposition.

Figure 5 illustrates the generalized depth of the Colchester Coal. The depth of the Colchester Coal ranges from about 150 feet in central La Salle County, the northeast half of Grundy County, and small areas of Livingston County, to more than 550 feet in south-central Livingston County, to more than 600 feet in southwestern La Salle County. Depths shown on the map are influenced by variations in topography, especially along the Illinois River and some major tributaries. However, a comparison of figure 5 with plate 6 shows that the main structural features of the La Salle Anticlinal Belt are also reflected in figure 5. The Colchester is considerably deeper in the synclinal troughs, where it ranges from 350 to 600 feet in depth. On the crests of anticlinal folds and domes the Colchester ranges from 300 feet to less than 150 feet in depth.

Areas of surface-minable Colchester are found in the northern quarter of the report area along the Illinois River in central La Salle County and in the northwestern and southeastern quarters of Grundy County (plate 1), where it averages 2 to 3 feet in thickness.

In the southern three-quarters of the area (plate 1) where the Colchester is greater than 150 feet in depth (i.e., where it is deep-minable) the thickness ranges from extremes of 1 foot on anticlinal crests to 4 feet in synclinal troughs. However, as with the surface-minable areas, the Colchester Coal generally ranges from 2 to 3 feet in thickness.

The Francis Creek Shale Member immediately overlies the Colchester Coal in most of the area (fig. 4). The Francis Creek Shale ranges from 0 to 40 feet in thickness in the western part of the report area, and reaches over 70 feet in thickness in the eastern part of Grundy County and in Livingston County (Smith, 1970). The Francis Creek Shale generally consists of a medium gray, silty shale. However, to the east where it is thickest, it consists of silty shale grading laterally and vertically to thinly bedded sheet sandstones and thicker, cross-bedded channel-fill sandstones. The Francis Creek Shale is overlain by a marine, black fissile shale (the Mecca Quarry Shale Member), which is in turn overlain by a marine limestone (the Oak Grove Limestone Member). The Oak Grove Limestone varies from a horizon of large septarian concretions to a more or less continuous single bed of argillaceous limestone or calcareous shale. These marine units are present in the western part of the report area where the Francis Creek Shale is 40 feet or less in thickness, and they directly overlie the coal where the Francis Creek is absent. They wedge out to the east where they are absent if the Francis Creek Shale is more than 40 feet thick (Baird, 1979).

Cardiff Coal Member. The Cardiff Coal is a local but thick coal that is known only in northeastern Livingston and southeastern Grundy Counties. The Cardiff fills linear channels that trend northeast to southwest (Cady, 1915; Smith, 1970). Locally the Cardiff Coal directly overlies the Colchester Coal, but elsewhere it may be separated

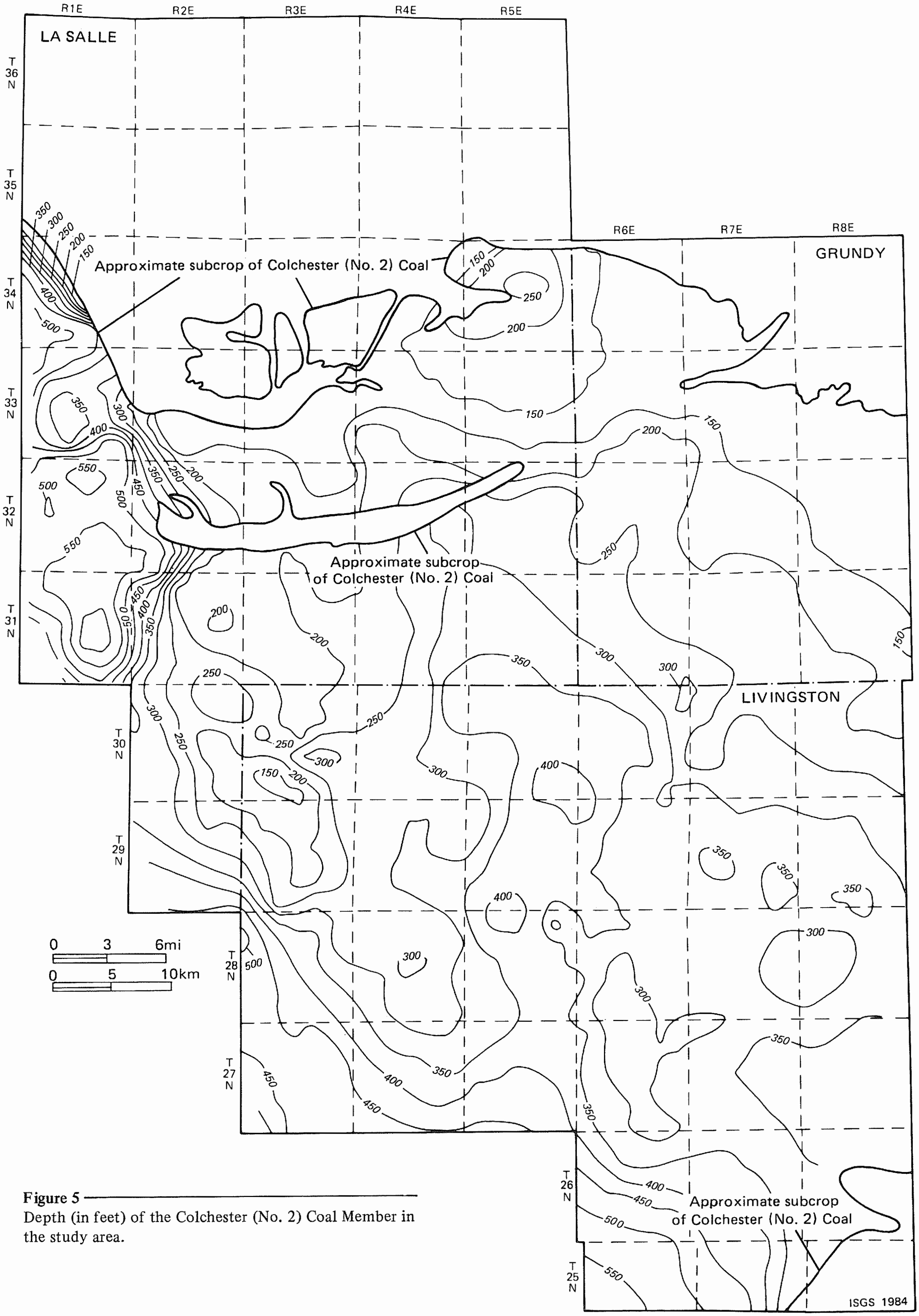


Figure 5
Depth (in feet) of the Colchester (No. 2) Coal Member in the study area.

from the Colchester by as much as 10 feet of an unnamed shale that is lithologically similar to the Francis Creek Shale. The Cardiff Coal ranges up to 12 feet in thickness and commonly is multibenched, the benches separated by gray shale. On the basis of palynological studies, Peppers (1970) concluded that the Cardiff Coal is slightly older than the Lowell Coal, but contains a similar flora that developed in abandoned channels or small depressions. In most of the known areas of occurrence, the Cardiff Coal has been mined out by deep and surface methods, but it has been found in cores scattered throughout the study area. Other small resources of this coal could probably be found in the future if drill holes were spaced closely enough to map the linear deposits.

Lowell Coal Member. The Lowell Coal occurs 25 to 50 feet above the Colchester Coal in the western two-thirds of the area where the Francis Creek Shale is less than 40 feet thick (fig. 6). In the eastern third of the area where the Francis Creek Shale exceeds 40 feet in thickness, the Lowell Coal or its horizon lies from 50 to more than 75 feet above the Colchester Coal. In general, where the Francis Creek Shale exceeds 50 feet in thickness, the Lowell Coal is mostly absent (Baird, 1979). However, locally the Lowell horizon or lenses of coal are present. The thickness of the Lowell Coal ranges from less than 1 inch to a little more than 2 feet. The Lowell Coal is too thin throughout most of the area to be considered a major deep-minable resource.

Houchin Creek (No. 4) Coal Member. The Houchin Creek (No. 4) Coal, formerly the Summum (No. 4) Coal (Jacobson et al., in press) is widespread throughout the study area. Its thickness is variable, ranging from a thin streak to about 4 feet (fig. 7).

The Houchin Creek Coal is very thin throughout most of the three-county area covered by this report. In scattered areas in La Salle and Livingston Counties, the coal is thicker and averages 2 feet in thickness (fig. 7). Two areas in Livingston County (T. 25 and 26 N., R. 6 E., and T. 27 N., R. 6 E.) have about 6 square miles of coal 3 feet in thickness, and in La Salle County three areas (T. 29 and 30 N., R. 2 E., and T. 31 N., R. 3 E.) have about 12 square miles of coal that is 3 feet in thickness. Finally, an area of coal ranging from 3 to 4 feet in thickness is found along a linear tract in central Grundy (north of Mazon) and northeastern Livingston County near Reddick (fig. 7, plate 2). The tract of 4-foot coal lies along approximately a 2-mile wide band running north-south along the eastern margins of T. 31 N., R. 8 E., Grundy County, and T. 30 N., R. 8 E., Livingston County.

The Houchin Creek Coal lies from slightly less than 50 feet to more than 100 feet above the Colchester Coal (fig. 8a). In general, the thicker interval seems to occur in synclinal troughs and, in the eastern part of the report area, where the Francis Creek Shale reaches its maximum thickness.

Figure 8b illustrates the generalized depth of the Houchin Creek Coal. In the three-county area the Houchin Creek Coal occurs at depths from less than 150 feet to more than 550 feet. The map in figure 8b shows the general structure of the Houchin Creek Coal as well as the major structural elements of the La Salle Anticlinal Belt. On the anticlinal crests the coal may be less than 150 feet in depth; in the synclinal troughs it reaches maximum depths of 550 feet or more.

Surface-minable resources lie in a swath from central Grundy to northeastern Livingston Counties and on top of the domes of the La Salle Anticlinal Belt in northwestern Livingston and south-central La Salle Counties (figs. 3 and 7, plate 2). The areas of thicker Houchin Creek Coal that average 3 feet in thickness in south-central and northwestern Livingston and south-central La Salle Counties are largely in the synclinal areas of the anticlinal belt (fig. 3, plate 6). These areas of deep-minable coal are marginal in thickness and size and are a resource of low development potential; therefore, no resources were calculated for these areas. A small portion of the 3- to 4-foot thick Houchin Creek Coal in T. 30 N., R. 8 E., Livingston County, is slightly more than 150 feet deep, and thus falls into the deep-minable category. However, that area is so small in comparison with the larger area of surface-minable coal to the immediate north that it can be considered only as a resource of low development potential. As a result, only surface-minable resources were estimated for the Houchin Creek Coal in the three-county study area.

Several feet of the Excello Shale Member, a dark gray to black shale that contains concretions of dense limestone, immediately overlies the Houchin Creek Coal. The remainder of the 10- to 15-foot interval between the Houchin Creek and overlying Springfield Coal consists of greenish shale, claystone, limestone, and limestone conglomerate. The Hanover Limestone Member immediately overlies the Excello Shale. It is a light brownish-gray limestone, often brecciated, and commonly occurs as nodules in a matrix of greenish claystone. The limestone conglomerate, the Covel Conglomerate Member, is quite distinctive and widespread over northern and western Illinois. It occurs a short distance below the Springfield (No. 5) Coal. The Covel Conglomerate is composed of rounded, dark gray to black phosphatic limestone pebbles and water-worn marine fossils in a matrix of sand-sized limestone clasts, silt, and clay (Willman et al., 1975). This unit is only 1 to 2 inches thick throughout most of the report area. The Hanover Limestone and the Covel Conglomerate were described in detail by Willman and Payne (1942).

Springfield (No. 5) Coal Member. In most of the report area the Springfield Coal is very thin or absent, but the horizon of the coal is marked by the distinctive overlying black, fissile shale that is present over the entire area. The Springfield Coal or its horizon lies 10 to 15 feet above the Houchin Creek Coal throughout much of this region. The persistent black shale is in turn overlain by the gray Canton Shale Member. The Canton Shale varies from a few feet in thickness where erosional channels filled with the Vermilionville Sandstone Member have cut into it to 75 feet in thickness where the Vermilionville Sandstone is thin or absent (Smith, 1968). Marine fossils are common in the basal part of the Canton Shale and the underlying black shale. In the report area the Springfield Coal lies from 75 to 125 feet above the Colchester (No. 2) Coal (fig. 9).

Spring Lake Coal Member. The Spring Lake Coal was mined near Streator in La Salle County (Willman and Payne, 1942). The Spring Lake Coal reaches a maximum thickness of 2½ feet and is from 11 to 17 feet below the Herrin (No. 6) Coal. The Spring Lake Coal appears to be localized and has not been recognized in many places outside of Streator, Illinois. Like the Cardiff Coal, the Spring Lake Coal probably represents an abandoned channel-fill deposit that thins rapidly away from its thickest occurrence. It is overlain by a fissile carbonaceous black to gray shale that contains freshwater fossils such as *Estheria* and *Leaia* (Willman et al., 1975). Willman and Payne (1942, p. 125-126) noted that much of the strata between the Herrin Coal and the Vermilionville Sandstone occurs only locally and appears to represent filling of abandoned channels.

Herrin (No. 6) Coal Member. The Herrin (No. 6) Coal is very thin or absent throughout most of the area covered by this report, but in a few places it attains considerable thickness (plate 3). The Herrin Coal ranges from less than 100 to 150 feet above the Colchester Coal on anticlinal ridges and domes and from 175 feet to more than 275 feet above it in synclinal troughs (fig. 10). Plate 3 shows four areas of thick Herrin Coal, ranging from 2½ to 9 feet in thickness. These areas are: 1) an outlier near Marseilles in T. 33 N., R. 5 E.; 2) western La Salle County (just west of the La Salle Anticlinal Belt); 3) 10 square miles near Verona in southwestern Grundy County; and 4) an area near Streator in south-central La Salle and northwestern Livingston Counties. Most of these areas of locally thick Herrin Coal appear to represent areas of thick peat accumulation in abandoned channels or depressions. However, one area may also be related to local structure. The largest area of thick Herrin Coal in western La Salle County is confined to the synclinal area related to the Granville Basin (plate 6). The thicker coal here may have accumulated while the syncline was actively subsiding.

Figure 11 illustrates the generalized depth of the Herrin Coal. The Herrin Coal extends to a maximum depth of more than 450 feet below the surface in southwestern La Salle County. Throughout most of the three-county area, however, the depth ranges from less than 150 feet to more than 300 feet. As in the depth maps for the other coals (figs 5, 8b, and 14), figure 11 illustrates the general structure of the coal. Along the Illinois River and its tributaries, the structure in these depth maps is influenced by large changes in topography. In figure 11 the major structural elements for the La Salle Anticlinal Belt are evident. On the anticlinal crests the Herrin Coal is quite shallow, ranging from depths of 200 feet to less than 150 feet below the surface; in the synclinal troughs the Herrin ranges from depths of 200 feet to more than 450 feet below the surface.

The strata immediately overlying the Herrin Coal in this area are quite variable. The coal is generally overlain by several feet of a hard, black fissile shale, the Anna Shale Member, that is in turn overlain by the Brereton Limestone Member. In the report area the Brereton Limestone is generally medium gray, argillaceous, dense, and fine-grained; it grades laterally and vertically into calcareous gray shale. In some parts of the region, the Brereton Limestone contains thin partings of shale that are irregularly interbedded with 1- to 3-inch beds of argillaceous nodular limestone; elsewhere it has a brecciated texture (Smith, 1968). It varies in thickness from a few inches to at least 4 feet. Locally, in south-central La Salle County near Streator, a silty, medium to dark bluish-gray shale up to 60 feet thick directly overlies the Herrin Coal (Willman and Payne, 1942; Smith, 1968). Near the top of this thick shale is a sandstone ranging from 3 to 20 feet in thickness. This sandstone interfingers with or grades laterally into shale in some places; in other places it fills channels cut into the shale. This gray shale is probably equivalent to the Energy Shale Member that is recognized in much of the southern two-thirds of the state. Usually coal beneath the Energy Shale has low to moderate sulfur values, but here the coal beneath this shale has the usual high values.

Danville (No. 7) Coal Member. The Danville Coal Member occurs 25 to 100 feet above the Herrin Coal (fig. 12) and 125 to 300 feet above the Colchester Coal (fig. 13). Like the Herrin Coal, the interval between the Danville and Colchester is greater in synclinal troughs (175 to 300 feet) than on anticlinal tops (125 to 200 feet).

The Danville Coal is from 2 to 5 feet thick throughout La Salle and Livingston Counties (plate 4). Like the Colchester and Herrin Coals, the Danville Coal thickens in synclines and thins on anticlines. The thickest Danville Coal occurs in or near the synclinal area in western La Salle County that is related to the Granville Basin and the

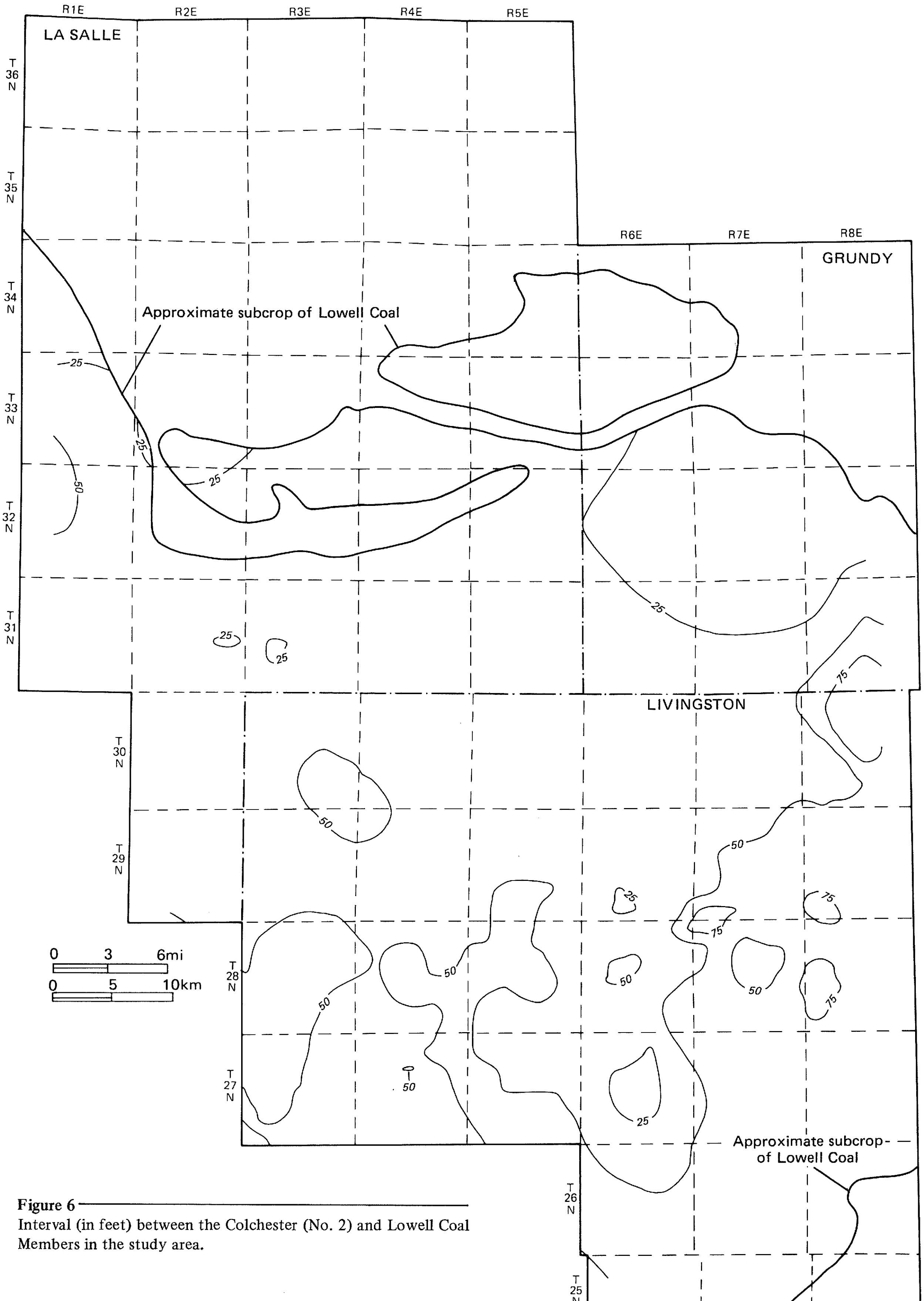


Figure 6
Interval (in feet) between the Colchester (No. 2) and Lowell Coal Members in the study area.

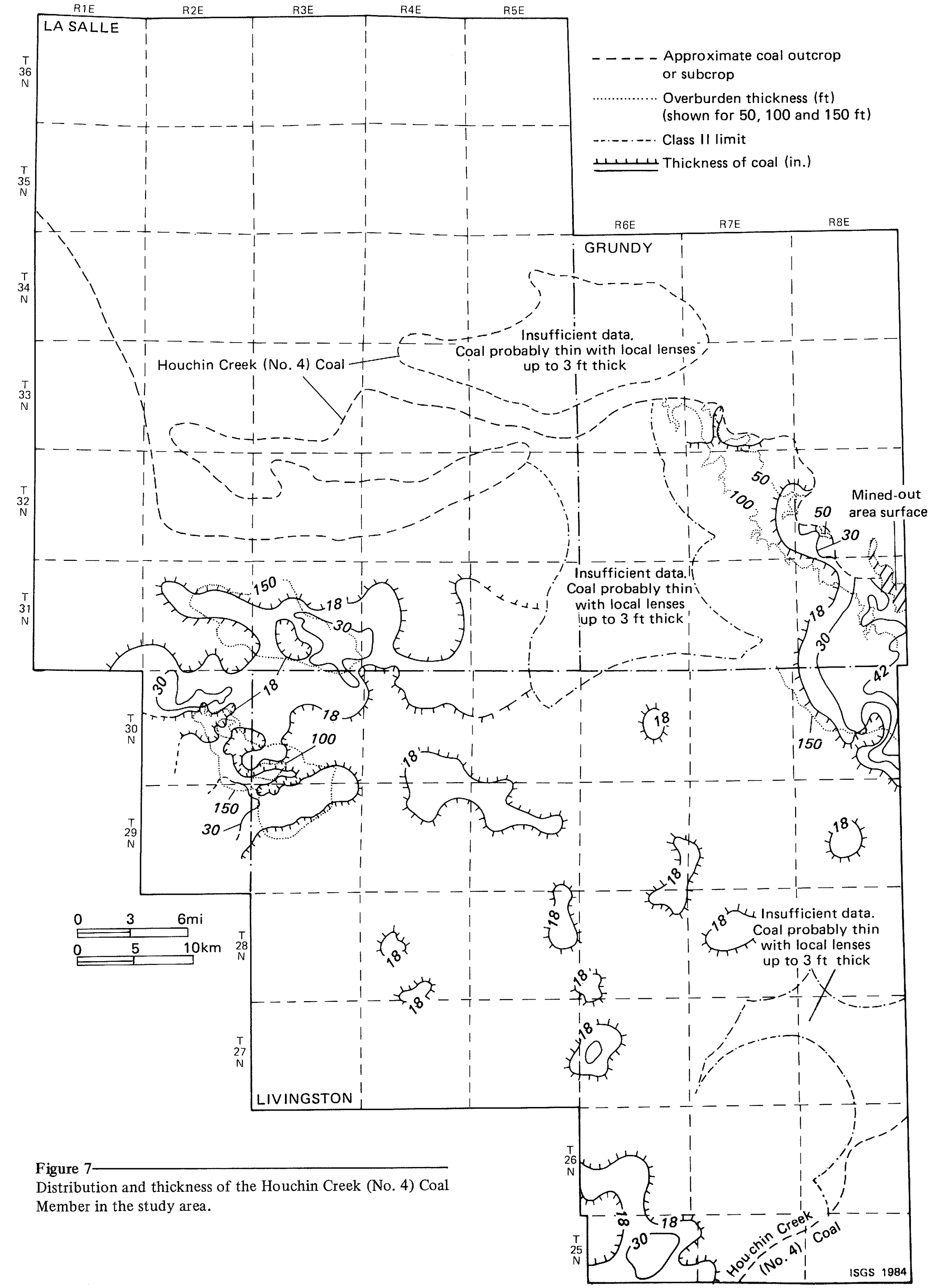


Figure 7—Distribution and thickness of the Houchin Creek (No. 4) Coal Member in the study area.

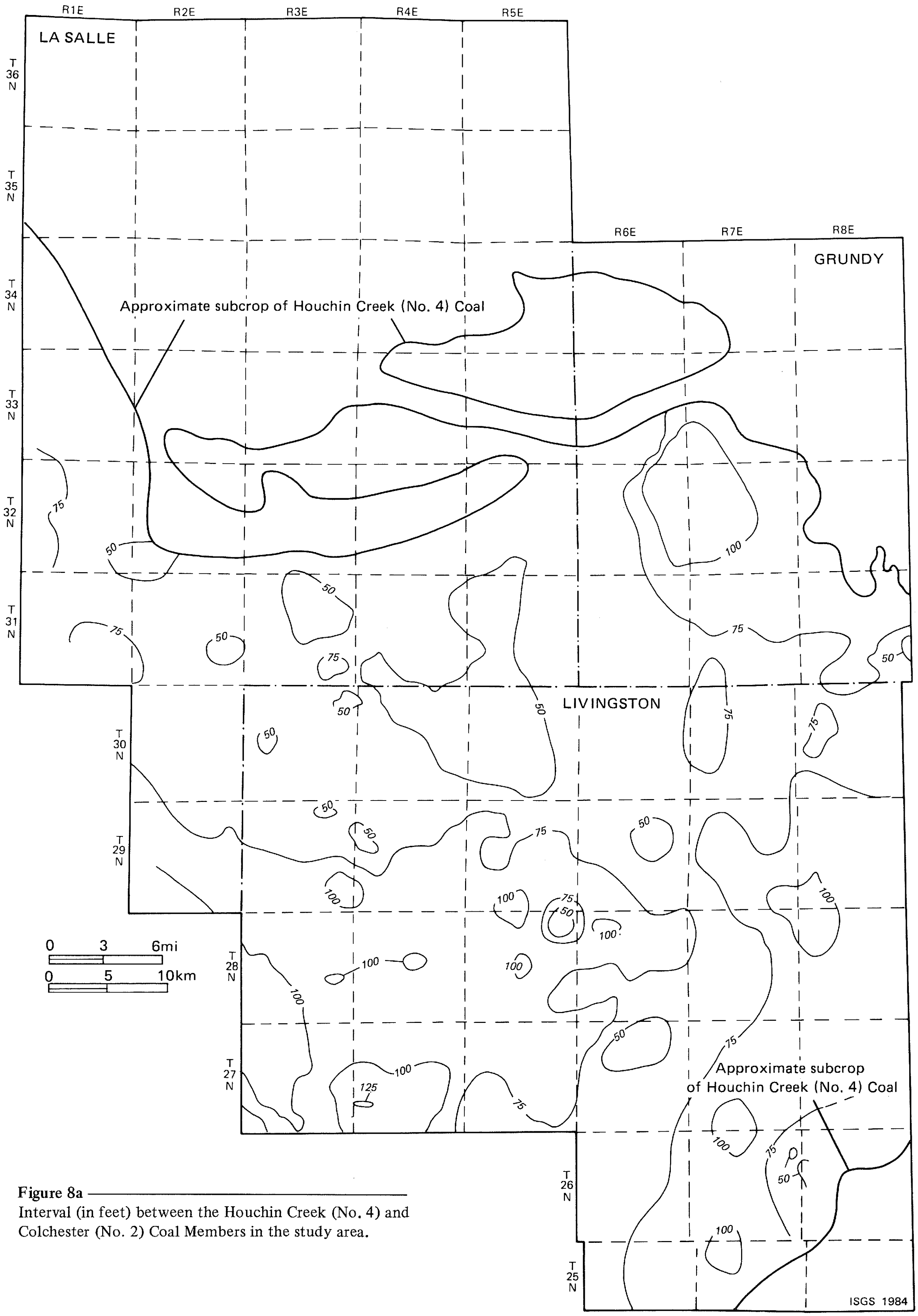


Figure 8a
Interval (in feet) between the Houchin Creek (No. 4) and Colchester (No. 2) Coal Members in the study area.

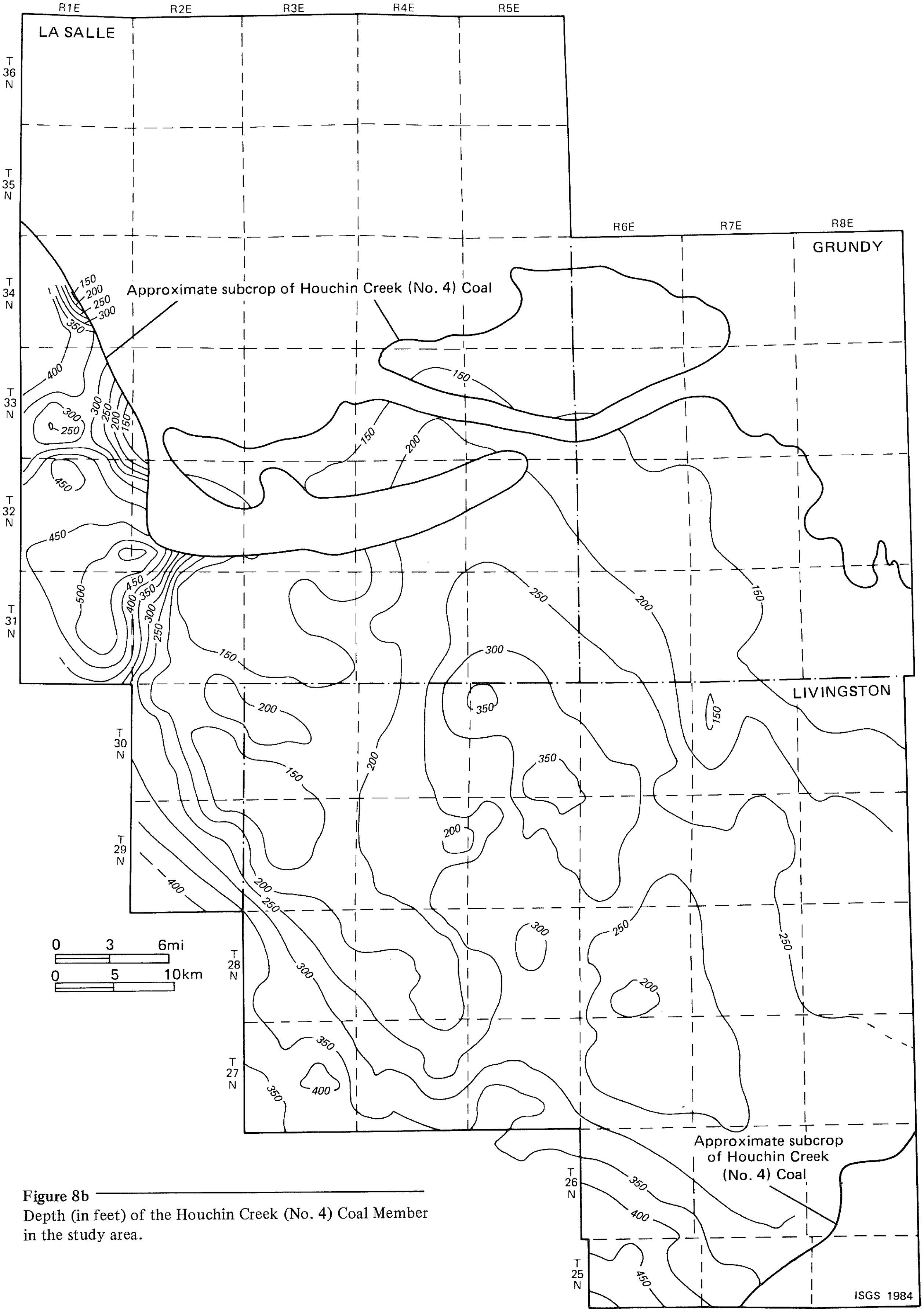


Figure 8b
Depth (in feet) of the Houchin Creek (No. 4) Coal Member in the study area.

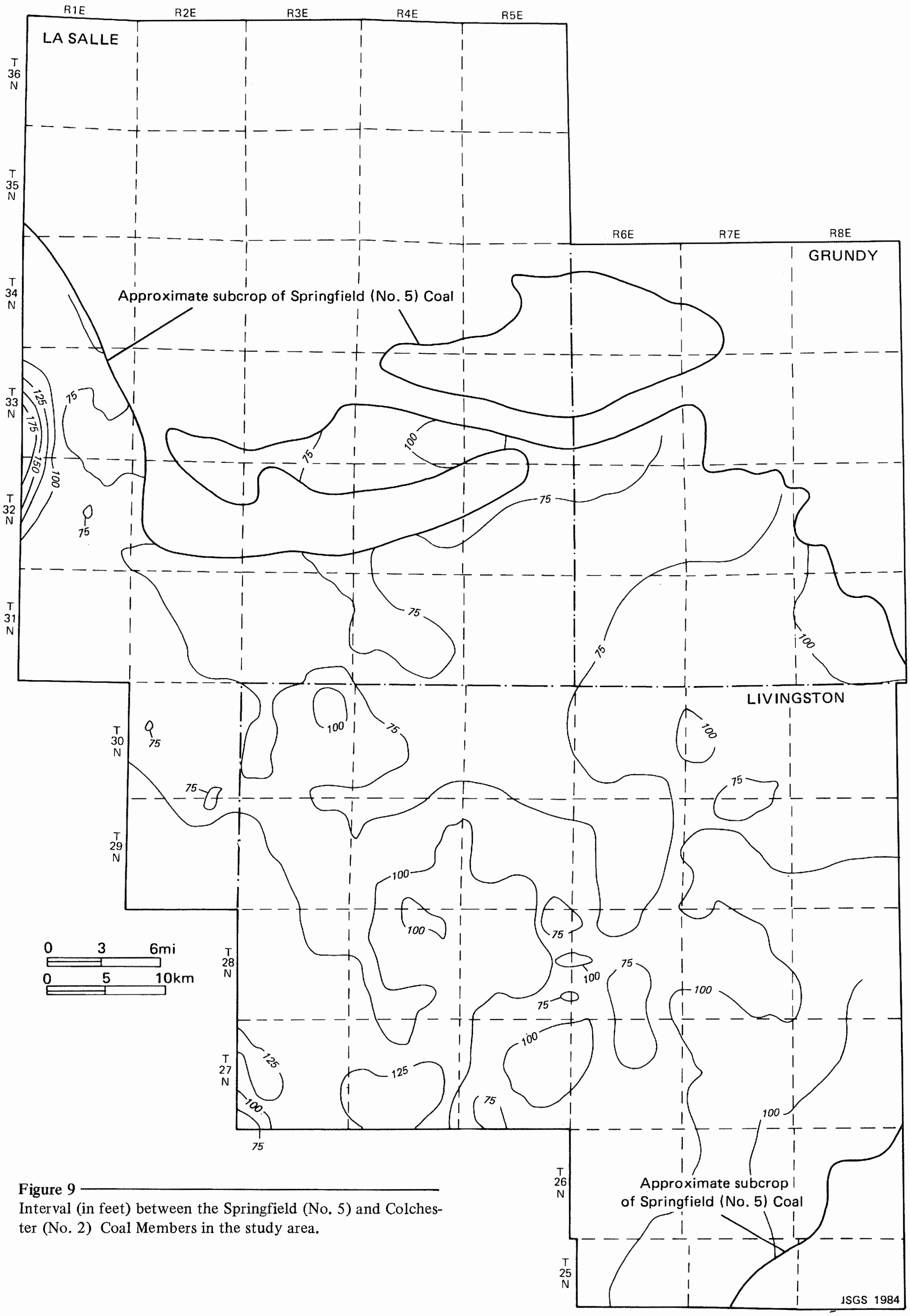


Figure 9
Interval (in feet) between the Springfield (No. 5) and Colchester (No. 2) Coal Members in the study area.

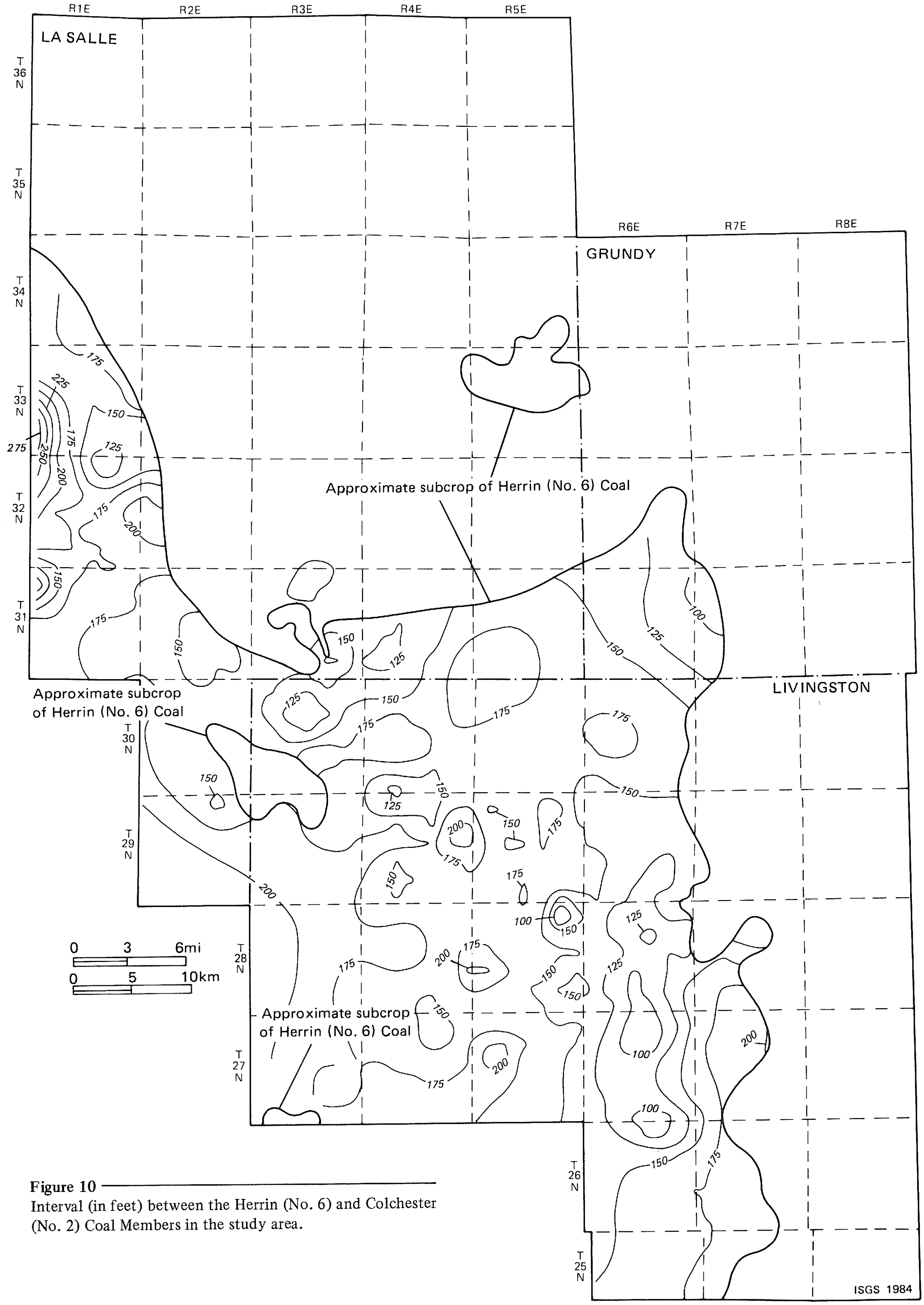


Figure 10
Interval (in feet) between the Herrin (No. 6) and Colchester (No. 2) Coal Members in the study area.

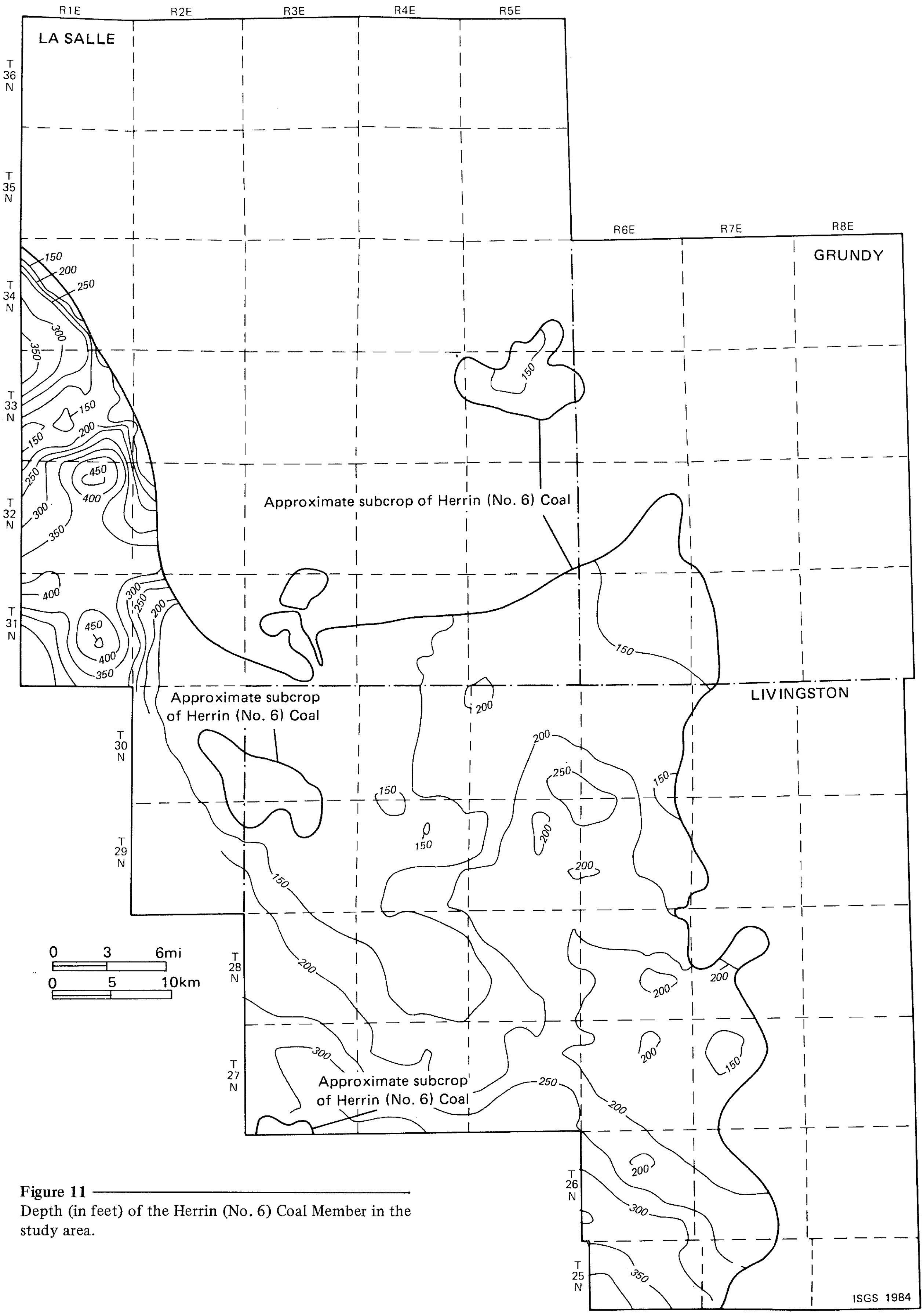


Figure 11
Depth (in feet) of the Herrin (No. 6) Coal Member in the study area.

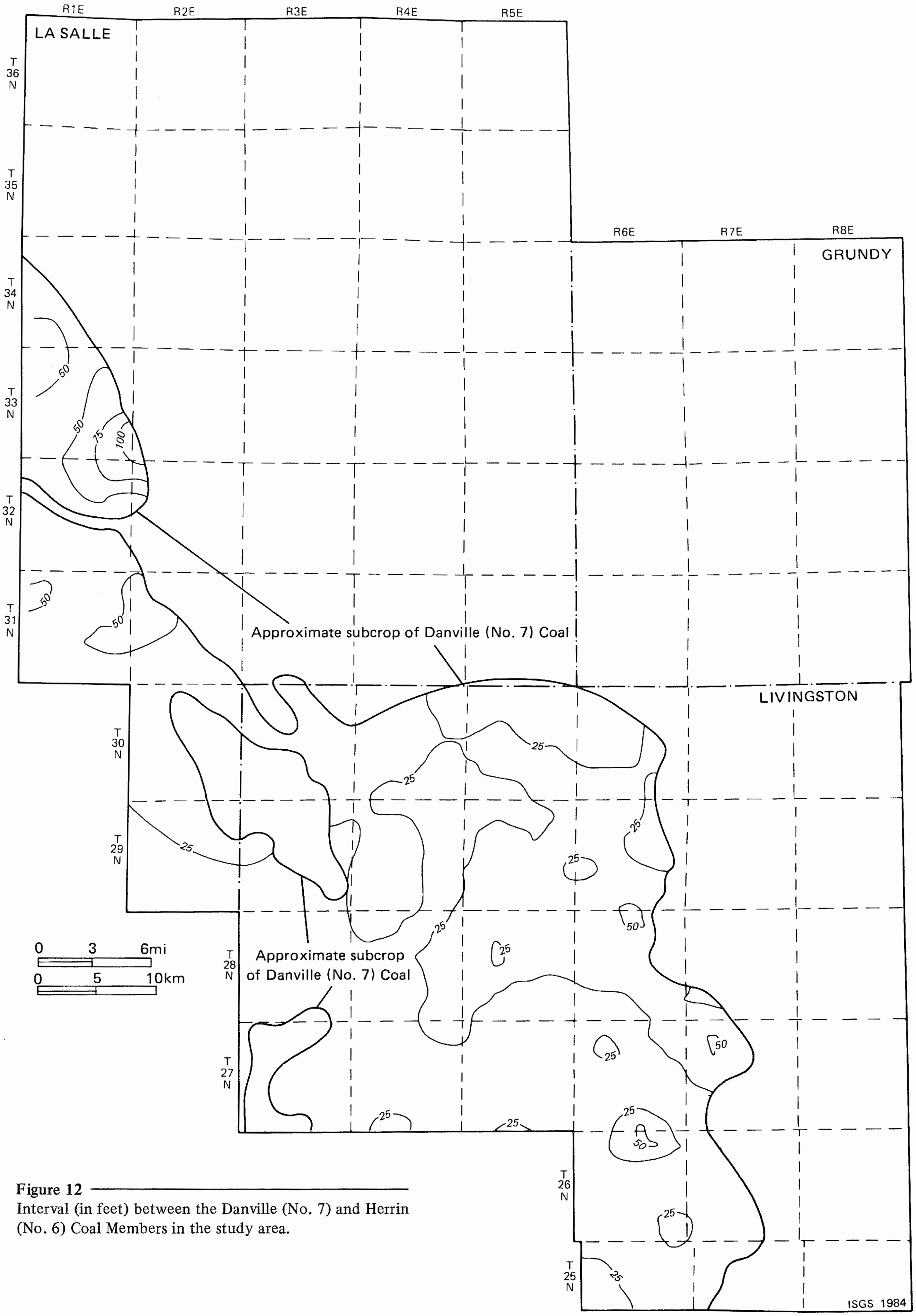


Figure 12
Interval (in feet) between the Danville (No. 7) and Herrin (No. 6) Coal Members in the study area.

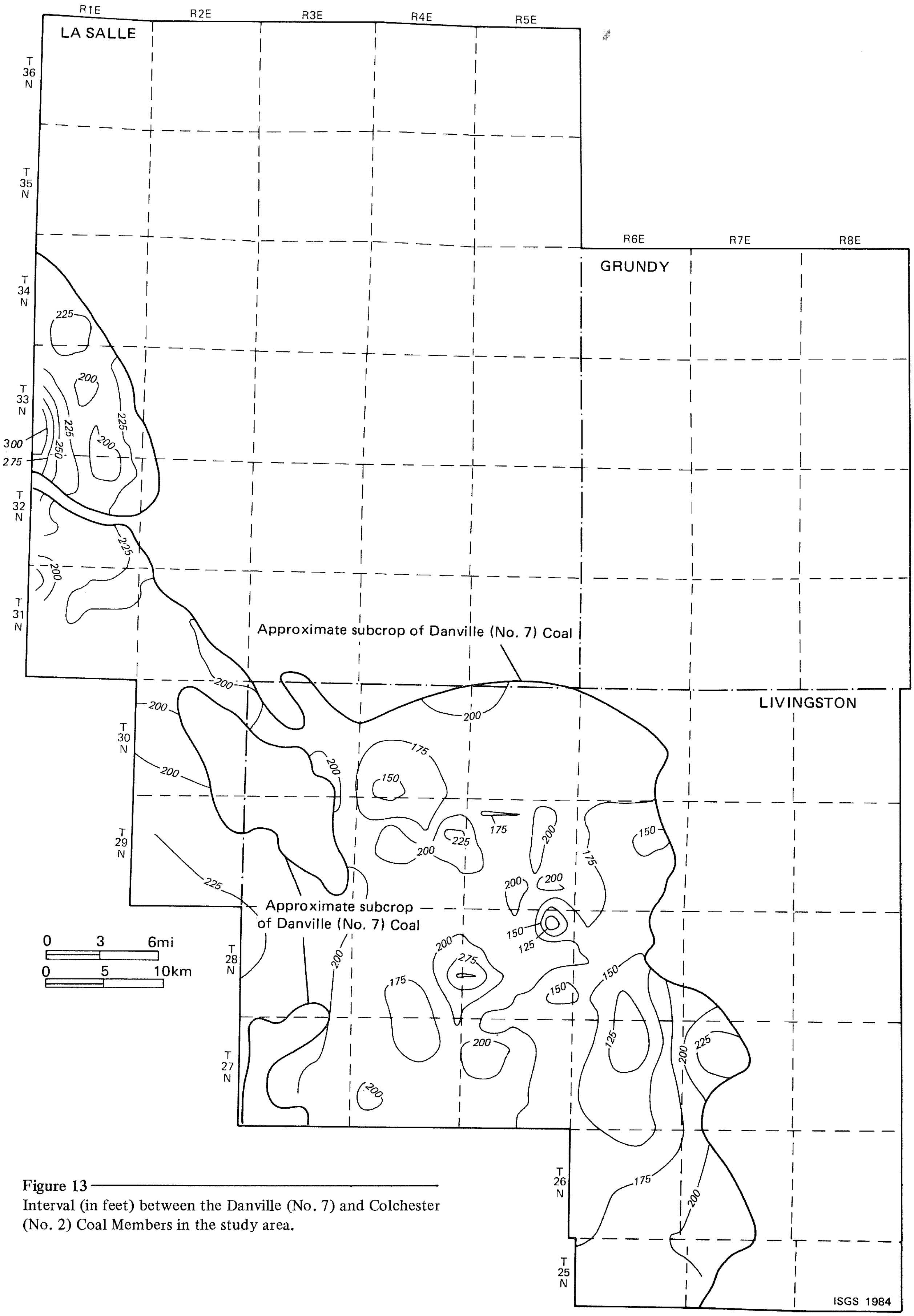


Figure 13
Interval (in feet) between the Danville (No. 7) and Colchester (No. 2) Coal Members in the study area.

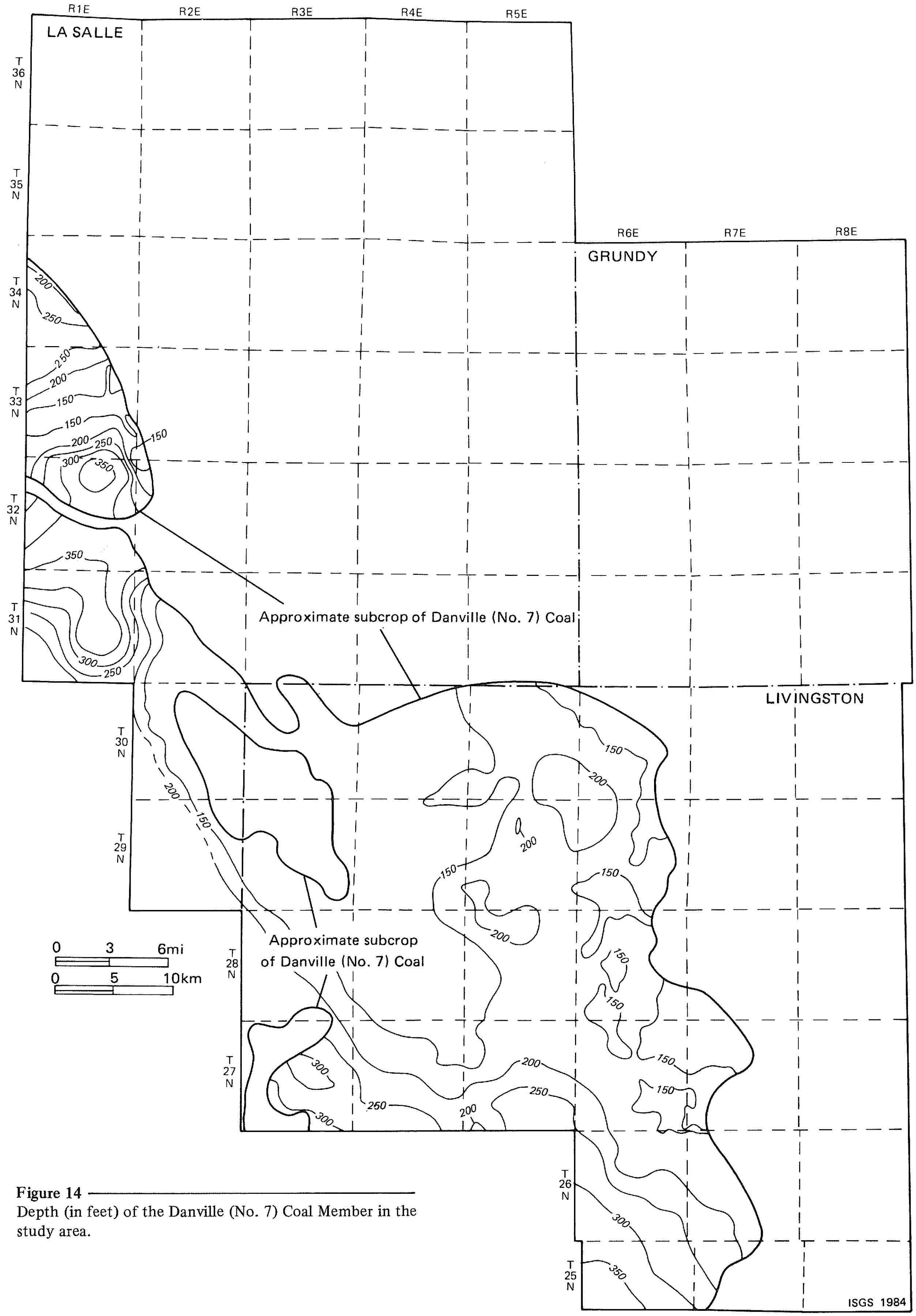


Figure 14
Depth (in feet) of the Danville (No. 7) Coal Member in the study area.

Ransom Syncline in central Livingston County (plates 4 and 6). In these areas the Danville Coal ranges from 3½ to 5 feet in thickness. However, on the tops of structures such as the Grindley Dome in southwest Livingston County, the Pontiac Dome in central Livingston County, the Ancona Dome in northwest Livingston County, and the Garfield Dome in northwest Livingston County and in extreme southern La Salle County, the Danville Coal ranges from 2 to 3 feet in thickness (fig. 3, plates 4 and 6).

Figure 14 illustrates the generalized depth of the Danville Coal. The Danville Coal reaches a maximum depth of more than 350 feet in southwestern La Salle County. Throughout most of the study area, this coal ranges from less than 150 to 300 feet below the surface. Figure 14 illustrates the major structural elements of the La Salle Anticlinal Belt. On the anticlinal crests the Danville Coal ranges from less than 150 feet to 200 feet in depth; in the synclinal troughs, from 200 feet to more than 300 feet below the surface.

Surface-minable coal is present along the Illinois River in west-central La Salle County, around the flanks of the Ancona and Garfield Domes and along the subcrop of the coal, which runs roughly north-south along a line just east of the centerline of Livingston County. Along the Illinois River in west-central La Salle County, the Danville Coal ranges from 3 to 5 feet in thickness; in the area around the flanks of the Ancona and Garfield Domes, it ranges from 2 to 4 feet in thickness. Along its croplines the Danville Coal is mostly 2 to 3 feet thick, except in parts of T. 27 and 28 N., R. 8 E., where it reaches 5 feet in thickness (plate 4). The Danville Coal was mined underground in both of the synclinal areas. Two small mines operated in the Danville Coal near Fairbury in south-central Livingston County, and five mines operated in this coal near La Salle along the Illinois River in west-central La Salle County.

Deep-minable coal is present in the remainder of the area shown in plate 4, where it ranges from 2 to 5 feet in thickness.

MCLEANSBORO GROUP

All Pennsylvanian strata in the report area above the top of the Danville Coal are included in the McLeansboro Group. The McLeansboro Group is divided into three formations: the Modesto, Bond, and Mattoon (fig. 4) (Willman et al., 1975). Strata of the Modesto, Bond, and basal Mattoon Formations are present in the synclinal area in western La Salle County that is related to the Granville Basin (plate 6) and the Ransom Syncline in central and south-central Livingston County (fig. 3, plate 6). In other parts of the area only strata of the lower part of the Modesto Formation are present.

Modesto Formation

The Modesto Formation includes all strata from the top of the Danville Coal Member to the base of the Carthage Limestone Member (formerly Shoal Creek Limestone Member; Jacobson et al., in press). In the report area the entire formation is present only in the structurally lower areas in western La Salle County and central to south-central Livingston County (fig. 3, plate 6). Here the Modesto Formation ranges from 150 to 200 feet thick. In the structurally higher areas, the Modesto Formation has been partly to completely removed by post-Pennsylvanian erosion. In the report area, the following members have been named (in ascending order): Farmington Shale, Gimlet Sandstone, Lonsdale Limestone, Exline Limestone, Trivoli Sandstone, Chapel (No. 8) Coal, and Cramer Limestone (fig. 4). Only the lowermost two members will be discussed because they have the most significance as roof strata for the Danville Coal.

Farmington Shale Member. The Farmington Shale directly overlies the Danville Coal in this area. This shale is gray to dark gray, although the lower foot of this shale can be dark gray to black. It is sometimes silty and contains abundant zones and layers of siderite concretions (Willman and Payne, 1942). The Farmington Shale can be absent or up to 50 feet in thickness. In mines near Fairbury the Farmington Shale and the Danville Coal were eroded and replaced by the Gimlet Sandstone.

Gimlet Sandstone Member. The Gimlet Sandstone is silty, somewhat clayey, gray to gray brown, fine-grained, and slightly calcareous in this region (Willman and Payne, 1942). It is commonly massive, sometimes cross-bedded, but locally it is thin-bedded. It rests unconformably on the underlying Farmington Shale, and occasionally fills channels that have cut most of the way down through the Farmington Shale. Notes on underground mines near Fairbury in south-central Livingston County indicate channels of the Gimlet Sandstone that even cut out part of the Danville Coal.

Bond Formation

The Bond Formation in the report area includes all the strata from the base of the Carthage Limestone to the top of the La Salle Limestone Member. Like the upper part of the Modesto Formation, the Bond Formation is only present in the structurally lower areas, such as the synclinal trough in western La Salle County and in central and south-central Livingston County.

Only three members have been formally named in the report area. They are the Carthage, Hall, and La Salle Limestone Members (Jacobson et al., in press; Jacobson, 1983; Willman et al., 1975). The remainder of the formation consists of red and gray claystones and shales, as well as thin coals and black shales that occur beneath the limestones. The Bond Formation ranges from about 60 to 120 feet in thickness throughout the report area (Kosanke et al., 1960; Jacobson, 1983).

Mattoon Formation

The Mattoon Formation is also restricted to the area in the structurally lower synclines in western La Salle and central and south-central Livingston Counties. In the report area the only unit that has been named in this formation is the Little Vermilion Limestone Member, which lies about 25 feet above the La Salle Limestone (Kosanke et al., 1960; Jacobson, 1983).

PREVIOUS MINING

In much of the northern part of the Illinois Basin Coal Field, including the report area, extensive longwall mining of the Colchester (No. 2) Coal occurred from the late 1800s until around 1915; the sites of many of these mines are still marked by conical refuse piles. The form of longwall mining used then is different from our modern, fully mechanized longwall methods. In the old method, sometimes called "long face" mining, the mine resembled a wheel with the shaft at the hub and the haulage entries radiating outward like spokes (Andros, 1914; Cady, 1915). Mining of coal occurred at the "wheel" rim and expanded outward. As coal was removed, the roof was supported by wooden props and by walls constructed of waste rock. Most of the mining was by hand, but in later years cutting machines and power drills were introduced.

The Herrin (No. 6) Coal was mined almost exclusively by underground methods. Some of these mines were the longwall type; others were the room and pillar type. Most of the mining in the Herrin Coal occurred in the La Salle-Peru area along the Illinois River and around Streator, both in La Salle County (plate 3). Some mining in the Herrin also occurred in the outlier near Marseilles in T. 33 N., R. 5 E., La Salle County, and near Verona in southwestern Grundy County. The Danville (No. 7) Coal was removed exclusively by underground methods, mainly by room and pillar. However, this mining was not widespread and much of the Danville coal remains unmined (plate 4). Small underground mines in the Danville are found along the Illinois River near La Salle and Peru in La Salle County, and near Pontiac in central Livingston County and Fairbury in south-central Livingston County.

Deep coal mining in the area declined greatly after 1915 because access by rail caused the much thicker coals of southern Illinois to be more attractive economically to customers. Surface mining of the Colchester Coal began on a large scale after the 1920s because its low to moderate sulfur values and nearness to customers in Chicago enabled it to compete with coal from southern Illinois. Surface mining of the Colchester continued as long as the companies operating in the area could undersell the competition. The last large surface mine in the area, Peabody Northern, closed in 1974. Since that time, no active mining occurred in the report area.

Surface mining focused on the Colchester (No. 2) Coal in Grundy County and along the Illinois River in La Salle County (plate 1). The Houchin Creek (No. 4) Coal in southeastern Grundy County (plate 2) was also surface mined. A small amount of surface mining of the Herrin (No. 6) Coal occurred around Streator in south-central La Salle and northwestern Livingston Counties (plate 3). Several small surface mines operated in the Danville (No. 7) Coal along the Vermilion River in northwestern Livingston County (plate 4).

No mines are currently active in the report area, and no plans have been announced to open any. However, several coal companies have drilled exploratory holes within the three counties in recent years.

Roof problems

Colchester (No. 2) Coal. The Colchester Coal in the east half of La Salle County, the northeast third of Livingston County, and all of Grundy County is overlain by gray Francis Creek Shale. In the report area roll-type structures (fig. 15) as well as small normal faults, which appear to be non-tectonic in origin, are common in this shale (fig. 16).

Roof problems were not commonly reported in many of the field notes for the Colchester Coal in this area because mining primarily incorporated the longwall method. Therefore, except in permanent entries and haulage roads, roof stability was not considered because the roof was supported by waste rock and wooden props after mining, and fewer problems probably occurred.

The primary problems with gray-shale roof type were related to weakened roof associated with rolls, compactional faults, other small faults, and shallowness (figs. 15 and 16). Any future mining in the gray-shale roof (Damberger et al., 1980) area of the Colchester Coal would likely use a mechanized longwall method because the seam is so thin. The structural irregularities in permanent entries and haulage roads could cause roof instability if the roofs are not supported promptly after coal removal.

The unpublished mine notes for the Colchester in the west half of La Salle County and southwestern two-thirds of Livingston County describe two types of roof transitional from gray shale to black shale-limestone: a thick wedge

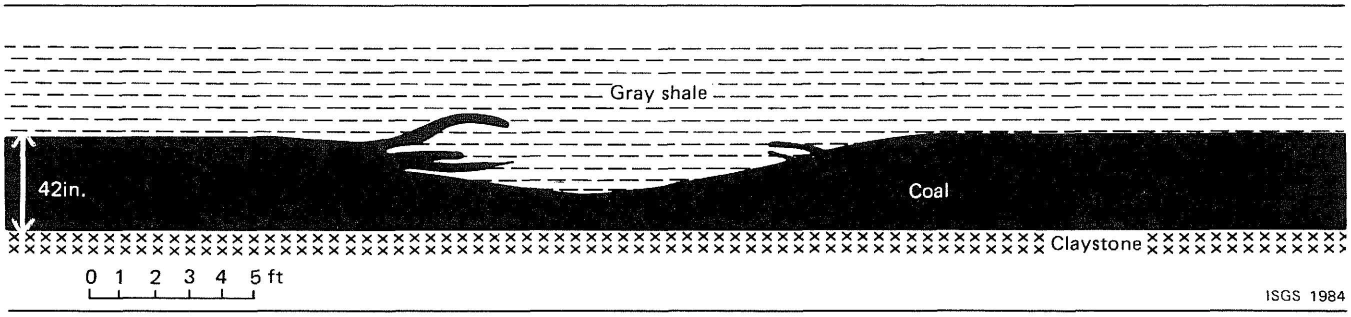


Figure 15
Roll in Colchester (No. 2) Coal Member on east wall of first room south of west gangway. James Bell Mine, Section 28, T. 34N, R. 7E, Grundy County (H. E. Culver, unpublished ISGS mine notes).

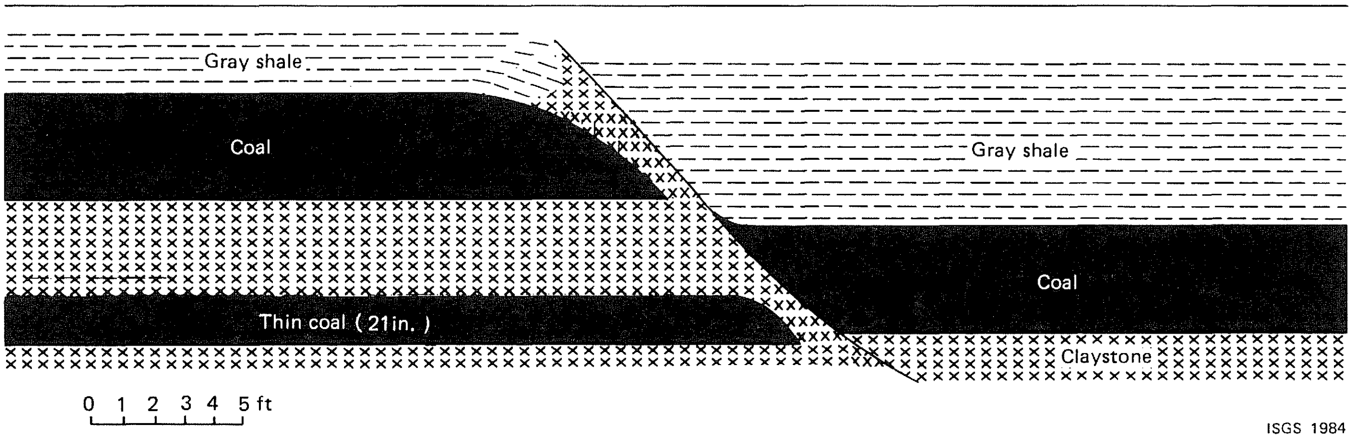


Figure 16
Fault in Colchester (No. 2) Coal Member. Face of southwest entry, 3,000 feet from shaft. Chicago, Wilmington, and Vermilion No. 1 and No. 2 Mines, Sections 11-14, T. 31 N, R. 8E, Grundy County (K. D. White, unpublished ISGS mine notes).

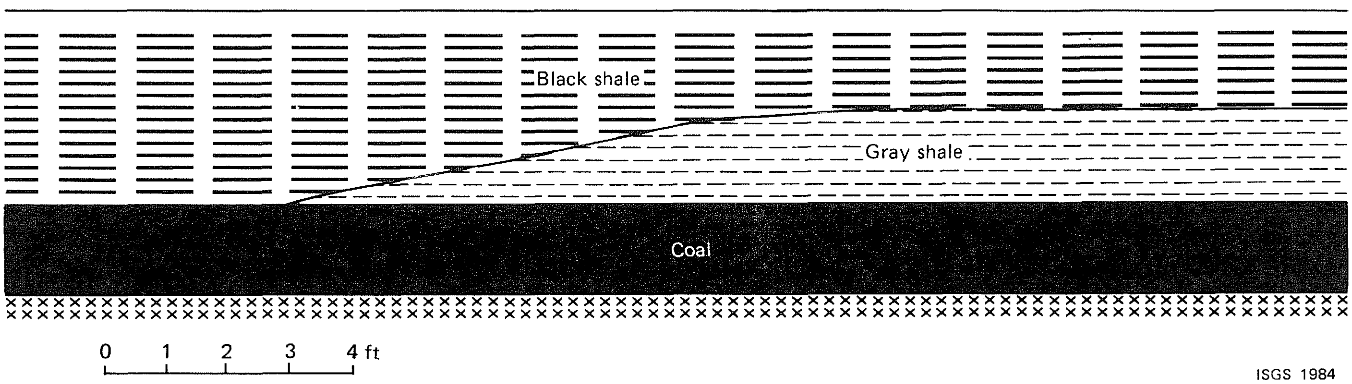


Figure 17
Transitional roof over Colchester (No. 2) Coal Member. Carbon Coal Co., Mine No. 1, Section 15, T. 33N, R. 1E, La Salle County (K. D. White, unpublished ISGS mine notes).

of gray shale overlain by black shale and pods of gray shale overlain by the black shale (figs. 17 and 18). However, information is not detailed enough to delineate the type in specific areas. Similar transitional types of roof overlying the Herrin Coal were identified by Damberger et al. (1980) and Krausse et al. (1979). Rolls having compactional faults (fig. 18) and clay dikes and small faults (fig. 19) are common in the transitional roof of the Colchester Coal. A few faults, probably tectonic, might be associated with structural features of the La Salle Anticlinal Belt. They are primarily low-angle thrust faults (fig. 20). Displacement is commonly 1 to 3 feet.

In this area rolls and compactional faults led to unstable roof conditions in the permanent entries and haulways of the longwall mines. Serious roof instability also occurred in association with small thrust faults in this transitional-roof area. Instability might also have been related partly to the transitional gray-shale wedges and pods.

In transitional areas the Oak Grove Limestone, which overlies the black, fissile Mecca Quarry Shale, is not generally solid like the Brereton Limestone that was studied in the transitional areas by Damberger et al. (1982). As noted earlier, the Oak Grove Limestone ranges from septarian concretions to lenses to a semi-continuous, very argillaceous limestone that locally grades to a calcareous shale. Thus, the absence of a solid limestone and the previously mentioned problems lead to the tentative conclusion that roof control in the transitional-type roof areas of the Colchester Coal would be difficult.

Herrin (No. 6) Coal. Two types of roof are found over the Herrin Coal in the report area. The first is the wedge-type transitional roof, which is present over the thick coal areas near Streator in south-central La Salle County and northwestern Livingston County, and near Verona in southwestern Grundy County. Gray shale up to 60 feet thick near Streator was shown to wedge out rapidly to the

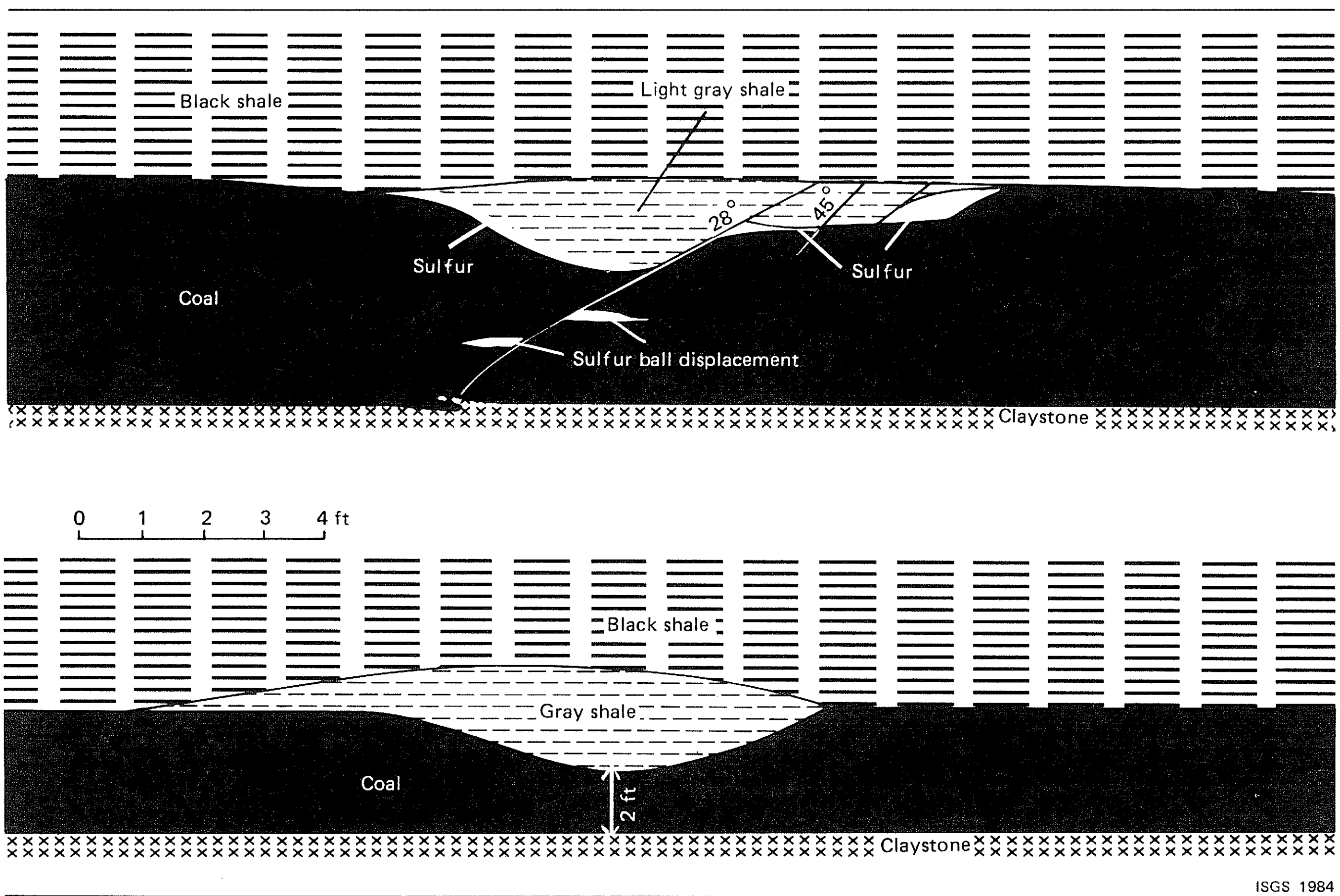
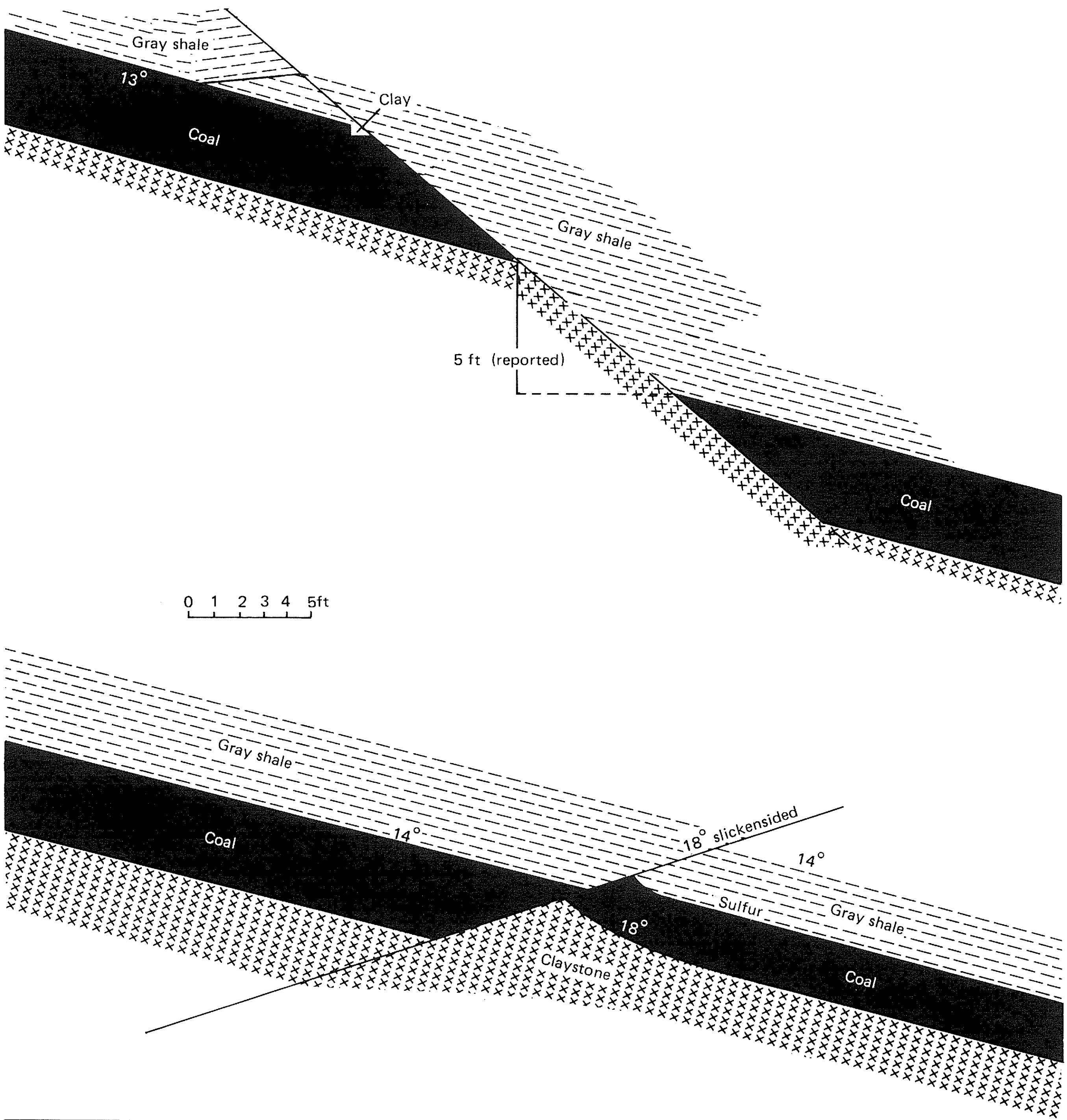


Figure 18
Rolls in transitional roof over Colchester (No. 2) Coal Member: a) roll in thicker wedge type, compactional faults; b) roll in pod type with no compactional faults observed. Carbon Coal Company Mine No. 1, Section 15, T. 33N, R. 1E, La Salle County (K. D. White, unpublished ISGS mine notes).

northwest along a section made by Willman and Payne (1942).

Rolls with compactional faults, clay dikes, and small normal faults were fairly common in the mines around Streator (fig. 21); however, too little bedrock over the coal caused most of the problems in this area. In many mines glacial drift was close to the coal or even in channels cut into the top of the Herrin Coal. Roof instability in such unconsolidated materials and water in the mines were common. In the area around Streator and near Verona, most of the Herrin Coal is less than 150 feet deep and now is considered



ISGS 1984

Figure 19
Low-angle normal faults, probably not of tectonic origin, in the Colchester (No. 2) Coal Member. Illinois Zinc Company, Black Hollow Mine, Section 30, T. 33N, R. 2E, La Salle County (K. D. White, unpublished ISGS mine notes).

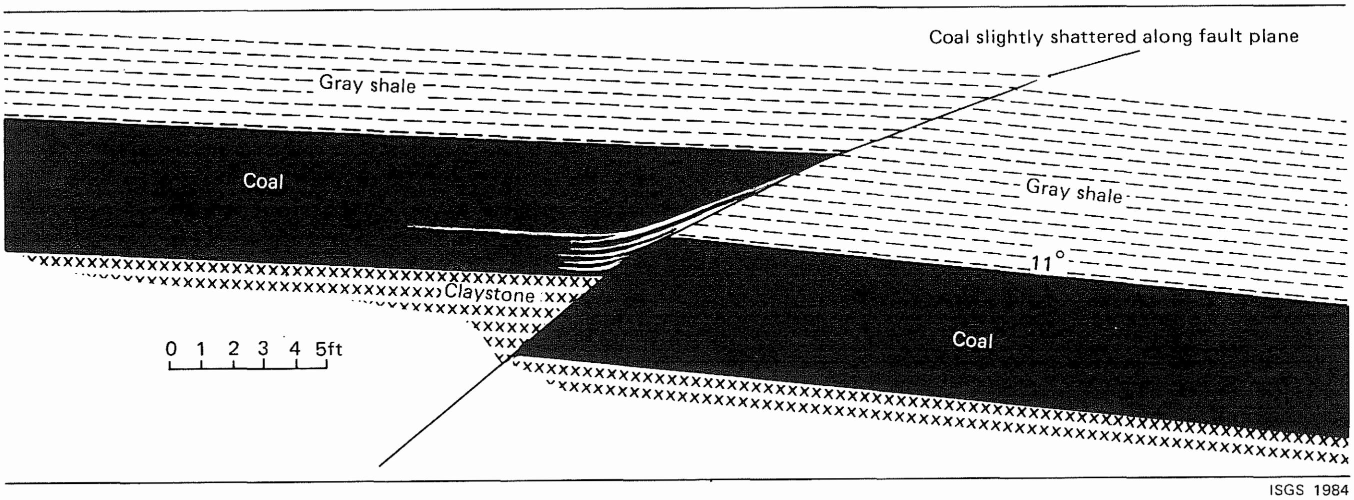


Figure 20
Low-angle thrust fault, possibly of tectonic origin, in the Colchester (No. 2) Coal Member. Roof fell in irregular layers along horizontal slickensides. Oglesby Coal Company, Mine No. 44, Section 25, T. 33N, R. 1E, La Salle County (K. D. White, unpublished ISGS mine notes).

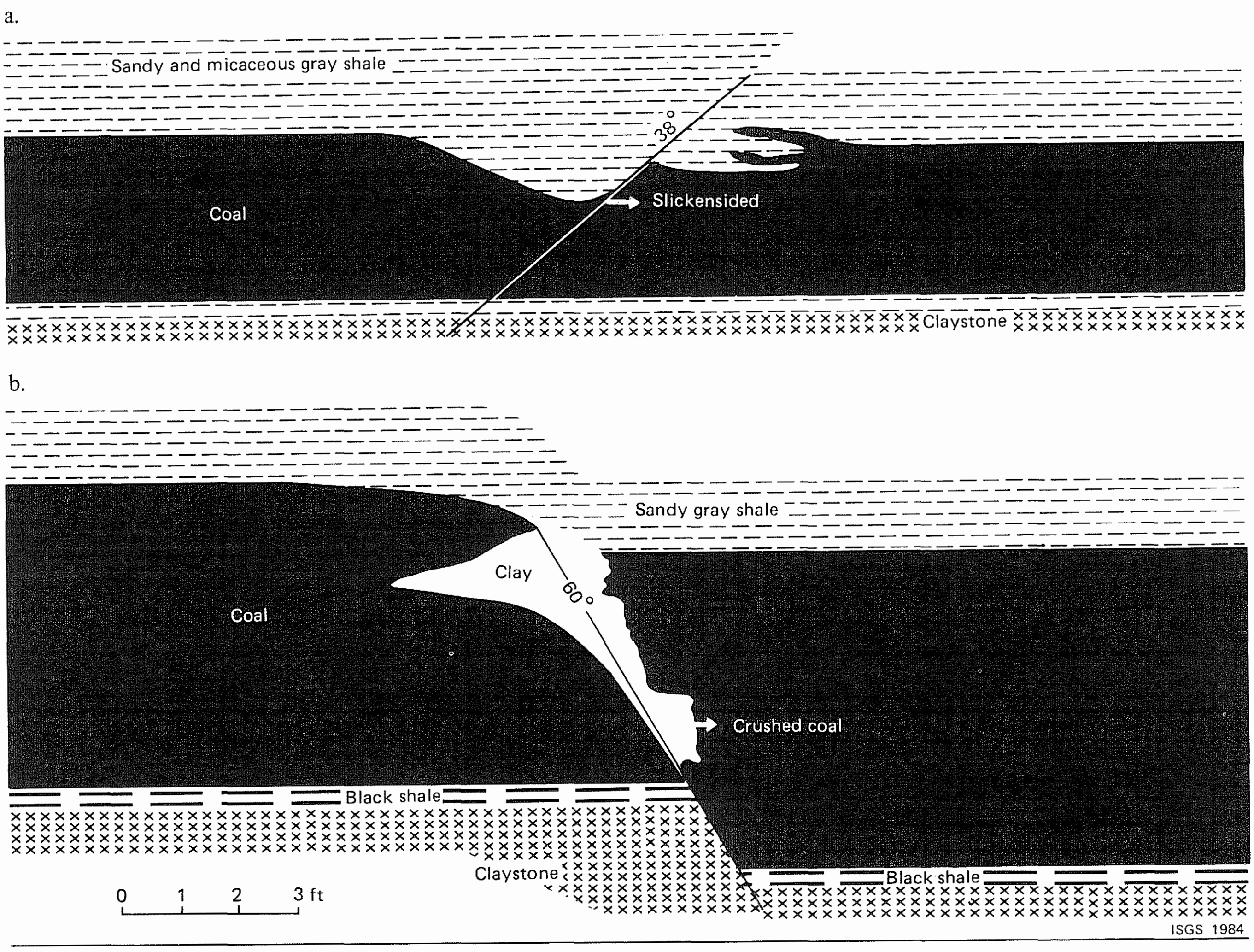


Figure 21
a) Roll with compactional fault; b) clay dike-type fault with wedge-type transitional roof in the Herrin (No. 6) Coal Member. Chicago, Wilmington, and Vermilion Coal Company Mine No. 3, Section 24, T. 31N, R. 3E, La Salle County (K. D. White, unpublished ISGS mine notes).

surface-minable. However, in deeper areas problems due to rolls, clay dikes, and clay-dike faults would be possible.

In the remainder of the report area, the Herrin Coal appears to be overlain by black shale or limestone. Numerous clay dikes and small normal faults were reported in mine notes (fig. 22). The Brereton Limestone, which overlies the black, fissile Anna Shale, is thin and lenticular and quite variable in lithology. Locally, it consists of nodular limestone in shale, and in some areas has a brecciated texture (Smith, 1968). The black Anna Shale may be overlain by a mottled gray shale, which in turn is overlain by the Brereton Limestone. No problems were noted in mines that had this type of roof. However, poor development of the Brereton Limestone, local abundance of clay dikes and faults, and the mottling of the upper part of the Anna Shale tend to weaken the roof.

In some mines of the report area, "white top" occurs. White top consists of light-colored sandstone, sandy shale, and clay in structurally disturbed areas of otherwise normal gray-shale and black-shale roofs. It is fragmental in texture, and the sandstone, sandy shale, or clay are intermixed with pieces of coal and normal roof rock. The white top may penetrate far into the coal. Damberger (1970, p. 115) reported that the top layers of the seam are most heavily disturbed, and that a layer of light gray to white clay up to 3 feet thick containing irregularly intermixed coal fragments is often found. Farther into the coal the clay decreases. Coal under such roof contains abundant irregular cracks filled with the same clay. The roof in such areas is unstable. Numerous clay dikes in the coal are often associated with the white top. White top apparently is present primarily along the margins of areas of thick coal. Further study is needed, however, for us to understand the nature and distribution of white top.

Danville (No. 7) Coal. The roof of the Danville Coal in the report area consists entirely of a very fine-grained, gray shale known as the Farmington Shale. Some apparent rolls were reported, but not illustrated in the mine notes, so it is not certain whether they were true rolls. The shale is up to 50 feet thick and is unconformably overlain by a sandstone (the Gimlet Sandstone) that cuts into the coal in places. The gray-shale roof in mines in south-central Livingston County and north-central McLean County proved very unstable. It slaked easily, large roof falls were common after exposure to humidity changes, and the sandstone contained water that seeped into the mines. However, in central Livingston County near Pontiac two mines in the Danville Coal did not have problems with the roof other than some initial slaking. After exposure to air the shale was said to "harden up" and made excellent roof. Thus, the Farmington Shale appears to vary in stability. Strength and slaking properties of the shale should be tested before mining the Danville Coal.

Overburden problems

Hopkins et al. (1979) reported that where the unconsolidated material in the overburden is thicker than the bedrock, the probability of roof instability is increased. In addition, water from aquifers in thick, unconsolidated overburden can seep into a mine through fractures in the roof. Hopkins et al. also noted that when the thickness of the unconsolidated overburden equaled the consolidated overburden

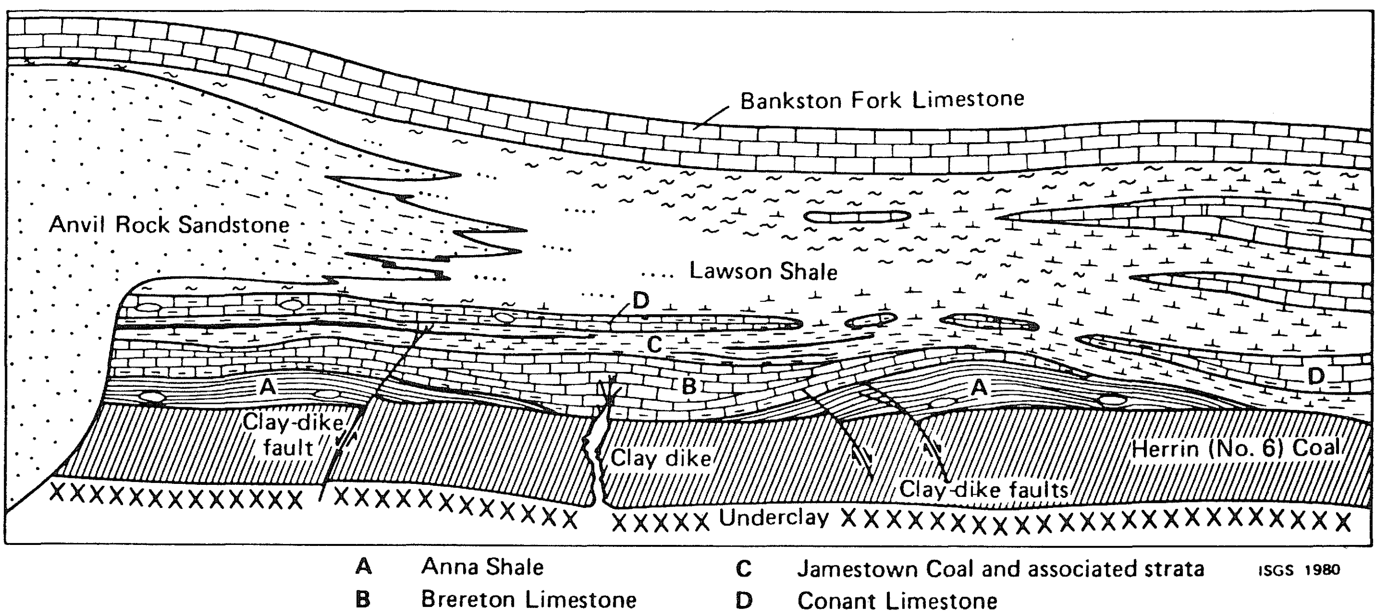


Figure 22
Schematic section of lithologies and structures of black shale and limestone roof type (after Damberger, Nelson, and Krausse, 1980).

thickness, claystone floors that had a high moisture content were overstressed and floor heaving tended to occur. Such areas may develop where the ratio of overburden thickness is 1 or greater.

Because of the potential for such problems where the ratio is 1 or greater, highly generalized maps illustrating the ratios of unconsolidated to consolidated overburden were made for the Colchester, Herrin, and Danville Coals. To determine the ratios for the overburden of each coal, the isopachs of the depth maps in figures 5, 11, and 14 were interfaced with isopachs of the glacial thickness map by Piskin (Piskin and Bergstrom, 1975) (figs. 23-25). In turn, the maps in figures 23-25 were interfaced with the coal isopach maps so that rough approximations of the tonnages in areas with a ratio of 1 or greater could be calculated (plates 1-5).

Colchester (No. 2) Coal. Figure 23 shows the unconsolidated to consolidated overburden ratios for the Colchester Coal in areas where it is deep-minable and greater than 28 inches in thickness. In Livingston County, about 331 million tons, in La Salle County, approximately 153 million tons, and in Grundy County, about 6 million tons of deep-minable Colchester Coal have a ratio of 1 or greater. Thus, in the three counties approximately 490 million tons of deep-minable Colchester Coal (about 17% of the total 2,894 million tons) have a ratio of unconsolidated to consolidated overburden that exceeds or equals the crucial value of 1. All but roughly 17 million tons of these resources average 3 feet or less in thickness, and have a low potential for development.

Herrin (No. 6) Coal. Figure 24 shows the ratio of unconsolidated to consolidated overburden for deep-minable Herrin Coal. About 10 million tons in La Salle County and 34 million tons in Livingston County have a ratio of 1 or greater. For the two counties approximately 44 million tons of deep-minable Herrin Coal (34% of the total 130 million tons) have an overburden ratio of 1 or greater. All but 7 million tons of these 44 million tons average 3 feet or less in thickness. Like the Colchester Coal, most of the resources that have a ratio of 1 or greater have a low potential for development.

Danville (No. 7) Coal. Figure 25 illustrates the ratio of unconsolidated to consolidated overburden for deep-minable Danville Coal. About 71 million tons of this coal in La Salle County have a ratio that equals or exceeds 1; in Livingston County, about 370 million tons of Danville Coal fall into this category. Approximately 441 million tons of deep-minable Danville Coal (29% of the total of 1,498 million tons estimated for the 2 counties) have a ratio that is greater than or equal to 1. About one-third (145 million tons) of these resources averages 3 feet or less in thickness and is of low development potential; another one-third that averages 4 feet in thickness probably has a moderate potential for development. The remainder of the 441 million tons is thick enough to have a high potential for development.

Other mining problems

Mine notes indicated that the claystone floor of the Colchester Coal was highly prone to heaving. In some cases entries were squeezed shut in less than 24 hours. Thus, tests of the floor material for the Colchester Coal are highly advisable during mine planning.

No problems were reported for the floors of the other minable coals in the report area, but data are sparse and more testing is recommended.

MINABLE COAL RESOURCES

Approximately 1,790 million tons of surface-minable coal resources and 4,520 million tons of deep-minable coal resources are contained in four minable coals: the Colchester (No. 2), Houchin Creek (No. 4), Herrin (No. 6), and Danville (No. 7).

Surface-minable resources (those coals that lie at depths of 150 feet or less and are 18 inches or more in thickness) are summarized in tables 1-5. A more detailed tabulation of these resources by county, township, seam and overburden thickness, and reliability classification is found in appendix B. In addition, resource blocks of coal of high development potential are listed to the nearest million tons in table 6.

Deep-minable coal resources (those coals that lie at depths greater than 150 feet and are 28 inches or more in thickness) are summarized in tables 7-10. They are tabulated by county, average coal thickness, reliability classification, and development potential in appendix C.

Coal resources in this report are divided into two classes (class I and class II) that designate the reliability of the estimate. Definitions of these classes are found in appendix A. They generally correspond to the first three classes of the system used by Cady (1952), with the addition of using interpretations of geophysical logs for accepted data points in class II.

Surface-minable coal resources

Treworgy et al. (1978) re-evaluated surface-minable coal resources to delineate areas that could be economically

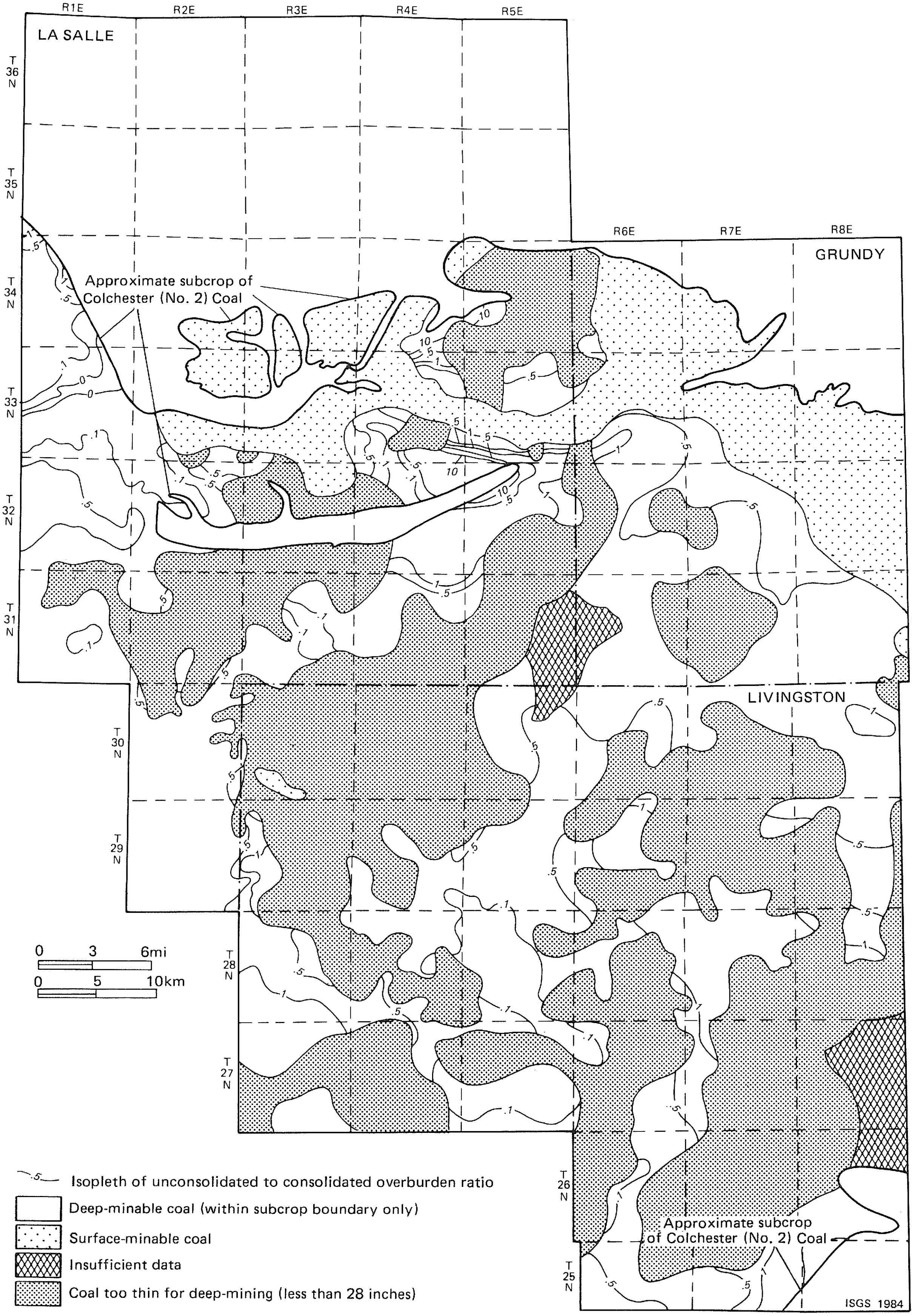


Figure 23
Unconsolidated to consolidated overburden ratio for deep-minable Colchester (No. 2) Coal Member in the study area.

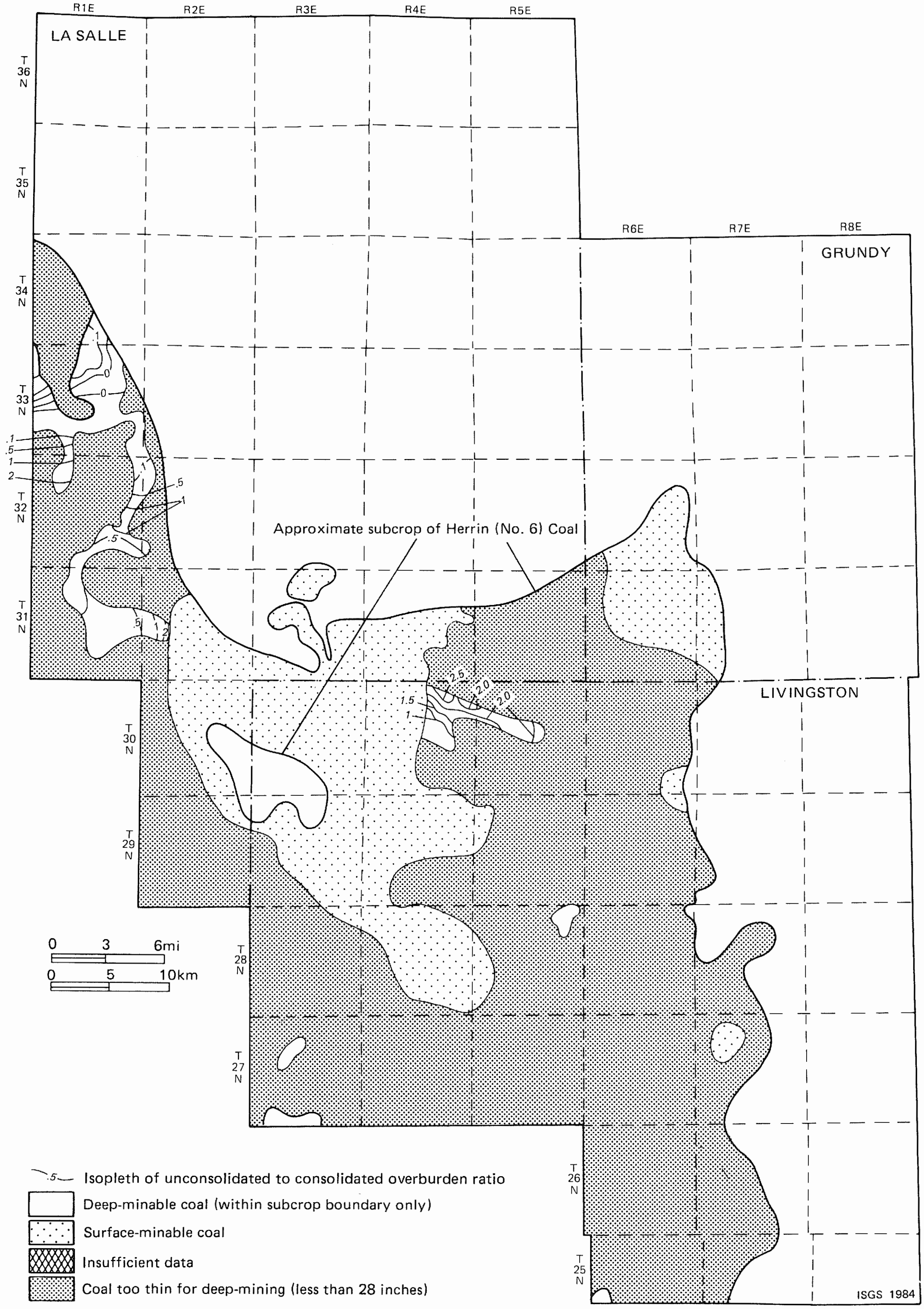


Figure 24

Unconsolidated to consolidated overburden ratio for deep-minable Herrin (No. 6) Coal Member in the study area.

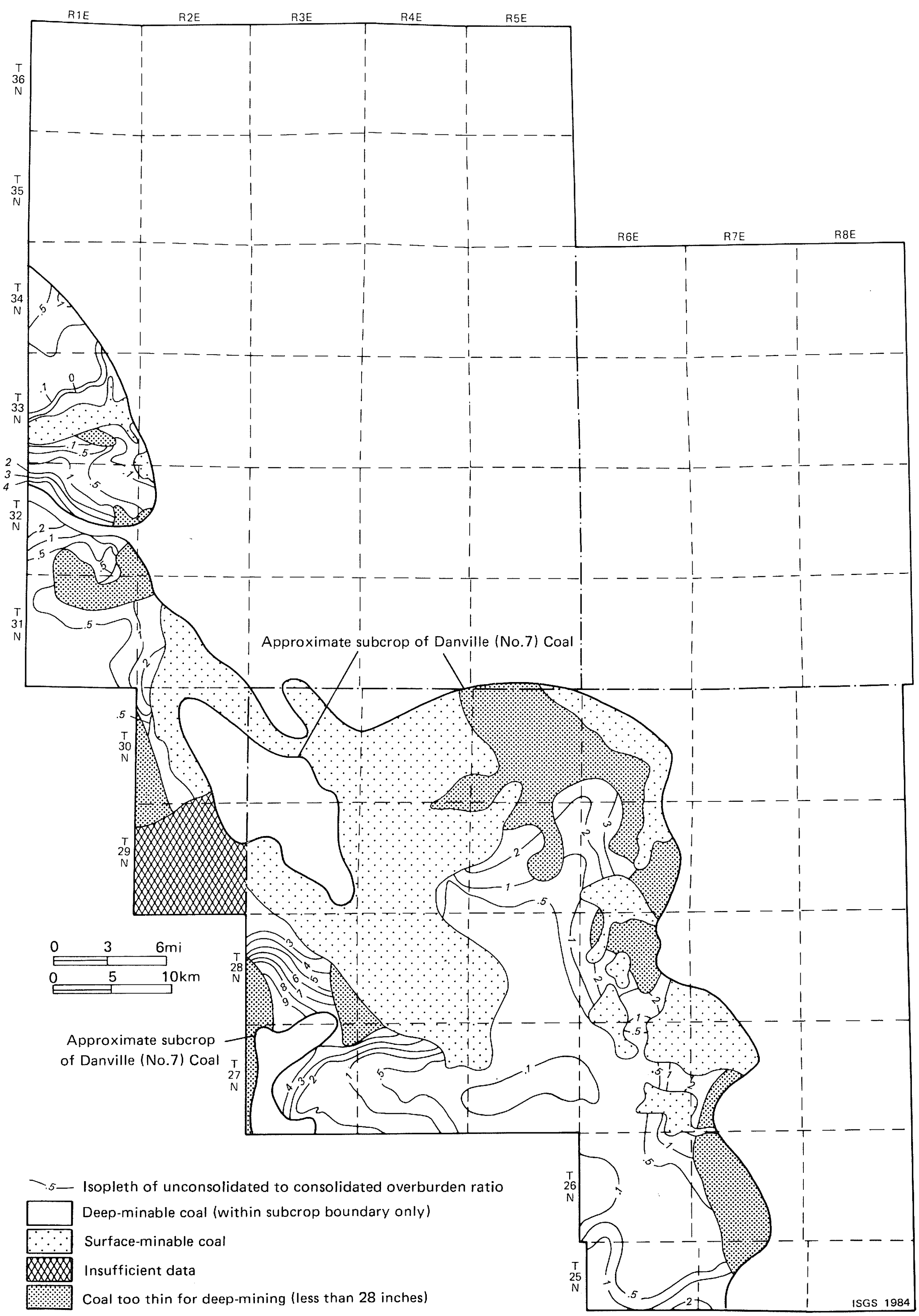


Figure 25
Unconsolidated to consolidated overburden ratio for deep-minable Danville (No. 7) Coal Member in the study area.

Table 1
Surface-minable resources of the Colchester (No. 2) Coal Member (in thousands of tons).

	Class I resources				Class II resources				
	Overburden thickness (ft)			Total I	Overburden thickness (ft)			Total II	Total I and II
County	0–50	50–100	100–150		0–50	50–100	100–150		
Grundy	15,610	104,001	147,298	266,908	0	6,567	31,135	37,702	304,610
La Salle	53,150	100,847	100,524	254,521	19	257	1,554	1,830	256,350
Livingston	0	0	7,999	7,999	0	0	0	0	7,999
Total	68,760	204,848	255,821	529,428	19	6,824	32,689	39,532	568,959

NOTE: Because of computer rounding, the values of row and column totals may vary by several thousand tons from actual total of individual components listed.

Table 2
Surface-minable resources of the Houchin Creek (No. 4) Coal Member (in thousands of tons).

	Class I resources				Class II resources				
	Overburden thickness (ft)			Total I	Overburden thickness (ft)			Total II	Total I and II
County	0–50	50–100	100–150		0–50	50–100	100–150		
Grundy	9,187	46,285	48,962	104,434	0	0	3,164	3,164	107,599
La Salle	0	1,466	31,657	33,123	0	0	12,423	12,423	45,546
Livingston	250	8,294	60,678	69,222	0	0	10,448	10,448	79,670
Total	9,437	56,045	141,297	206,779	0	0	26,035	26,035	232,815

NOTE: Because of computer rounding, the values of row and column totals may vary by several thousand tons from actual total of individual components listed.

Table 3
Surface-minable resources of the Herrin (No. 6) Coal Member (in thousands of tons).

	Class I resources				Class II resources				
	Overburden thickness (ft)			Total I	Overburden thickness (ft)			Total II	Total I and II
County	0–50	50–100	100–150		0–50	50–100	100–150		
Grundy	0	18,887	21,933	40,821	0	0	0	0	40,821
La Salle	10,516	57,861	35,563	103,939	845	10,571	5,585	17,002	120,941
Livingston	3,300	49,704	37,324	90,328	0	315	19,109	19,424	109,751
Total	13,816	126,452	94,820	235,088	845	10,886	24,694	36,426	271,513

NOTE: Because of computer rounding, the values of row and column totals may vary by several thousand tons from actual total of individual components listed.

Table 4
Surface-minable resources of the Danville (No. 7) Coal Member (in thousands of tons).

	Class I resources				Class II resources				
	Overburden thickness (ft)			Total I	Overburden thickness (ft)			Total II	Total I and II
County	0–50	50–100	100–150		0–50	50–100	100–150		
La Salle	0	11,485	21,217	32,702	11,070	44,589	19,765	75,424	108,126
Livingston	33,360	14,686	45,486	93,532	25,901	170,674	319,035	515,610	609,142
Total	33,360	26,171	66,703	126,234	36,971	215,263	338,800	591,034	717,268

NOTE: Because of computer rounding, the values of row and column totals may vary by several thousand tons from actual total of individual components listed.

Table 5
Surface-minable resources by county, coal bed, and reliability of classification (in thousands of tons).

	Class I resources				Class II resources				
County	Overburden thickness (ft)			Total I	Overburden thickness (ft)			Total I	Total I and II
Coal	0–50	50–100	100–150		0–50	50–100	100–150		
Livingston County									
Colchester			7,999	7,999					7,999
Houchin Creek	250	8,294	60,678	69,222			10,448	10,448	79,670
Herrin	3,300	49,704	37,324	90,328		315	19,109	19,424	109,751
Danville	33,360	14,686	45,486	93,532	25,901	170,674	319,035	515,610	609,142
Total	36,910	72,684	151,487	261,081	25,901	170,989	348,592	545,482	806,562
La Salle County									
Colchester	53,150	100,847	100,524	254,521	19	257	1,554	1,830	256,350
Houchin Creek		1,466	31,657	33,123			12,423	12,423	45,546
Herrin	10,516	57,861	35,563	103,939	845	10,571	5,585	17,002	120,941
Danville		11,485	21,217	32,702	11,070	44,589	19,765	75,424	108,126
Total	63,666	171,659	188,961	424,285	11,934	55,417	39,327	106,679	530,963
Grundy County									
Colchester	15,610	104,001	147,298	266,908		6,567	31,135	37,702	304,610
Houchin Creek	9,187	46,285	48,962	104,434			3,164	3,164	107,599
Herrin		18,877	21,933	40,821					40,821
Total	24,797	169,173	218,193	412,163		6,567	34,299	40,866	453,030
TOTAL	125,373	413,516	558,641	1,097,529	37,835	232,973	422,218	693,027	1,790,555

NOTE: Because of computer rounding, the values of row and column totals may vary by several thousand tons from actual total of individual components listed.

Table 6
Estimated tonnages for resource blocks of high development potential surface-minable coal (in millions of tons).

Block*	County	Coal	Tonnage
A	Grundy	Colchester	14
B	La Salle	Colchester	21
C	Grundy, Livingston	Houchin Creek	11
D	Grundy	Houchin Creek	6
E	Grundy	Herrin	31
F	La Salle, Livingston	Herrin	15
G	La Salle	Herrin	12
H	La Salle, Livingston	Herrin	19
I	Livingston	Danville	31
J	La Salle, Livingston	Danville	65
K	La Salle	Danville	14
L	La Salle	Danville	12
M	Livingston	Danville	8
Total			259

*See figures 27-30

Table 7
Deep-minable resources by coal, development potential, and county (in millions of tons).

	Coal				Development potential				
County	Danville	Herrin	Colchester	Total	High	Moderate	Low	Restricted	Total
Grundy	0	0	489	489	0	15	460	14	489
La Salle	379	121	1,066	1,565	7	335	1,058	166	1,565
Livingston	1,216	39	1,492	2,747	415	423	1,806	102	2,747
TOTAL	1,595	160	3,046	4,801	422	774	3,323	281	4,801

NOTE: Because of computer rounding, the values of row and column totals may vary by one million tons from actual total of individual components listed.

Table 8
Development potential of deep-minable resources, by coal and county (in millions of tons).

		Development potential				
County	Seam	High	Moderate	Low	Restricted	Total
Grundy	Colchester	0	15,408	459,702	13,554	486,664
	Total	0	15,408	459,702	13,554	486,664
La Salle	Colchester	1,710	156,888	819,720	87,552	1,065,870
	Danville	1,260	170,784	160,326	46,170	378,540
	Herrin	3,780	7,704	77,544	31,842	120,870
	Total	6,750	335,376	1,057,590	165,564	1,565,280
Livingston	Colchester	0	35,856	1,404,810	51,030	1,491,696
	Herrin	0	4,104	34,290	486	38,880
	Danville	415,134	383,400	366,984	50,688	1,216,206
	Total	415,134	423,360	1,806,084	102,204	2,746,782
Total						
	Colchester	1,710	208,152	2,684,232	152,136	3,046,230
	Danville	416,394	554,184	527,310	96,858	1,594,746
	Herrin	3,780	11,808	111,834	32,328	159,750
	Total	421,884	774,144	3,323,376	281,322	4,800,726

NOTE: Because of computer rounding, the values of row and column totals may vary by one million tons from actual total of individual components listed.

Table 9
Deep-minable coal that has a restricted potential for development due to surface features, by county (in millions of tons).

County	Cities	Parks	Highways	Total
Grundy	9	0	4	14
La Salle	129	13	24	166
Livingston	67	2	33	102
Total	206	14	61	281

NOTE: Because of computer rounding, the values of row and column totals may vary by one million tons from actual total of individual components listed.

Table 10
Development potential and reliability classification of deep-minable coal, by county.

County Coal	Coal thickness (in.)	Development potential High	 Moderate	 Low	 Restricted	 Total	Class I resources	Class II resources
Grundy								
Colchester	28-42	0	0	460	13	473	224	236
	42-54	0	15	0	1	16	14	1
	Total	0	15	460	14	489	238	237
La Salle								
Colchester	28-42	0	0	820	65	885	640	180
	42-54	0	156	0	22	178	154	1
	54-66	2	1	0	0	3	3	0
	Total	2	157	820	88	1,066	797	181
Herrin	28-42	0	0	78	18	96	75	3
	42-54	0	8	0	7	15	8	0
	54-66	3	0	0	5	8	3	0
	66-78	1	0	0	2	3	1	0
	Total	4	8	78	32	121	86	3
Danville	28-42	0	0	160	21	181	137	24
	42-54	0	171	0	18	189	153	18
	54-66	1	0	0	7	8	1	0
	Total	1	171	160	46	379	291	41
	County Total	2	335	1,058	166	1,565	1,174	225
Livingston								
Colchester	28-42	0	0	1,405	51	1,456	160	1,244
	42-54	0	36	0	0	36	0	36
	Total	0	36	1,405	51	1,492	160	1,280
Herrin	28-42	0	0	34	0	35	0	34
	42-54	0	4	0	0	4	0	4
	Total	0	4	34	0	39	0	38
Danville	28-42	0	0	367	12	379	33	334
	42-54	12	383	0	32	428	46	350
	54-66	403	0	0	7	410	99	303
	Total	415	383	367	51	1,216	178	988
	County Total	415	423	1,806	102	2,747	338	2,306
	Total	422	774	3,323	281	4,801	1,751	2,768

NOTE: Because of computer rounding, the values of row and column totals may vary by one million tons from actual total of individual components listed.

mined. Their criteria included 1) overburden and coal thickness, 2) reliability of the data, 3) areal size of the block of coal, and 4) proximity to man-made and natural obstacles. The term *reserves* was applied to surface-minable coal classified according to these criteria. This term is approximately equivalent to the term *high development potential* used by Treworgy and Bargh (1982) for deep-minable resources. In this paper high development potential is used for what was called reserves in the 1978 study. Appendix A contains a discussion of the parameters for each of the four criteria.

One of the criteria for assessing the potential of coal for surface mining is the size of the block of contiguous or nearly adjacent coal not separated by obstructions (Treworgy et al., 1978). Blocks with a minimum of 6 million tons are necessary. Thirteen such blocks were identified in this study, each meeting the other three criteria for high development potential. These 13 blocks contain approximately 259 million tons of coal (table 6), about 14 percent of the 1.8 billion tons of total surface-minable resources.

Deep-minable coal resources

Treworgy and Bargh (1982) developed a classification for deep-minable resources to evaluate the potential for development of the coal on the basis of current mining practices. It involves comparing the characteristics of a coal deposit to those of deposits that are currently being mined. Thus, in addition to being classed by the reliability estimate, the deep-minable coal resources in this report are classified according to development potential (tables 7-10, appendix C). Details of the methodology used to classify coals by development potential are summarized in appendix A.

Of the 4.5 billion tons of deep-minable coal resources in the three counties, only 422 million tons are estimated to have a high potential for development, and 774 million tons, a moderate potential for mining (tables 8 and 10).

Figure 26 illustrates how the development potential is distributed by reliability class. This graph shows that little, if any, correlation exists between the reliability classification of the resources and their potential for development. Both reliability classes have similar percentages of high, moderate, and low development potentials. More than 70 percent of the resources estimated for both classes have low development potential. This reflects the thinness of the most widespread of the minable coals, the Colchester Coal, which averages 3 feet in thickness through much of the area. Hence, most of the resources estimated for the Colchester are too thin for underground mining to be profitable at this time.

Colchester (No. 2) Coal

Surface-minable coal resources. The surface-minable resources of the Colchester Coal are found in the northern quarter of the three counties. This area lies along the Illinois River valley in central La Salle County, in a line running roughly from Utica to Seneca, and in a swath covering the northwestern quarter and the southern half of the southeastern quarter of Grundy County. Small areas of surface-minable coal are also present on the Ancona and Garfield Domes (fig. 3) in T. 30 N., R. 2 E., La Salle County, and T. 30 N., R. 3 E., Livingston County.

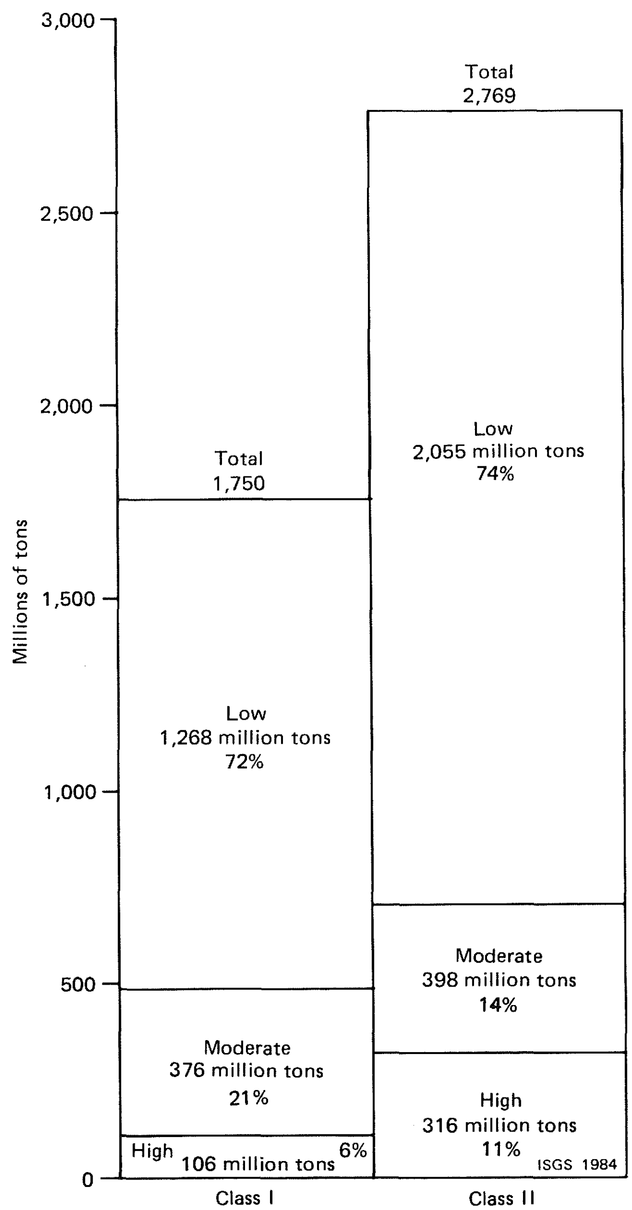


Figure 26
Distribution of development potential by reliability class for deep-minable resources in the study area.

Grundy County contains a total of 304 million tons of class I and II resources of Colchester Coal (table 5, appendix B). However, only 14 million tons of this coal, in one resource block, have high potential for surface-mining (table 6). This area (figure 27, area A) is located in a belt along the Illinois River valley.

La Salle County has a total of 256 million tons of class I and II resources of Colchester Coal (table 5, appendix B). Only 21 million tons of this resource, in the central part of the county, have high potential for development (fig. 27, area B; table 6).

Resources of 7.9 million tons of surface-minable Colchester Coal lie on top of the Ancona Dome (plate 1, fig. 3, table 5, appendix B). This coal is considered to have only low potential for mining.

Of the estimated total of 569 million tons of surface-minable resources, only 35 million tons (about 6%) have high development potential.

Deep-minable coal resources. Most of the deep-minable resources of the Colchester Coal lie beneath the southwestern half of Grundy County, the southern half and west-central part of La Salle County, and most of Livingston County. Most of this coal resource averages 3 feet in thickness (table 10), the minimum average for deep-minable resource calculations.

Approximately 475 million tons of class I and II deep-minable Colchester Coal lie in Grundy County; another 14 million tons are restricted because they lie beneath surface features, (table 10, appendix C). Fifteen million tons of coal have moderate potential for mining; the remaining 460 million tons have a low potential (tables 8 and 10). Resources having moderate development potential average 4 feet in thickness and are found in a 2-square-mile area near central Grundy County.

Approximately 978 million tons of class I and II deep-minable resources of Colchester Coal were estimated for La Salle County; another 88 million tons are restricted by surface features (table 10, appendix C). As in Grundy County, only the coal 4 feet or greater in thickness has high to moderate development potential (table 10). Resources of approximately 2 million tons of 5-foot thick coal were estimated to have high development potential. These resources lie along the south side of the Illinois River in central La Salle County. In west-central La Salle County some 156 million tons of coal 4 feet thick were estimated to have moderate potential for exploitation (plate 1, tables 8 and 10).

A total of approximately 1,441 million tons of class I and II resources and an additional 51 million tons restricted by surface features occur in Livingston County (table 10, appendix C). Of this figure only 36 million tons of resources averaging 4 feet in thickness were estimated to have moderate development potential (table 10).

The three counties contain a total of approximately 2,894 million tons of class I and II resources of the Colchester Coal. Only 2 million tons of this are considered to have a high potential for development and 208 million tons, a moderate development potential (table 10). These two figures compose 7.3 percent of the total estimated resources of Colchester Coal in Grundy, La Salle, and Livingston Counties.

Houchin Creek (No. 4) Coal

Surface-minable resources. In Grundy County approximately 107.6 million tons of class I and II surface-minable resources of the Houchin Creek Coal were estimated for the area where the coal is 2 to 4 feet in thickness (table 5, appendix B). About 45.6 million tons of class I and II resources were estimated for the Houchin Creek Coal that is 2 to 3 feet in thickness and lies on the anticlinal areas in

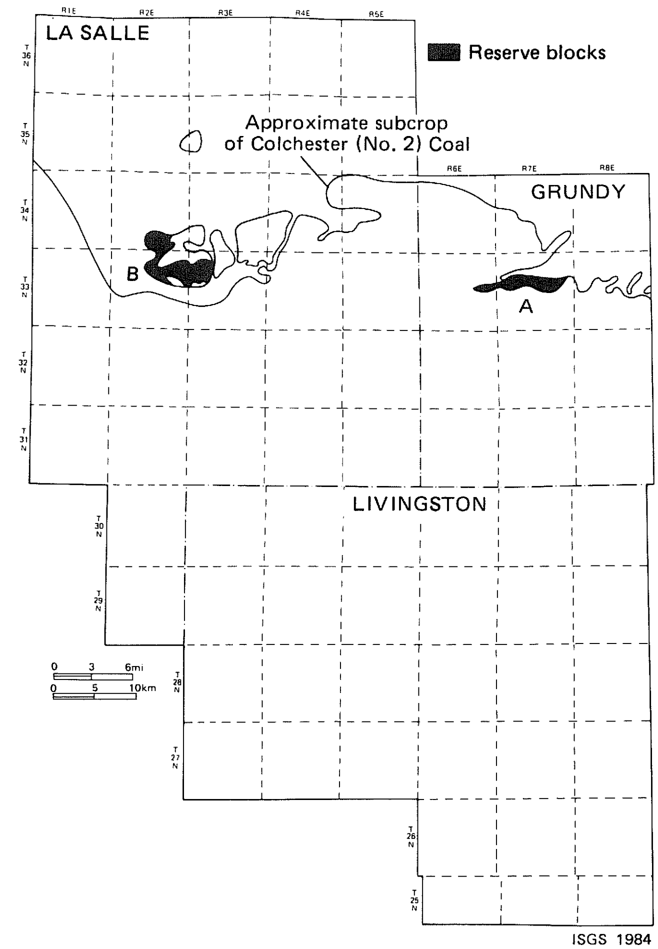


Figure 27
Blocks of high development potential, surface-minable Colchester (No. 2) Coal Member in the study area.

La Salle County (table 5, appendix B). In Livingston County approximately 79 million tons of Houchin Creek Coal of class I and II resources were estimated (table 5, appendix B).

Of the almost 233 million tons of class I and II surface-minable resources of Houchin Creek Coal, only 17 million tons (7.3%) were estimated to have high development potential (table 6). These resources are found in two blocks in central Grundy to northeastern Livingston Counties where the coal is 3 to 4 feet in thickness (figs. 6 and 28, table 6). Block C contains an estimated 11 million tons of coal and block D contains approximately 6 million tons of coal (fig. 28, table 6).

Herrin (No. 6) Coal

Surface-minable resources. Surface-minable resources of the Herrin Coal are located in three areas: near Verona in southwestern Grundy County, in the outlier in east-central La Salle County near Marseilles, and near Streator in south-central La Salle County and northwestern Livingston County (plate 3).

Approximately 41 million tons of class I and II resources of the Herrin Coal are in southwestern Grundy County near Verona (table 5, appendix B). All of the coal mapped for this area that was formerly considered deep-minable is now classified as surface-minable. Of the 41 million tons, approximately 31 million tons (76%) were estimated to have high development potential (fig. 29, block E; table 6).

In La Salle County 120 million tons of class I and II surface-minable resources of the Herrin Coal were estimated for the area around Streator (table 5, plate 3); in Livingston County in the area around Streator an estimated 110 million tons of class I and II resources of the Herrin Coal were mapped. In the area around Streator in both counties, an estimated 46 million tons of resources having a high potential for development were calculated, about 20 percent of the estimated 230 million tons of surface-minable resources (fig. 29, tables 5 and 6).

The three counties contain an estimated 272 million tons of class I and II resources of the Herrin Coal; 77 million tons (28%) were estimated to have high development potential.

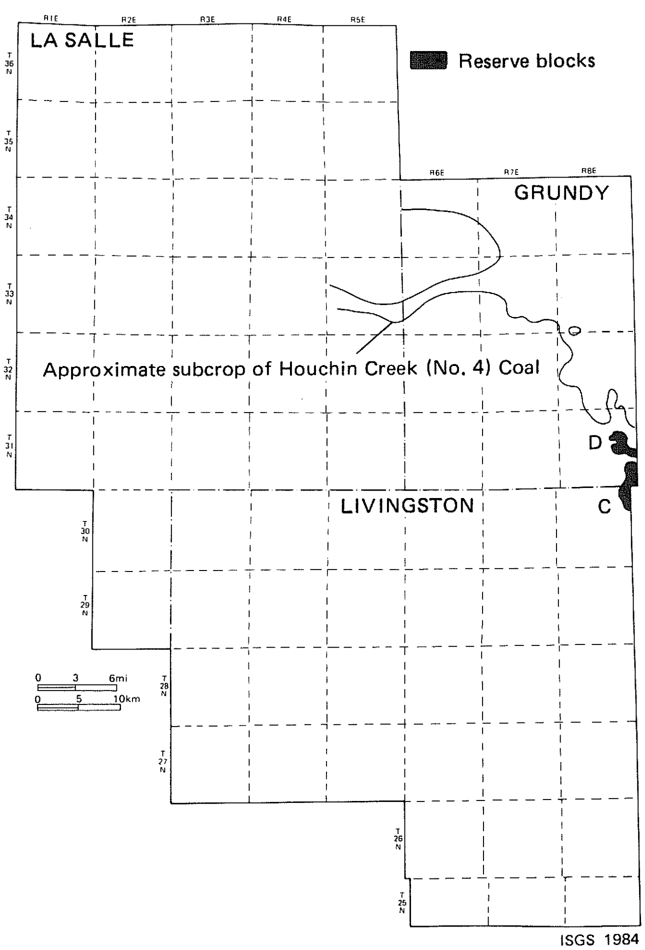


Figure 28
Blocks of high development potential, surface-minable Houchin Creek (No. 4) Coal Member in the study area.

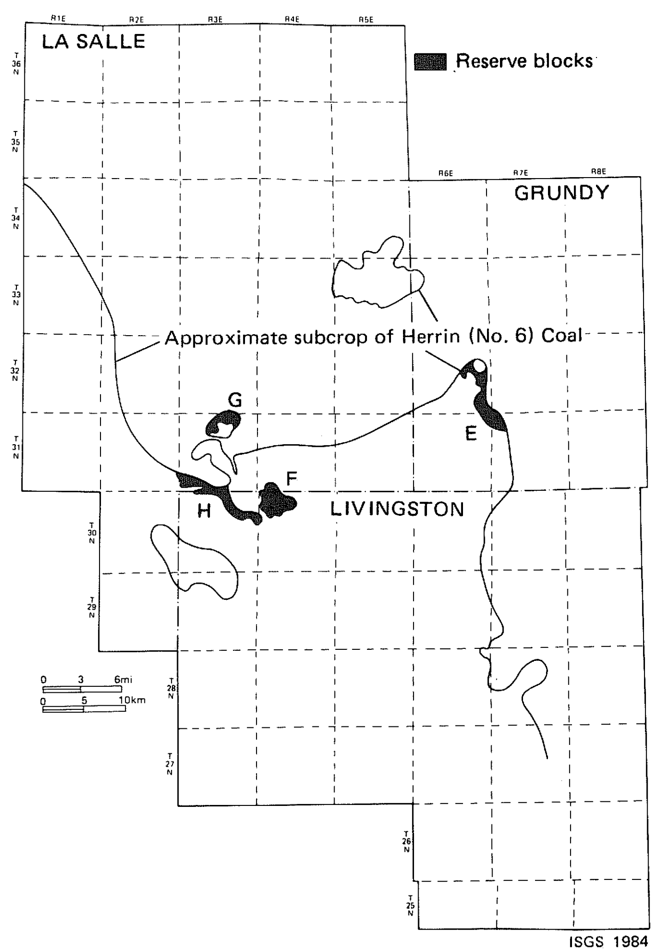


Figure 29
Blocks of high development potential, surface-minable Herrin (No. 6) Coal Member in the study area.

Deep-minable resources. Most of the deep-minable resources of Herrin Coal occur in the deeper areas in western La Salle County and the thicker coal area southeast of Streator in Livingston County. Some small patches of 3-foot Herrin Coal were also mapped in central and southern Livingston Counties. In all of these areas the thicker coal areas are mined out and most of the remaining mapped coals average 3 feet in thickness (plate 3, table 10).

In the western part of La Salle County, an estimated total of 90 million tons of class I and II resources were mapped (table 10, appendix C). An additional 32 million tons were not included in the totals because they are restricted by surface features. Of the 89 million tons, only 4 million (4.5%) were estimated to have high development potential, and 8 million tons (9%) were estimated to have moderate development potential (tables 8 and 10). The resources that have high potential for development are 5 feet or greater in thickness; the resources of moderate development potential are 4 feet in thickness.

In Livingston County, an estimated 39 million tons of class I and II deep-minable resources were mapped for the Herrin Coal (table 10, appendix C). Four million tons (10%) of these resources are estimated to have moderate development potential (table 10). These resources, like those of the Herrin Coal in La Salle County, average 4 feet in thickness. Most of the Herrin Coal in Livingston County, however, averages 3 feet in thickness and thus has low development potential.

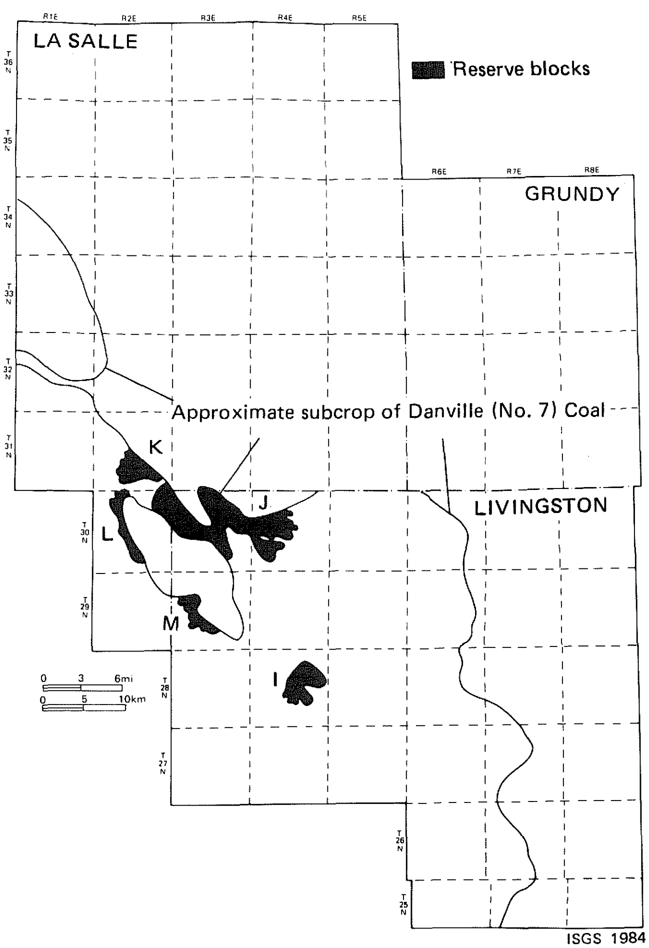


Figure 30
Blocks of high development potential, surface-minable Danville (No. 7) Coal Member in the study area.

In La Salle and Livingston Counties a total of almost 130 million tons of class I and II deep-minable resources were estimated for the Herrin Coal. Only 4 million tons (3%) of this figure were estimated to have high development potential, and 12 million tons (9%) have moderate potential.

Danville (No. 7) Coal

Surface-minable resources. Surface-minable resources were mapped in three areas along the Illinois River valley in west-central La Salle County, on the flanks of the Ancona and Garfield Domes in northwestern Livingston county and adjacent La Salle County, and along the subcropline near the centerline of Livingston County (plate 4).

In La Salle County an estimated total of 108 million tons of class I and II surface-minable resources was mapped for the Danville Coal (table 5, appendix B). In Livingston County 609 million tons of class I and II surface-minable resources were estimated. Thus, for the two counties a total of 717 million tons of class I and II resources was mapped for the Danville Coal. Of this total about 130 million tons (18%) were estimated to have high development potential in the two counties. These resources are found in five blocks, all located on the flanks of the Ancona and Garfield Domes (table 6, figs. 3 and 30). The largest of the blocks, block J (located in La Salle and Livingston Counties), contains an estimated 65 million tons of Danville Coal with high development potential. The smallest block, block M (located in Livingston County), contains an estimated total of 8 million tons of resources with high development potential (table 6, fig. 30).

Deep-minable resources. Deep-minable resources were mapped in western La Salle County and central, south-central, and southwestern Livingston County (plate 4).

In La Salle County, a total of 333 million tons of class I and II resources were estimated for the Danville Coal (table 10, appendix C). In addition, 46 million tons were mapped but were not included in the total because they are restricted by surface features. Of the 333 million tons, about 1 million tons (0.3%) were estimated to have high development potential, and 171 million tons (51%) of the resources have moderate potential for development (tables 8 and 10).

In Livingston County an estimated 1,165 million tons of class I and II deep-minable resources were mapped for the Danville Coal. An additional 51 million tons were excluded because of surface feature restrictions (table 10, appendix C). Of the 1,165 million tons, 415 million tons (36%) were estimated to have high potential for development, and 383 million tons (33%), moderate potential (tables 8 and 10).

A total of about 1,498 million tons of class I and II deep-minable resources was mapped for the Danville Coal in La Salle and Livingston Counties. Of this figure 416 million tons (28%) were estimated to have high development potential and 555 million tons (37%), moderate development potential (tables 8 and 10). Like the other minable coals, the high to moderate development potential resources are restricted to the Danville Coal where it is 4 feet or more in thickness. Thus, high to moderate development potential resources are found in the synclinal troughs (fig. 3, plate 4).

Quality of the minable coals

Available chemical analyses of coal samples are summarized in appendix D. Mine and county averages of the results of the proximate, ultimate, sulfur, heating value (Btu), and chlorine analyses are given for all samples of the Colchester (No. 2), Houchin Creek (No. 4), Herrin (No. 6), and Danville (No. 7) Coals.

Most of the coal in the report area is high in sulfur (3 to 6%, moisture free), although lower values are reported. Treworgy and Jacobson (in press) have shown that low to moderate values of sulfur (i.e., less than 2.5%, moisture free) in the Colchester are related to localized areas where non-marine gray shale covered the peat before brackish to saline waters could contaminate it with sulfur. Values as low as 2 to 2.5 percent and as high as 7 to 9 percent (moisture free) have been reported (Cady, 1952).

In the report area most of the minable coals are high volatile C bituminous coal. A few samples of Colchester Coal and the Danville Coal tested about 13,000 Btu/lb (moist, mineral-free basis), and fell into the lower range of the high volatile B bituminous rank. The higher rank of one sample of Danville Coal might be related to the fact that it came from a mine in the center of the Ransom Syncline where the coal was covered by thicker sediments. The other samples of higher-rank Colchester Coal (appendix D) were all from cores and had unusually low moisture values of 5 to 9 percent, compared with the typical range of 12 to 17 percent in this area. The samples analyzed had undoubtedly been allowed to dry before testing. Adjustment of the heating values to the expected moisture value yields lower heating values, and therefore a rank of high volatile C bituminous coal.

Ash content of all the coals ranged between 5 and 14 percent and is typical of that reported for Illinois Basin coals (Damberger et al., 1982). Ash content of most samples ranged between 8 and 10 percent, although that of all reported Danville samples was slightly higher (11.5 to 14%).

Chlorine in coal is thought to contribute to corrosion and fouling of high temperature boilers. The content of chlorine in Illinois coal generally increases with increasing depth of the coal. Coals with values of 0.5 percent or greater may require special preparation (Gluskoter and Rees, 1964). However, all samples analyzed fell far below 0.5 percent.

SUMMARY

Resources for four minable coals in Grundy, La Salle, and Livingston Counties were tabulated. The coals found in the Carbondale Formation of the Pennsylvanian System are (in ascending order): the Colchester (No. 2) Coal, the Houchin Creek (No. 4) Coal, the Herrin (No. 6) Coal, and the Danville (No. 7) Coal Members.

In the Colchester Coal about 569 million tons of surface-minable resources were calculated; only 35 million tons of these resources have high development potential. Deep-minable resources total about 2,894 million tons; only 2 million tons of these resources have high development potential.

Nearly 233 million tons of surface-minable resources of the Houchin Creek Coal were estimated for the report area. Of this figure, only 17 million tons have high development potential. No deep resource calculations were made for the Houchin Creek Coal because it is too thin and patchy in the areas where it lies at deep-minable depths.

A total of 272 million tons of surface-minable coal were estimated for the Herrin Coal. Approximately 77 million tons of this total have high development potential. Deep-minable resources for the Herrin Coal were calculated to be nearly 130 million tons; only 4 million tons have high development potential.

More than 717 million tons of surface-minable resources of the Danville Coal were estimated for the study area. Of this figure, approximately 130 million tons have high development potential. Approximately 1,498 million tons of deep-minable resources were estimated for the Danville Coal; 416 million tons have high development potential.

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APPENDIX A

Methods of preparing resource estimates.

Sources of information. Most data used in this study were taken from records of holes drilled to locate underground gas storage reservoirs. Most of these records are geophysical and contain a standard electric log, and a few gamma and gamma-density logs. Records from coal-test holes and mine shafts scattered throughout the area were also used. These records were useful in calibrating the more common geophysical data so that thickness of the coals could be estimated reliably.

Hopkins (1968) discussed the usefulness, accuracy, and limitations of electric logs in a resource study of the Springfield (No. 5) Coal of southeastern Illinois. Thicknesses determined from such geophysical data may have to be modified when more reliable data are obtained.

In addition to the above data, existing maps and reports about the three counties were used in all aspects of this study. In particular, Smith (1968), Smith and Stahl (1975), and Clegg (1972) provided background information for the preparation of this report.

Definition of surface-minable coal. Surface-minable coal resources are defined principally by the thickness of coal and by overburden depths. This report follows definitions established by earlier studies for surface-minable coal (Smith, 1957). Surface-minable coals include those seams that are 18 inches or more thick and lie at depths of 150 feet or less.

Development potential of surface-minable coal resources. Treworgy et al. (1978) established criteria for what they called *reserves* in their study of surface-minable coal; in Treworgy and Bargh (1982), these are called *high-development-potential resources.* The criteria defined by Treworgy (1978) used in the current report are

- reliability of data. If coal resources were not within 4 miles from a datum point, they were excluded from the category of high development potential.

- overburden and coal thickness. The stripping ratio of the thickness of overburden to the thickness of coal is an important factor in determining the amount of overburden that can be removed economically. Mining through greater thicknesses of overburden requires larger and more expensive machinery and the blasting of more consolidated material. The potential for encountering problems due to highwall instability and groundwater increases in relation to the depth of the mine. Therefore, a constant stripping ratio was not used to determine the economic limits of mining. The following ratios were used:

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

- size of the block of coal. The minimum size for a surface mine in Illinois was defined as 500,000 tons mined per year. Assuming a recovery of 80 percent and a life of 10 years, the minimum size for a block of coal required to support such a mine is 6 million tons in place.

- proximity to man-made and natural obstacles. If coal occurs in blocks that are irregularly shaped (such as in steep-walled, narrow-stream valleys), or are sandwiched between abandoned mines or areas of cultural development, mining is difficult. Hence, such blocks were excluded.

Definition of deep-minable coal. Deep-minable coal resources are those coal seams that are 28 or more inches in thickness and have an overburden of 150 feet or greater. Some of these resources are not recoverable because they lie beneath towns, cities, highways, lakes, or pipelines. For this study, estimates of resources were based on total coal in place minus restrictions due to these surface features.

Development potential of deep-minable coal resources (Treworgy and Bargh, 1982). By comparing characteristics of a potential deep-minable deposit to those of deposits currently being mined, the potential for development of the deposit can be rated. Treworgy and Bargh (1982) have developed a classification to which a particular deposit can be compared to determine its development potential (fig. A-1). Basically, the classification indicates that deposits having characteristics similar to those of deposits undergoing mining have a high potential for development; those with significantly inferior characteristics have a low potential for development. This classification, because it relies on characteristics of currently mined or unminable resources, allows for flexibility in changing the category of development potential as new coal is discovered, as choicer coals are mined out, and as changes occur in mining technology, in the market conditions, and in laws that affect mining.

Thickness and depth are two major factors in rating the development potential of deep-minable coals. Information on these two factors was obtained by Treworgy and Bargh (1982) for seams being mined and leased and, together with additional information that came from interviews with coal companies and consultants, was used to define four categories of coal-development potential. Figure A-1, which illustrates this classification, is discussed in the following paragraphs.

High development potential. Coal deposits that have the highest potential for development are those with thickness and depth equivalent to deposits currently being mined. At present, those deposits that are 4½ feet or greater in thickness and less than 400 feet in depth, or 5½ feet or greater in thickness and less than 1,000 feet in depth are included in this category.

Moderate development potential. This category includes coal seams that are currently undergoing active leasing but are somewhat thinner or deeper than deposits that are currently being mined. Deposits greater than 3½ feet in thickness and less than 1,000 feet in depth, greater than 4½ feet in thickness and less than 1,200 feet in depth, and greater than 5½ feet in thickness with no depth limit fall into this category.

Low development potential. Deposits in this category are those that are significantly thinner and deeper than deposits undergoing active mining today. This coal is normally included by the Illinois State Geological Survey in its resource estimates because it is technically minable.

Restricted development potential. This category includes coal deposits that are technically minable but have a restricted potential for development because they lie beneath cultural features such as cities, parks, highways,

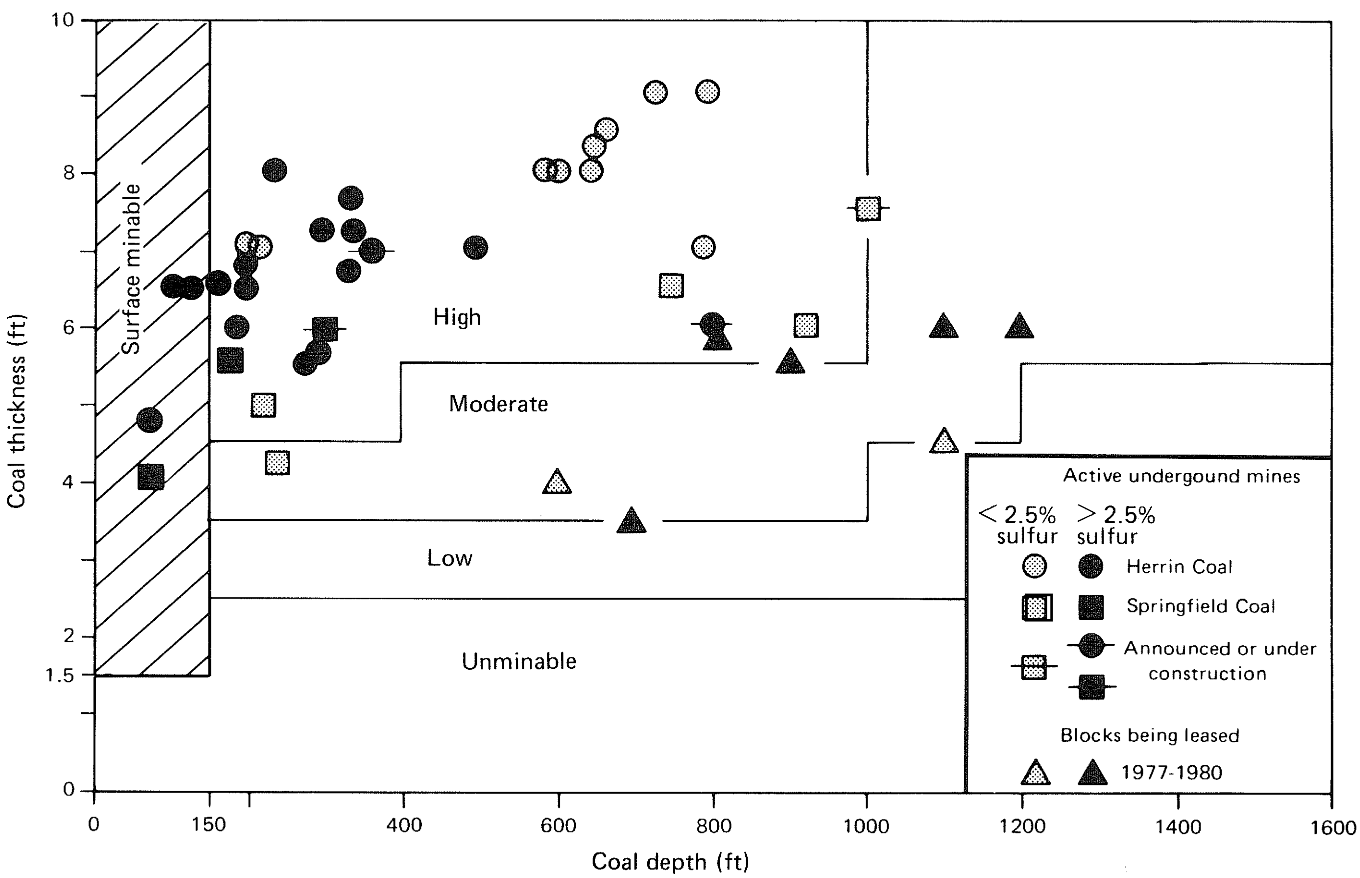

Figure A-1

Classification of development potential of deep-minable coal in Illinois based on the thickness and depth of coal currently being mined or leased. Solid symbols indicate that the coal has a sulfur content greater than 2.5 percent; stippled symbols indicate a sulfur content of less than 2.5 percent.

and railroads, or because they are in areas heavily drilled for oil and gas.

Limits for these categories are arbitrary and subjective. As companies mine out more desirable coals, mining and leasing activities will move to less desirable seams. Thus, the present limits for high and moderate development potential shown in figure A-1 will change.

Resource calculations. In this report the figure of 1800 tons of coal per acre foot was used for tonnage estimations. This conforms to the figure used by the U.S. Geological Survey to estimate resources of highly volatile, bituminous coal.

Mapping of coal subcrops and overburden depths. Subcrops of coal mapped by Smith (1968) and Smith and Stall (1975) were modified on the basis of new drill-hole data. Reduced or extended subcrops were then plotted on the maps for each coal discussed in this report.

Previously drawn overburden contours were not used in this study, except in the case of the Houchin Creek (No. 4) Coal, for which parts of the original maps were used with modifications and additions. Overburden contours on all other maps were made by interpolation of intervals between topographic maps and coal structure maps at a scale of 1:62,500.

In this study, as with previous surface-minable studies (such as Smith, 1968), overburden contours are shown on the map at depth intervals of 50 feet. Three categories of overburden thickness are shown: 0 to 50, 50 to 100, and 100 to 150 feet. Tables 1-6 and appendix B show tabulations of the amount and thickness of surface-minable coal resources for each of these categories. In Illinois the present limit of overburden depth removed in active mines ranges from 100 to 120 feet.

In addition, generalized depth maps were made for each of the coals using all the drill-hole information from this study. Generalized depth maps were assembled from this information as they were for the minable coals. These maps are helpful for planning deep mining and for determining bedrock to drift ratios.

Classification of resources. In this study coal resources are divided into two classes to designate the reliability of the estimate. These classes are listed in table A-1 and correspond to the first three classes of the system used by Cady (1952), except that geophysical logs were used (as in Treworgy and Bargh, 1982) to include more coal in the "strongly indicated" category.

Thickness of the coal. In plates 1-4 and figure 6, isopach lines (1-foot intervals, starting at 18 inches) show the thickness of the coal. Coal resources were calculated on a township basis by using the average thickness value between adjacent isopach lines.

Average thickness values and isopach intervals used for this study primarily correspond with those used in previous resource and reserve studies of the Illinois State Geological Survey (such as those of Smith, 1968; Smith and Stall 1975; Cady et al., 1952; Treworgy, 1978; Treworgy and Bargh, 1982). This study used a minimum thickness of 18 inches for surface-minable coal and 28 inches for deep-minable coal. Twenty-eight inches was originally selected as a minimum for deep coal by a national committee, and the Illinois State Geological Survey accepted it for use in its reports on deep-minable coal resources (J. A. Simon, Illinois State Geological Survey, personal communication, 1982). Coal as thin as 28 inches has been mined underground in Illinois, and is currently being mined underground in other parts of the United States where the coal is of sufficient quality to warrant mining of such thin seams.

Mined-out coal. Areas of mined-out coal are shown on plates 1-4. Information was taken from maps originally compiled by Cady (1952) and updated periodically by members of the Coal Section staff.

Table A-1
Summary of classifications for coal resources.

Class	Maximum distance from accepted datum points*	Accepted datum points	Remarks
I Proved & probable	2 miles	Mined-out areas, diamond drill holes, outcrops, coal tests, drill holes.	Approximately equivalent to the "measured" and "indicated" categories of the USGS. Includes IA and IB of Cady (1952).
II Strongly indicated	4 miles	All points of class I plus holes that have unusually good records; interpretations of conventional electric logs and gamma-density logs.	Approximately equivalent to the "inferred" category of the USGS. Includes only IIA of Cady (1952).

*Distances modified in practice by geological considerations.

APPENDIX B

Surface-minable coal resources, according to thickness of overburden, thickness of coal, and reliability of classification, by county and township (in thousands of tons).

Location	Coal thickness (in.)	Class I resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL I	Class II resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL II	TOTAL I & II
GRUNDY COUNTY										
Colchester (No. 2) Coal										
31N 8E	24	0.	0.	90.	90.	0.	0.	0.	0.	90.
	36	0.	551.	9,571.	10,121.	0.	0.	0.	0.	10,121.
	48	0.	1,302.	4,725.	6,027.	0.	0.	0.	0.	6,027.
TOTAL		0.	1,853.	14,386.	16,238.	0.	0.	0.	0.	16,238.
32N 7E	36	0.	533.	10,787.	11,320.	0.	0.	0.	0.	11,320.
TOTAL		0.	533.	10,787.	11,320.	0.	0.	0.	0.	11,320.
32N 8E	36	0.	4,086.	68,604.	72,689.	0.	0.	0.	0.	72,689.
	24	0.	365.	0.	365.	0.	0.	0.	0.	365.
TOTAL		0.	4,450.	68,604.	73,054.	0.	0.	0.	0.	73,054.
33N 6E	24	301.	14,819.	3,114.	18,234.	0.	0.	1,154.	1,154.	19,388.
	36	204.	13,938.	11,375.	25,517.	0.	0.	636.	636.	26,154.
	48	0.	2,122.	55.	2,177.	0.	0.	0.	0.	2,177.
TOTAL		505.	30,879.	14,545.	45,928.	0.	0.	1,790.	1,790.	47,719.
33N 7E	24	2,950.	7,131.	372.	10,454.	0.	0.	0.	0.	10,454.
	36	6,234.	19,312.	24,480.	50,025.	0.	0.	2,701.	2,701.	52,726.
	48	0.	0.	3,434.	3,434.	0.	0.	0.	0.	3,434.
TOTAL		9,184.	26,443.	28,286.	63,913.	0.	0.	2,701.	2,701.	66,614.
33N 8E	24	2,396.	5,657.	285.	8,338.	0.	0.	0.	0.	8,338.
	36	2,004.	4,079.	1,475.	7,558.	0.	0.	0.	0.	7,558.
	48	0.	904.	70.	974.	0.	0.	0.	0.	974.
	60	0.	1,066.	0.	1,066.	0.	0.	0.	0.	1,066.
TOTAL		4,400.	11,706.	1,830.	17,936.	0.	0.	0.	0.	17,936.
34N 6E	24	0.	3,321.	7,476.	10,789.	0.	336.	9,328.	9,664.	20,461.
	36	0.	7,818.	1,385.	8,203.	0.	6,232.	17,315.	23,547.	32,749.
TOTAL		0.	11,139.	8,861.	20,000.	0.	6,567.	26,643.	33,210.	53,211.
34N 7E	24	914.	7,786.	0.	8,700.	0.	0.	0.	0.	8,700.
	36	607.	9,212.	0.	9,819.	0.	0.	0.	0.	9,819.
TOTAL		1,521.	16,997.	0.	18,518.	0.	0.	0.	0.	18,518.
SEAM TOTAL		15,610.	104,001.	147,298.	266,908.	0.	6,567.	31,135.	37,702.	304,610.
Houchin Creek (No. 4) Coal										
31N 8E	24	0.	2,603.	11,357.	13,960.	0.	0.	3,164.	3,164.	17,124.
	36	0.	9,156.	30,297.	39,453.	0.	0.	0.	0.	39,453.
	48	2,345.	14,488.	4,361.	21,194.	0.	0.	0.	0.	21,194.
TOTAL		2,345.	26,247.	46,015.	74,607.	0.	0.	3,164.	3,164.	77,771.
32N 7E	24	333.	3,541.	0.	3,874.	0.	0.	0.	0.	3,874.
TOTAL		333.	3,541.	0.	3,874.	0.	0.	0.	0.	3,974.
32N 8E	24	1,656.	5,310.	0.	6,966.	0.	0.	0.	0.	6,966.
	36	1,235.	5,419.	0.	6,654.	0.	0.	0.	0.	6,654.
TOTAL		2,891.	10,729.	0.	13,620.	0.	0.	0.	0.	13,620.
33N 7E	24	3,618.	5,768.	2,948.	12,334.	0.	0.	0.	0.	12,334.
TOTAL		3,618.	5,768.	2,948.	12,334.	0.	0.	0.	0.	12,334.
SEAM TOTAL		9,187.	46,285.	48,962.	104,434.	0.	0.	3,164.	3,164.	107,599.
Herrin (No. 6) Coal										
32N 6E	24	0.	1,171.	37.	1,208.	0.	0.	0.	0.	1,208.
	36	0.	1,603.	134.	1,737.	0.	0.	0.	0.	1,737.
	48	0.	2,161.	262.	2,423.	0.	0.	0.	0.	2,423.
	60	0.	5,530.	845.	6,376.	0.	0.	0.	0.	6,376.
	72	0.	4,586.	2,101.	6,686.	0.	0.	0.	0.	6,686.
	84	0.	3,015.	885.	3,901.	0.	0.	0.	0.	3,901.
	96	0.	821.	923.	1,744.	0.	0.	0.	0.	1,744.
TOTAL		0.	18,887.	5,187.	24,074.	0.	0.	0.	0.	24074.
32N 7E	60	0.	0.	324.	324.	0.	0.	0.	0.	324.
TOTAL		0.	0.	324.	324.	0.	0.	0.	0.	324.
31N 6E	24	0.	0.	1,098.	1,098.	0.	0.	0.	0.	1,098.
	36	0.	0.	1,163.	1,163.	0.	0.	0.	0.	1,163.
	48	0.	0.	1,437.	1,437.	0.	0.	0.	0.	1,437.
	60	0.	0.	2,903.	2,903.	0.	0.	0.	0.	2,903.
	72	0.	0.	380.	380.	0.	0.	0.	0.	380.
TOTAL		0.	0.	6,981.	6,981.	0.	0.	0.	0.	6,981.
31N 7E	24	0.	0.	806.	806.	0.	0.	0.	0.	806.
	36	0.	0.	3,618.	3,618.	0.	0.	0.	0.	3,618.
	48	0.	0.	3,286.	3,286.	0.	0.	0.	0.	3,286.
	60	0.	0.	1,733.	1,733.	0.	0.	0.	0.	1,733.
TOTAL		0.	0.	9,442.	9,442.	0.	0.	0.	0.	9,442.
SEAM TOTAL		0.	18,887.	21,933.	40,821.	0.	0.	0.	0.	40,821.
COUNTY TOTAL		24,797.	169,173.	218,193.	412,163.	0.	6,567.	34,299.	40,866.	453,030.

NOTE: Actual township totals may vary by 1,000 to 5,000 tons from totals listed because of computer rounding of row and column figures.

Appendix B (continued)

Location	Coal thickness (in.)	Class I resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL I	Class II resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL II	TOTAL I & II
LA SALLE COUNTY										
Colchester (No. 2) Coal										
30N 2E	36	0.	0.	998.	998.	0.	0.	0.	0.	998.
	24	0.	0.	40.	40.	0.	0.	0.	0.	40.
TOTAL		0.	0.	1,038.	1,038.	0.	0.	0.	0.	1,038.
31N 3E	36	610.	2,078.	4,737.	7,246.	0.	0.	0.	0.	7,426.
	24	101.	230.	426.	757.	19.	257.	639.	915.	1,672.
TOTAL		711.	2,308.	5,163.	8,183.	19.	257.	639.	915.	9,098.
32N 2E	48	0.	160.	488.	648.	0.	0.	0.	0.	648.
TOTAL		0.	160.	488.	648.	0.	0.	0.	0.	648.
33N 2E	24	11,859.	5,950.	1,555.	19,365.	0.	0.	0.	0.	19,365.
	36	4,217.	4,194.	5,387.	13,798.	0.	0.	0.	0.	13,798.
	48	0.	1,410.	1,029.	2,439.	0.	0.	0.	0.	2,439.
	60	0.	77.	230.	307.	0.	0.	0.	0.	307.
TOTAL		16,076.	11,631.	8,202.	35,909.	0.	0.	0.	0.	35,909.
33N 3E	24	9,607.	9,002.	6,722.	25,331.	0.	0.	0.	0.	25,331.
	36	4,717.	8,535.	5,507.	18,759.	0.	0.	0.	0.	18,759.
	48	635.	2,231.	8,509.	11,375.	0.	0.	0.	0.	11,375.
	60	0.	414.	1,130.	1,545.	0.	0.	0.	0.	1,545.
TOTAL		14,959.	20,182.	21,868.	57,010.	0.	0.	0.	09.	57,010.
33N 4E	36	2,146.	6,028.	11,566.	19,740.	0.	0.	0.	0.	19,740.
	24	6,388.	4,680.	2,692.	13,759.	0.	0.	0.	0.	13,759.
	48	1,210.	1,520.	284.	3,013.	0.	0.	0.	0.	3,013.
	60	467.	152.	118.	737.	0.	0.	0.	0.	737.
TOTAL		10,211.	12,379.	14,659.	37,249.	0.	0.	0.	0.	37,249.
33N 5E	24	340.	3,786.	2,352.	6,477.	0.	0.	0.	0.	6,477.
	36	651.	12,499.	15,179.	28,300.	0.	0.	0.	0.	28,330.
TOTAL		991.	16,285.	17,531.	34,807.	0.	0.	0.	0.	34,807.
34N 1E	36	0.	0.	761.	761.	0.	0.	416.	416.	1,177.
	48	0.	218.	690.	908.	0.	0.	0.	0.	908.
TOTAL		0.	218.	1,451.	1,669.	0.	0.	416.	416.	2,086.
34N 2E	24	6,128.	3,963.	0.	10,092.	0.	0.	0.	0.	10,092.
TOTAL		6,128.	3,963.	0.	10,092.	0.	0.	0.	0.	10,092.
34N 3E	24	67.	13,753.	4,836.	18,656.	0.	0.	0.	0.	18,656.
	36	118.	933.	4,429.	5,480.	0.	0.	0.	0.	5,480.
	48	97.	986.	303.	1,387.	0.	0.	0.	0.	1,387.
	60	0.	378.	0.	378.	0.	0.	0.	0.	378.
TOTAL		283.	16,050.	9,568.	25,901.	0.	0.	0.	0.	25,901.
34N 4E	24	1,745.	5,851.	7,396.	14,993.	0.	0.	0.	0.	14,993.
	36	1,612.	2,542.	9,136.	13,291.	0.	0.	0.	0.	13,291.
TOTAL		3,358.	8,394.	16,533.	28,284.	0.	0.	0.	0.	28,284.
34N 5E	24	433.	1,544.	3,915.	5,891.	0.	0.	498.	498.	6,389.
TOTAL		433.	1,544.	3,915.	5,891.	0.	0.	498.	498.	6,389.
35N 2E	24	0.	867.	0.	867.	0.	0.	0.	0.	867.
TOTAL		0.	867.	0.	867.	0.	0.	0.	0.	867.
35N 3E	24	0.	6,741.	0.	6,741.	0.	0.	0.	0.	6,741.
TOTAL		0.	6,741.	0.	6,741.	0.	0.	0.	0.	6,741.
35N 5E	24	0.	124.	109.	233.	0.	0.	0.	0.	233.
TOTAL		0.	124.	109.	233.	0.	0.	0.	0.	233.
SEAM TOTAL		53,150.	100,847.	100,524.	254,521.	19.	257.	1,554.	1,830.	256,350.
Houchin Creek (No. 4) Coal										
29N 2E	24	0.	0.	1,254.	1,254.	0.	0.	0.	0.	1,254.
TOTAL		0.	0.	1,254.	1,254.	0.	0.	0.	0.	1,254.
30N 2E	24	0.	1,466.	7,292.	8,758.	0.	0.	0.	0.	8,758.
TOTAL		0.	1,466.	7,292.	8,758.	0.	0.	0.	0.	8,758.
31N 2E	24	0.	0.	0.	0.	0.	0.	10,011.	10,011.	10,011.
TOTAL		0.	0.	0.	0.	0.	0.	10,011.	10,011.	10,011.
31N 3E	24	0.	0.	23,110.	23,110.	0.	0.	2,412.	2,412.	25,522.
TOTAL		0.	0.	23,110.	23,110.	0.	0.	2,412.	2,412.	25,522.
SEAM TOTAL		0.	1,466.	31,657.	33,123.	0.	0.	12,423.	12,423.	45,546.
Herrin (No. 6) Coal										
30N 2E	24	0.	1,005.	954.	1,959.	0.	2,179.	674.	2,852.	4,811.
TOTAL		0.	1,005.	954.	1,959.	0.	2,179.	674.	2,852.	4,811.
31N 2E	24	0.	1,676.	179.	1,855.	106.	8,212.	3,844.	12,162.	14,018.
	36	0.	0.	0.	0.	0.	0.	262.	262.	262.
TOTAL		0.	1,676.	179.	1,855.	106.	8,212.	4,106.	12,424.	14,280.
31N 3E	48	823.	13,688.	802.	15,314.	0.	0.	0.	0.	15,314.
	60	4,510.	12,682.	714.	17,906.	0.	0.	0.	0.	17,906.
	24	1,628.	1,521.	0.	3,149.	739.	181.	0.	920.	4,069.
	36	0.	4,208.	0.	4,208.	0.	0.	0.	0.	4,208.
TOTAL		6,962.	32,098.	1,516.	40,577.	739.	181.	0.	920.	41,496.

Appendix B (continued)

Location	Coal thickness (in.)	Class I resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL I	Class II resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL II	TOTAL I & II
LA SALLE COUNTY (Continued)										
Herrin (No. 6) Coal (Continued)										
31N 4E	24	0.	722.	5,202.	5,974.	0.	0.	0.	0.	5,974.
	36	0.	3,330.	3,886.	7,216.	0.	0.	0.	0.	7,216.
	48	0.	3,936.	1,029.	4,965.	0.	0.	0.	0.	4,965.
	60	0.	727.	0.	727.	0.	0.	0.	0.	727.
TOTAL		0.	8,765.	10,117.	18,882.	0.	0.	0.	0.	18,882.
32N 2E	24	157.	720.	273.	1,150.	0.	0.	0.	0.	1,150.
	36	0.	263.	368.	631.	0.	0.	0.	0.	631.
TOTAL		157.	983.	640.	1,780.	0.	0.	0.	0.	1,780.
32N 3E	48	0.	1,852.	0.	1,852.	0.	0.	0.	0.	1,852.
TOTAL		0.	1,852.	0.	1,852.	0.	0.	0.	0.	1,852.
33N 1E	24	0.	0.	39.	39.	0.	0.	0.	0.	39.
	36	0.	540.	1,263.	1,803.	0.	0.	0.	0.	1,803.
	48	174.	1,740.	2,773.	4,687.	0.	0.	0.	0.	4,687.
	60	65.	957.	1,479.	2,502.	0.	0.	0.	0.	2,502.
TOTAL		239.	3,238.	5,554.	9,030.	0.	0.	0.	0.	9,030.
33N 2E	24	130.	801.	310.	1,241.	0.	0.	0.	0.	1,241.
	36	0.	266.	429.	695.	0.	0.	0.	0.	695.
	48	0.	0.	175.	175.	0.	0.	0.	0.	175.
TOTAL		130.	1,067.	914.	2,110.	0.	0.	0.	0.	2,110.
33N 4E	24	0.	0.	320.	320.	0.	0.	0.	0.	320.
	36	0.	0.	222.	222.	0.	0.	0.	0.	222.
TOTAL		0.	0.	542.	542.	0.	0.	0.	0.	542.
33N 5E	24	354.	1,468.	6,436.	8,258.	0.	0.	0.	0.	8,258.
	36	1,731.	4,284.	6,685.	12,700.	0.	0.	0.	0.	12,700.
	48	552.	701.	862.	2,115.	0.	0.	0.	0.	2,115.
	60	390.	684.	263.	1,337.	0.	0.	0.	0.	1,337.
TOTAL		3,027.	7,138.	14,245.	24,410.	0.	0.	0.	0.	24,410.
34N 1E	24	0.	40.	233.	273.	0.	0.	0.	0.	273.
TOTAL		0.	40.	233.	273.	0.	0.	0.	0.	273.
34N 5E	24	0.	0.	167.	167.	0.	0.	411.	411.	579.
	36	0.	0.	501.	501.	0.	0.	394.	394.	895.
TOTAL		0.	0.	668.	668.	0.	0.	805.	805.	1,474.
SEAM TOTAL		10,516.	57,861.	35,563.	103,939.	845.	10,571.	5,585.	17,002.	120,941.
Danville (No. 7) Coal										
30N 2E	36	0.	0.	1,943.	1,943.	1,082.	9,953.	8,049.	19,085.	21,028.
	48	0.	0.	500.	500.	0.	11,983.	4,723.	16,706.	17,206.
	24	0.	0.	0.	0.	340.	4,803.	0.	5,143.	5,143.
TOTAL		0.	0.	2,443.	2,443.	1,423.	26,738.	12,772.	40,933.	43,376.
31N 2E	24	0.	0.	0.	0.	5,910.	8,931.	1,515.	16,355.	16,355.
	36	0.	0.	0.	0.	3,738.	8,920.	5,362.	18,020.	18,020.
	48	0.	0.	0.	0.	0.	0.	116.	116.	116.
TOTAL		0.	0.	0.	0.	9,648.	17,850.	6,993.	34,491.	34,491.
32N 1E	36	0.	50.	160.	210.	0.	0.	0.	0.	210.
TOTAL		0.	50.	160.	210.	0.	0.	0.	0.	210.
32N 2E	36	0.	275.	209.	484.	0.	0.	0.	0.	484.
	48	0.	155.	681.	836.	0.	0.	0.	0.	836.
TOTAL		0.	430.	890.	1,320.	0.	0.	0.	0.	1,320.
33N 1E	24	0.	0.	308.	308.	0.	0.	0.	0.	308.
	36	0.	907.	3,124.	4,031.	0.	0.	0.	0.	4,031.
	48	0.	9,549.	11,009.	20,557.	0.	0.	0.	0.	20,557.
	60	0.	0.	2,297.	2,297.	0.	0.	0.	0.	2,297.
TOTAL		0.	10,456.	16,738.	27,194.	0.	0.	0.	0.	27,194.
33N 2E	36	0.	404.	985.	1,389.	0.	0.	0.	0.	1,389.
	48	0.	146.	0.	146.	0.	0.	0.	0.	146.
TOTAL		0.	549.	985.	1,535.	0.	0.	0.	0.	1,535.
SEAM TOTAL		0.	11,485.	21,217.	32,702.	11,070.	44,589.	19,765.	75,424.	108,126.
COUNTY TOTAL		63,666.	171,659.	188,961.	424,285.	11,934.	55,417.	39,327.	106,679.	530,963.
LIVINGSTON COUNTY										
Colchester (No. 2) Coal										
29N 3E	24	0.	0.	320.	320.	0.	0.	0.	0.	320.
TOTAL		0.	0.	320.	320.	0.	0.	0.	0.	320.
30N 3E	24	0.	0.	5,391.	5,391.	0.	0.	0.	0.	5,391.
	36	0.	0.	2,288.	2,288.	0.	0.	0.	0.	2,288.
TOTAL		0.	0.	7,679.	7,679.	0.	0.	0.	0.	7,679.
SEAM TOTAL		0.	0.	7,999.	7,999.	0.	0.	0.	0.	7,999.

Location	Coal thickness (in.)	Class I resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL I	Class II resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL II	TOTAL I & II
LIVINGSTON COUNTY (Continued)										
Houchin Creek (No. 4) Coal										
29N 3E	24	0.	0.	11,282.	11,282.	0.	0.	6,617.	6,617.	17,900.
TOTAL		0.	0.	11,282.	11,282.	0.	0.	6,617.	6,617.	17,900.
30N 3E	24	0.	2,346.	5,434.	7,779.	0.	0.	0.	0.	7,779.
TOTAL		0.	2,346.	5,434.	7,779.	0.	0.	0.	0.	7,779.
30N 8E	24	0.	0.	8,744.	8,744.	0.	0.	1,576.	1,576.	10,320.
	36	250.	0.	26,733.	26,983.	0.	0.	2,255.	2,255.	29,238.
	48	0.	5,948.	8,485.	14,433.	0.	0.	0.	0.	14,433.
TOTAL		250.	5,948.	43,962.	50,160.	0.	0.	3,831.	3,831.	53,991.
SEAM TOTAL		250.	8,294.	60,678.	69,222.	0.	0.	10,448.	10,448.	79,670.
Herrin (No. 6) Coal										
29N 3E	24	0.	0.	0.	0.	0.	0.	90.	90.	90.
TOTAL		0.	0.	0.	0.	0.	0.	90.	90.	90.
29N 4E	24	0.	0.	0.	0.	0.	0.	262.	262.	262.
TOTAL		0.	0.	0.	0.	0.	0.	262.	262.	262.
30N 3E	24	0.	7,415.	4,739.	12,154.	0.	315.	5,691.	6,006.	18,159.
	36	0.	11,532.	7,192.	18,724.	0.	0.	2,006.	2,006.	20,730.
	48	1,288.	7,249.	5,000.	13,538.	0.	0.	0.	0.	13,538.
	60	1,415.	1,013.	1,357.	3,786.	0.	0.	0.	0.	3,786.
TOTAL		2,704.	27,210.	18,288.	48,201.	.	315.	7,697.	8,012.	56,213.
30N 4E	24	0.	251.	4,492.	4,743.	0.	0.	3,456.	3,456.	8,199.
	36	0.	1,551.	9,596.	11,137.	0.	0.	1,620.	1,620.	12,756.
	48	269.	5,001.	4,413.	9,683.	0.	0.	5,162.	5,162.	14,846.
	60	327.	15,691.	545.	16,563.	0.	0.	823.	823.	17,386.
TOTAL		596.	22,494.	19,037.	42,126.	0.	0.	11,060.	11,060.	53,187.
SEAM TOTAL		3,300.	49,704.	37,324.	90,328.	0.	315.	19,109.	19,424.	109,751.
Danville (No. 7) Coal										
26N 6E	36	0.	0.	125.	125.	0.	0.	0.	0.	125.
	48	0.	0.	651.	651.	0.	0.	0.	0.	651.
TOTAL		0.	0.	775.	775.	0.	0.	0.	0.	775.
26N 7E	36	0.	0.	35.	35.	0.	0.	48.	48.	82.
	24	0.	0.	0.	0.	0.	0.	258.	258.	258.
TOTAL		0.	0.	35.	35.	0.	0.	305.	305.	340.
37N 4E	24	0.	0.	0.	0.	0.	0.	7,000.	7,000.	7,000.
	36	0.	0.	0.	0.	0.	0.	10,078.	10,078.	10,078.
TOTAL		0.	0.	0.	0.	0.	0.	17,079.	17,079.	17,079.
27N 5E	24	0.	0.	0.	0.	0.	0.	540.	540.	540.
	36	0.	0.	0.	0.	0.	0.	6,971.	6,971.	6,971.
	48	0.	0.	0.	0.	0.	0.	1,741.	1,741.	1,741.
TOTAL		0.	0.	0.	0.	0.	0.	9,253.	9,253.	9,253.
27N 6E	24	0.	886.	2,021.	2,908.	0.	0.	0.	0.	2,908.
	36	0.	348.	5,633.	5,982.	0.	35.	4,052.	4,086.	10,068.
	48	0.	0.	11,842.	11,842.	0.	0.	7,197.	7,197.	19,039.
	60	0.	0.	11,849.	11,849.	0.	0.	2,459.	2,459.	14,308.
TOTAL		0.	1,235.	31,345.	32,580.	0.	35.	13,708.	13,743.	46,323.
27N 7E	24	0.	1,073.	0.	1,073.	0.	11,280.	6,908.	18,188.	19,261.
	36	0.	0.	0.	0.	0.	97.	5,376.	5,473.	5,473.
	48	0.	0.	0.	0.	0.	0.	201.	201.	201.
TOTAL		0.	1,073.	0.	1,073.	0.	11,377.	12,485.	23,862.	24,935.
28N 3E	24	0.	0.	0.	0.	0.	7,788.	8,121.	15,910.	15,910.
	36	0.	0.	0.	0.	0.	0.	9,141.	9,141.	9,141.
TOTAL		0.	0.	0.	0.	0.	7,788.	17,262.	25,051.	25,051.
28N 4E	24	0.	0.	0.	0.	0.	14,069.	19,590.	33,659.	33,659.
	36	0.	0.	0.	0.	0.	18,917.	11,962.	30,878.	30,878.
	48	0.	0.	0.	0.	0.	28,785.	12,867.	41,652.	41,652.
TOTAL		0.	0.	0.	0.	0.	61,770.	44,419.	106,189.	106,189.
28N 5E	36	0.	0.	280.	280.	0.	829.	13,228.	14,056.	14,336.
	48	0.	0.	174.	174.	0.	36.	4,777.	4,813.	4,987.
	24	0.	0.	0.	0.	0.	0.	623.	623.	623.
TOTAL		0.	0.	454.	454.	0.	865.	18,627.	19,492.	19,946.
28N 6E	24	0.	0.	239.	239.	0.	0.	3,977.	3,977.	4,216.
	36	0.	0.	7,161.	7,161.	0.	0.	9,203.	9,203.	16,364.
	48	0.	0.	3,671.	3,671.	0.	0.	7,535.	7,535.	11,206.
TOTAL		0.	0.	11,072.	11,072.	0.	0.	20,715.	20,715.	31,786.
28N 7E	36	0.	117.	949.	1,066.	0.	72.	4,741.	4,813.	5,879.
	24	0.	106.	0.	106.	0.	2,330.	681.	3,011.	3,117.
TOTAL		0.	223.	949.	1,172.	0.	2,402.	5,422.	7,824.	8,996.

Appendix B (continued)

Location	Coal thickness (in.)	Class I resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL I	Class II resources: Overburden thickness (ft) 0 - 50	50 - 100	100 - 150	TOTAL II	TOTAL I & II
LIVINGSTON COUNTY (Continued)										
Danville (No. 7) Coal (Continued)										
29N 3E	24	0.	0.	0.	0.	7,941.	21,440.	2,106.	31,487.	31,487.
	36	0.	0.	0.	0.	0.	1,735.	5,110.	6,845.	6,845.
TOTAL		0.	0.	0.	0.	7,941.	23,174.	7,216.	38,331.	38,331.
29N 4E	24	0.	0.	0.	0.	112.	19,251.	15,978.	35,341.	35,341.
	36	0.	0.	0.	0.	0.	10,174.	36,279.	46,453.	46,453.
	48	0.	0.	0.	0.	0.	0.	963.	963.	963.
TOTAL		0.	0.	0.	0.	112.	29,425.	53,221.	82,757.	82,757.
29N 5E	24	0.	0.	0.	0.	0.	0.	8,629.	8,629.	8,629.
	36	0.	0.	0.	0.	0.	0.	4,918.	4,918.	4,918.
	48	0.	0.	0.	0.	0.	0.	1,326.	1,326.	1,326.
TOTAL		0.	0.	0.	0.	0.	0.	14,874.	14,874.	14,874.
29N 6E	24	0.	0.	0.	0.	0.	260.	14,789.	15,049.	15,049.
	36	0.	0.	0.	0.	0.	0.	6,708.	6,708.	6,708.
TOTAL		0.	0.	0.	0.	0.	260.	21,497.	21,757.	21,757.
30N 3E	24	19,548.	7,289.	359.	27,196.	0.	59.	353.	413.	27,609.
	36	9,855.	4,391.	497.	14,742.	3,748.	705.	1,697.	1,649.	20,891.
	48	1,420.	0.	0.	1,420.	2,455.	0.	0.	2,455.	3,875.
TOTAL		30,823.	11,680.	856.	43,358.	6,203.	764.	2,050.	9,017.	52,375.
30N 4E	24	2,538.	476.	0.	3,014.	10,959.	22,020.	11,222.	44,202.	47,216.
	36	0.	0.	0.	0.	686.	10,794.	13,690.	25,169.	25,169.
TOTAL		2,538.	476.	0.	3,014.	11,645.	32,814.	24,912.	69,371.	72,385.
30N 5E	24	0.	0.	0.	0.	0.	0.	11,028.	11,028.	11,028.
TOTAL		0.	0.	0.	0.	0.	0.	11,028.	11,028.	11,028.
30N 6E	24	0.	0.	0.	0.	0.	0.	24,963.	24,963.	24,963.
TOTAL		0.	0.	0.	0.	0.	0.	24,963.	24,963.	24,963.
SEAM TOTAL		33,360.	14,686.	45,486.	93,532.	25,901.	170,674.	319,305.	515,610.	609,142.
COUNTY TOTAL		36,910.	72,684.	151,487.	261,081.	25,901.	170,989.	348,592.	545,482.	806,562.
GRAND TOTAL		125,373.	413,516.	558,641.	1,097,529.	37,835.	232,973.	422,218.	693,027.	1,790,555.

APPENDIX C

Development potential of deep-minable coal resources, by reliability classification, county, and township (in millions of tons).

Location	Coal	Coal thickness (in.)	Development potential High	Moderate	Low	Restricted	Total	Class I	Class II
GRUNDY COUNTY									
31N 6E	Colchester	28 - 42	0	0	80	1	81	7	73
TOTAL, TOWNSHIP			0	0	80	1	81	7	73
31N 7E	Colchester	28 - 42	0	0	53	4	56	18	34
TOTAL, TOWNSHIP			0	0	53	4	56	18	34
31N 8E	Colchester	28 - 42	0	0	85	5	89	62	23
		42 - 54	0	0	0	1	1	0	0
TOTAL, COAL BED			0	0	85	5	90	62	23
TOTAL, TOWNSHIP			0	0	85	5	90	62	23
32N 6E	Colchester	28 - 42	0	0	78	1	79	34	44
		42 - 54	0	0	0	0	0	0	0
TOTAL, COAL BED			0	0	78	1	79	34	44
TOTAL, TOWNSHIP			0	0	78	1	79	34	44
32N 7E	Colchester	28 - 42	0	0	93	2	94	49	44
		42 - 54	0	5	0	0	5	5	0
TOTAL, COAL BED			0	5	93	2	99	53	44
TOTAL, TOWNSHIP			0	5	93	2	99	53	44
32N 8E	Colchester	28 - 42	0	0	14	0	14	14	0
TOTAL, TOWNSHIP			0	0	14	0	14	14	0
33N 6E	Colchester	28 - 42	0	0	41	1	42	27	14
		42 - 54	0	1	0	0	1	0	0
TOTAL, COAL BED			0	1	41	1	43	28	14
TOTAL, TOWNSHIP			0	1	41	1	43	28	14
33N 7E	Colchester	28 - 42	0	0	13	0	13	13	0
		42 - 54	0	9	0	0	9	9	0
TOTAL, COAL BED			0	9	13	0	23	22	0
TOTAL, TOWNSHIP			0	9	13	0	23	22	0
34N 6E	Colchester	28 - 42	0	0	3	0	3	0	3
TOTAL, TOWNSHIP			0	0	3	0	3	0	3
TOTAL BY COAL	Colchester	28 - 42	0	0	460	13	473	224	236
		42 - 54	0	15	0	1	16	14	1
TOTAL COUNTY			0	15	460	14	489	238	237
LA SALLE COUNTY									
29N 2E	Colchester	28 - 42	0	0	116	2	118	67	49
		42 - 54	0	3	0	0	3	3	0
TOTAL, COAL BED			0	3	116	2	120	69	49
	Danville	28 - 42	0	0	1	0	1	0	1
TOTAL, TOWNSHIP			0	3	117	2	121	69	50
30N 2E	Colchester	28 - 42	0	0	98	1	99	84	14
		42 - 54	0	8	0	0	8	8	0
TOTAL, COAL BED			0	8	98	1	107	92	14
	Danville	28 - 42	0	0	20	0	20	10	10
		42 - 54	0	1	0	0	1	0	1
TOTAL, COAL BED			0	1	20	0	21	10	11
TOTAL, TOWNSHIP			0	9	118	1	128	102	25

NOTE: Because of computer rounding, the values of row and column totals may vary by one million tons from actual total of individual components listed.

Location	Coal	Coal thickness (in.)	Development potential: High	Moderate	Low	Restricted	Total	Class I	Class II
LA SALLE COUNTY (Continued)									
31N 1E	Colchester	28 - 42	0	0	79	2	81	67	12
		42 - 54	0	16	0	1	17	16	0
TOTAL, COAL BED			0	16	79	3	98	83	12
	Herrin	28 - 42	0	0	31	2	33	30	1
	Danville	28 - 42	0	0	37	3	39	37	0
		42 - 54	0	77	0	1	79	62	16
TOTAL, COAL BED			0	77	37	4	118	98	16
TOTAL, TOWNSHIP			0	93	146	9	248	211	28
31N 2E	Colchester	28 - 42	0	0	27	0	27	16	11
	Herrin	28 - 42	0	0	5	0	5	3	2
	Danville	28 - 42	0	0	17	0	17	9	8
		42 - 54	0	1	0	0	1	0	1
TOTAL, COAL BED			0	1	17	0	18	9	9
TOTAL, TOWNSHIP			0	1	50	0	51	29	22
31N 3E	Colchester	28 - 42	0	0	44	11	54	43	1
TOTAL, TOWNSHIP			0	0	44	11	54	43	1
31N 4E	Colchester	28 - 42	0	0	54	2	56	41	14
TOTAL, TOWNSHIP			0	0	54	2	56	41	14
31N 5E	Colchester	28 - 42	0	0	7	0	7	6	1
TOTAL, TOWNSHIP			0	0	7	0	7	6	1
32N 1E	Colchester	28 - 34	0	0	77	4	82	77	0
		42 - 54	0	43	0	2	45	43	0
TOTAL, COAL BED			0	43	77	6	126	120	0
	Herrin	28 - 42	0	0	23	3	26	23	0
	Danville	28 - 42	0	0	57	3	60	57	0
		42 - 54	0	32	0	2	34	32	0
TOTAL, COAL BED			0	32	57	5	94	89	0
TOTAL, TOWNSHIP			0	76	157	14	247	232	0
32N 2E	Colchester	28 - 42	0	0	64	3	66	51	12
		42 - 54	0	4	0	1	5	4	0
		54 - 66	0	1	0	0	1	1	0
TOTAL, COAL BED			0	5	64	3	72	56	12
	Herrin	28 - 42	0	0	3	0	3	3	0
TOTAL, TOWNSHIP			0	5	66	3	74	59	12
32N 3E	Colchester	28 - 42	0	0	2	0	2	2	0
TOTAL, TOWNSHIP			0	0	2	0	2	2	0
32N 4E	Colchester	28 - 42	0	0	60	1	61	32	28
		42 - 54	0	13	0	0	13	12	1
TOTAL, COAL BED			0	13	60	1	74	44	29
TOTAL, TOWNSHIP			0	13	60	1	74	44	29
32N 5E	Colchester	28 - 42	0	0	42	21	63	8	35
TOTAL, TOWNSHIP			0	0	42	21	63	8	35

Location	Coal	Coal thickness (in.)	Development potential: High	Moderate	Low	Restricted	Total	Class I	Class II
LA SALLE COUNTY (Continued)									
33N 1E	Colchester	28 - 42	0	0	37	11	48	36	1
		42 - 54	0	28	0	16	44	28	0
TOTAL, COAL BED			0	28	37	28	92	64	1
	Herrin	28 - 42	0	0	15	12	27	15	0
		42 - 54	0	6	0	6	13	6	0
		54 - 66	3	0	0	5	8	3	0
		66 - 78	1	0	0	2	3	1	0
TOTAL, COAL BED			4	6	15	25	50	25	0
	Danville	28 - 42	0	0	19	15	34	15	4
		42 - 54	0	29	0	14	43	28	0
		54 - 66	1	0	0	7	8	1	0
TOTAL, COAL BED			1	29	19	36	85	44	5
TOTAL, TOWNSHIP			5	63	71	89	227	133	5
33N 2E	Colchester	28 - 42	0	0	4	0	4	4	0
		42 - 54	0	1	0	1	1	1	0
		54 - 66	0	0	0	0	1	0	0
TOTAL, COAL BED			0	1	4	1	6	5	0
	Herrin	28 - 42	0	0	0	0	0	0	0
		42 - 54	0	0	0	0	0	0	0
TOTAL, COAL BED			0	0	0	0	0	0	0
	Danville	28 - 42	0	0	1	0	1	1	0
TOTAL, TOWNSHIP			0	1	5	1	7	6	0
33N 3E	Colchester	28 - 42	0	0	4	0	4	4	0
		42 - 54	0	2	0	0	3	2	0
		54 - 66	1	0	0	0	2	1	0
TOTAL, COAL BED			1	2	4	0	8	8	0
TOTAL, TOWNSHIP			2	2	4	0	8	8	0
33N 4E	Colchester	28 - 42	0	0	24	1	25	24	0
		42 - 54	0	9	0	0	9	9	0
TOTAL, COAL BED			0	9	24	1	33	33	0
TOTAL, TOWNSHIP			0	9	24	1	33	33	0
33N 5E	Colchester	28 - 42	0	0	41	6	46	39	1
TOTAL, TOWNSHIP			0	0	41	6	46	39	1
34N 1E	Colchester	28 - 42	0	0	30	0	30	28	2
		42 - 54	0	29	0	2	31	29	0
TOTAL, COAL BED			0	29	30	2	61	57	2
	Herrin	28 - 42	0	0	2	0	2	2	0
		42 - 54	0	1	0	1	2	1	0
TOTAL, COAL BED			0	1	2	1	4	3	0
	Danville	28 - 42	0	0	9	0	10	9	1
		42 - 54	0	30	0	1	31	30	0
TOTAL, COAL BED			0	30	9	1	41	39	1
TOTAL, TOWNSHIP			0	60	41	4	106	99	2
34N 4E	Colchester	28 - 42	0	0	7	1	8	7	0
TOTAL, TOWNSHIP			0	0	7	1	8	7	0

Location	Coal	Coal thickness (in.)	Development potential: High	Moderate	Low	Restricted	Total	Class I	Class II
LIVINGSTON COUNTY (Continued)									
27N 5E	Colchester	28 - 42	0	0	66	0	66	0	66
	Herrin	28 - 42	0	0	5	0	5	0	5
	Danville	28 - 42	0	0	39	0	39	0	39
		42 - 54	0	30	0	0	30	0	30
TOTAL, COAL BED			0	30	39	0	69	0	69
TOTAL, TOWNSHIP			0	30	109	0	139	0	139
27N 4E	Colchester	28 - 42	0	0	32	6	38	0	32
	Danville	28 - 42	0	0	50	3	53	0	50
		42 - 54	0	56	0	6	62	0	56
TOTAL, COAL BED			0	56	50	9	115	0	106
TOTAL, TOWNSHIP			0	56	82	15	153	0	138
27N 5E	Colchester	28 - 42	0	0	81	0	82	0	81
	Danville	28 - 42	0	0	14	0	14	0	14
		42 - 54	0	57	0	0	57	0	57
		54 - 66	99	0	0	0	99	0	99
TOTAL, COAL BED			99	57	14	0	170	0	169
TOTAL, TOWNSHIP			99	57	95	0	251	0	251
27N 6E	Colchester	28 - 42	0	0	42	1	43	19	24
TOTAL, COAL BED			0	0	42	1	43	19	24
	Danville	28 - 42	0	0	3	0	3	1	2
		42 - 54	0	23	0	0	23	15	8
		54 - 66	101	0	0	0	101	64	37
TOTAL, COAL BED			101	23	3	1	127	86	46
TOTAL, TOWNSHIP			101	23	45	2	171	99	70
27N 7E	Colchester	28 - 42	0	0	25	0	25	1	23
	Danville	28 - 42	0	0	5	0	5	0	5
TOTAL, TOWNSHIP			0	0	30	0	30	1	29
28N 5E	Colchester	28 - 42	0	0	87	2	89	0	87
	Danville	28 - 42	0	0	60	2	62	0	60
TOTAL, TOWNSHIP			0	0	147	4	151	0	147
28N 4E	Colchester	28 - 42	0	0	66	0	67	0	66
	Danville	28 - 42	0	0	5	0	5	0	5
		42 - 54	0	7	0	0	7	0	7
TOTAL, COAL BED			0	7	5	0	12	0	12
TOTAL, TOWNSHIP			0	7	71	0	79	0	79
28N 5E	Colchester	28 - 42	0	0	78	19	96	19	58
	Herrin	28 - 42	0	0	2	0	3	0	2
	Danville	28 - 42	0	0	27	3	30	15	12
		42 - 54	0	77	0	20	97	18	59
TOTAL, COAL BED			0	77	27	23	127	33	71
TOTAL, TOWNSHIP			0	77	107	42	227	52	132

Location	Coal	Coal thickness (in.)	Development potential: High	Moderate	Low	Restricted	Total	Class I	Class II
LIVINGSTON COUNTY (Continued)									
28N 6E	Colchester	28 - 42	0	0	45	0	45	1	44
	Herrin	28 - 42	0	0	1	0	1	0	1
	Danville	28 - 42	0	0	18	0	18	4	14
		42 - 54	0	20	0	0	20	5	15
TOTAL, COAL BED			0	20	18	0	38	9	29
TOTAL, TOWNSHIP			0	20	64	0	84	11	73
28N 7E	Colchester	28 - 42	0	0	79	1	80	1	78
TOTAL, TOWNSHIP			0	0	79	1	80	1	78
28N 8E	Colchester	28 - 42	0	0	27	0	27	0	27
TOTAL, TOWNSHIP			0	0	27	0	27	0	27
29N 3E	Colchester	28 - 42	0	0	30	0	30	4	26
	Danville	28 - 42	0	0	2	0	2	0	2
TOTAL, TOWNSHIP			0	0	32	0	32	4	28
29N 4E	Colchester	28 - 42	0	0	46	0	46	0	46
	Danville	28 - 42	0	0	9	0	9	0	9
		42 - 54	12	0	0	0	12	0	12
TOTAL, COAL BED			12	0	9	0	21	0	21
TOTAL, TOWNSHIP			23	0	56	0	68	0	68
29N 5E	Colchester	28 - 42	0	0	101	1	102	0	101
	Danville	28 - 42	0	0	50	1	51	0	50
		42 - 54	0	35	0	0	35	0	35
TOTAL, COAL BED			0	35	50	1	86	0	85
TOTAL, TOWNSHIP			0	35	152	2	189	0	187
29N 6E	Colchester	28 - 42	0	0	36	6	42	0	36
	Danville	28 - 42	0	0	32	1	33	0	32
TOTAL, TOWNSHIP			0	0	68	7	75	0	68
29N 7E	Colchester	28 - 42	0	0	21	0	21	0	21
TOTAL, TOWNSHIP			0	0	21	0	21	0	21
29N 8E	Colchester	28 - 42	0	0	67	0	67	4	63
TOTAL, TOWNSHIP			0	0	67	0	67	4	63
30N 3E	Colchester	28 - 42	0	0	4	0	4	4	0
TOTAL, TOWNSHIP			0	0	4	0	4	4	0
30N 4E	Herrin	28 - 42	0	0	16	0	16	0	16
		42 - 54	0	4	0	0	4	0	4
	Danville	28 - 42	0	0	2	0	2	0	2
TOTAL, TOWNSHIP			0	4	18	0	22	0	22
30N 5E	Colchester	28 - 42	0	0	85	0	85	0	85
	Herrin	28 - 42	0	0	9	0	9	0	9
	Danville	28 - 42	0	0	3	0	3	0	3
TOTAL, TOWNSHIP			0	0	97	0	97	0	97

Appendix C (continued)

Location	Coal	Coal thickness (in.)	Development potential High	Moderate	Low	Restricted	Total	Class I	Class II
LIVINGSTON COUNTY									
34N 5E	Colchester	28 - 42	0	0	3	0	3	3	0
TOTAL, TOWNSHIP			0	0	3	0	3	3	0
TOTAL BY COAL									
	Colchester	28 - 42	0	0	820	65	885	640	180
		42 - 54	0	156	0	22	178	154	1
		54 - 66	2	1	0	0	3	3	0
TOTAL, COAL BED			2	157	820	88	1,066	797	181
	Herrin	28 - 42	0	0	78	18	96	75	3
		42 - 54	0	8	0	7	15	8	0
		54 - 66	3	0	0	5	8	3	0
		66 - 78	1	0	0	2	3	1	0
TOTAL, COAL BED			4	8	78	32	121	86	3
	Danville	28 - 42	0	0	160	21	181	137	24
		42 - 54	0	171	0	18	189	153	18
		54 - 66	1	0	0	7	8	1	0
TOTAL, COAL BED			1	171	160	46	379	291	41
TOTAL, COUNTY			7	335	1,058	166	1,565	1,174	225
25N 6E	Colchester	28 - 42	0	0	58	0	58	0	58
	Herrin	28 - 42	0	0	1	0	1	0	1
	Danville	42 - 54	0	21	0	0	21	0	21
		54 - 66	103	0	0	0	103	0	103
TOTAL, COAL BED			103	21	0	0	124	0	124
TOTAL, TOWNSHIP			103	21	60	0	184	0	184
25N 7E	Colchester	28 - 42	0	0	53	1	54	0	53
	Danville	28 - 42	0	0	6	0	7	0	6
		42 - 54	0	13	0	0	14	0	13
TOTAL, COAL BED			0	13	6	0	21	0	19
TOTAL, TOWNSHIP			0	13	60	1	74	0	73
25N 8E	Colchester	28 - 42	0	0	15	0	15	0	15
TOTAL, TOWNSHIP			0	0	15	0	15	0	15
26N 6E	Colchester	28 - 42	0	0	37	8	44	14	22
	Danville	28 - 42	0	0	22	1	23	11	10
		42 - 54	0	42	0	6	47	7	34
		54 - 66	100	0	0	6	106	35	65
TOTAL, COAL BED			100	42	22	13	177	54	109
TOTAL, TOWNSHIP			100	42	59	21	221	69	132
26N 7E	Colchester	28 - 42	0	0	10	0	10	1	9
	Danville	28 - 42	0	0	12	0	10	1	11
		42 - 54	0	2	0	0	2	0	2
TOTAL, COAL BED			0	2	12	0	12	1	13
TOTAL, TOWNSHIP			0	2	21	0	24	2	22
26N 8E	Colchester	28 - 42	0	0	27	0	27	0	27
TOTAL, TOWNSHIP			0	0	27	0	27	0	27

Appendix C *(continued)*

Location	Coal	Coal thickness (in.)	Development potential				Total	Class I	Class II
			High	Moderate	Low	Restricted			
LIVINGSTON COUNTY (Continued)									
30N 6E	Colchester	28 - 42	0	0	52	2	53	2	50
		42 - 54	0	36	0	0	36	0	36
TOTAL, COAL BED			0	36	52	2	89	2	86
	Danville	28 - 42	0	0	7	0	7	0	7
TOTAL, TOWNSHIP			0	36	59	2	96	2	93
30N 7E	Colchester	28 - 42	0	0	37	4	41	16	20
TOTAL, TOWNSHIP			0	0	37	4	41	16	20
30N 8E	Colchester	28 - 42	0	0	99	0	99	74	25
TOTAL, TOWNSHIP			0	0	99	0	99	74	25
TOTAL BY COAL									
	Colchester	28 - 42	0	0	1,405	51	1,456	160	1,244
		42 - 54	0	36	0	0	36	0	36
TOTAL, COAL BED			0	36	1,405	51	1,492	160	1,280
	Herrin	28 - 42	0	0	34	0	35	0	34
		42 - 54	0	4	0	0	4	0	4
	Danville	28 - 42	0	0	367	12	379	33	334
		42 - 54	12	383	0	32	428	46	350
		54 - 66	403	0	0	7	410	99	303
TOTAL, COAL BED			415	383	367	51	1,216	178	988
TOTAL, COUNTY			415	423	1,806	102	2,747	338	2,306
TOTAL ALL COUNTIES			422	774	3,323	281	4,801	1,751	2,768

APPENDIX D

Chemical analyses of coal samples

Table D-1
Mine and county averages of proximate and ultimate analyses for Grundy County, Colchester (No. 2) Coal Member.

Location				As received												
				Proximate				Ultimate								
Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
14-31N-8E	Chicago, Wilmington, and Vermilion/No. 1	5375-76-78 (3)	1912[a]	16.3	38.5	40.5	4.7	2.2					11,390	2.6	12,050	
36-31N-8E	University of Chicago Field Museum	C-17299-1 Core Channel sample	1971[b]	12.9	39.8	39.9	7.4	4.2					11,399	4.9	12,480	.22
5-32N-8E	Wilmington Star Mining Co.	5373-4-5 (3)	1912[a]	16.0	39.3	38.5	6.2	2.8					11,100	3.3	11,940	
26-33N-8E	Big 4 Wilmington Coal Co./ Mine No. 6	5367-8-9 (3)	1912[a]	19.5	37.6	38.0	4.9	2.0					10,820	2.6	11,460	
34-34N-7E	Morris Coal & Mining Co.	C-946 Composite of 3	1934[a]	16.6	34.2	41.7	7.5	3.8	6.0	59.5	1.0	22.2	10,860	4.5	11,880	
Average				16.3	37.9	39.7	6.1	3.0	6.0	59.5	1.0	22.2	11,114	3.6	11,962	.22

[a] From Cady (1935)
[b] From unpublished ISGS chemical analyses

Table D-2
Mine and county averages of proximate and ultimate analyses for Grundy County, Houchin Creek (No. 4) Coal Member.

Location				As received												
				Proximate				Ultimate								
Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
13-31-8E	Peabody Coal Co./ Northern Ill. Mine	C-5712, C-16564 Average of 2 composites	1948[b], 1970[a]	11.5	39.8	39.7	8.9	3.1	5.9	62.8	1.2	18.2	11,412	3.5	12,695	.04
25-31N-8E	Clark City Wilmington/ Clark City Mine	C-2131 Composite of 2	1939[b]	13.0	41.8	40.0	5.2	2.8	6.3	65.3	1.0	19.3	11,822	3.2	12,584	
36-31N-8E	University of Chicago	C-17298 Core	1971[b]	9.5	41.6	38.8	10.1	3.2					11,550	3.5	13,042	.12
Average				11.3	41.1	39.5	8.1	3.0	6.1	64.0	1.1	18.7	11,595	3.4	12,774	.08

[a] From Cady (1948)
[b] From unpublished ISGS chemical analyses

Table D-3
Mine and county averages of proximate and ultimate analyses for Grundy County, Herrin (No. 6) Coal Member.

Location				As received												
				Proximate				Ultimate								
Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
23-32N-6E	Wright Brothers/No. 1 Verona Mine	86302-03, C-148 Composite of 2	1932[a]	14.0	36.4	38.9	10.7	3.9	5.8	58.4	.9	20.3	10,770	4.6	12,250	

[a] From Cady (1948)

Table D-4

Mine and county averages of proximate and ultimate analyses for La Salle County, Colchester (No. 2) Coal Member.

Location				As received												
				Proximate				Ultimate								
Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
18-29N-2E	Rutland Coal Co./ Rutland Mine	10263-64 (2)	1917[a]	12.4	39.4	41.3	6.9	2.6					11,780	3.0	12,790	
14-30N-2E	Northern Illinois Gas/ Hole #S-113	C-13031 Core	1963[c]	6.2	38.8	39.9	15.1	8.6					11,411	9.1	13,906	
15-30N-2E	Northern Illinois Gas/ Hole #S-117	C-12901 Core	1963[c]	9.3	41.8	43.7	5.2	1.8					12,746	2.0	13,553	.12
24-30N-2E	Northern Illinois Gas/ Hole #S-91	C-12350 Core	1962[c]	4.7	44.7	38.9	11.7	5.2	5.6	66.4	1.0	10.1	12,275	5.5	14,218	.11
34-30N-2E	Northern Illinois Gas/ Hole #S-118	C-12960 Core	1963[c]	9.0	40.5	38.4	12.1	5.1					11,310	5.6	13,143	.04
4-32N-1E-4	La Salle County Carbon Coal Co./Cedar Point No. 5 Mine	84453 Composite of 3	1912[a]	14.7	34.8	42.4	8.1	3.4	5.8	61.5	1.0	20.2	11,040	4.0	12,160	
15-33N-1E	La Salle Carbon Coal Co./ La Salle #1 Mine	5306-7-11 (3)	1912[a]	15.1	39.7	37.0	8.2	3.3					10,900	3.9	12,020	
16-33N-1E	Peru Deep Vein Coal Co./ Mine No. 3	BM A51404-5-6 (3)	1929[a]	12.7	37.8	40.6	8.9	3.5					11,260	4.0	12,530	
25-33N-1E	Oglesby Coal Co./ Oglesby Mine	5388-89-90 (3)	1912[a]	14.6	39.9	37.0	8.5	4.0					10,900	4.7	12,090	
14-33N-2E	Osage Coal Co./ Osage Mine No. 1	C-2306 Composite of 2	1940	12.0	40.6	39.7	7.7	6.0	6.0	61.8	.9	17.6	11,540	6.8	12,720	
30-33N-2E	Illinois Zinc Co./ Black Hallow Mine	5351-2-3 (3)	1912[a]	17.5	39.0	34.5	9.0	3.2					10,390	3.8	11,560	
9-33N-3E	Illinois Valley Minerals Coop. Strip Pit	C-10778	1958[c]	15.3	35.3	38.9	10.5	4.8					10,667	5.6	12,120	
8-33N-4E	McElwain Coal Co.	C-2309 Composite of 2	1940[b]	14.2	36.2	39.5	10.1	7.1	5.7	57.9	1.0	18.2	10,780	8.3	12,240	
Average				12.1	39.1	39.4	9.4	4.5	5.8	61.9	1.0	16.5	11,308	5.1	12,696	.1

[a] From Cady (1935)
[b] From Cady (1948)
[c] From unpublished ISGS chemical analyses

Table D-5

Mine and county averages of proximate and ultimate analyses for La Salle County, Herrin (No. 6) Coal Member.

Location				As received												
				Proximate				Ultimate								
Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
3-31N-3E	French Coal Co./ Mine No. 2	C-872 Composite of 3	1934[a]	12.8	38.2	39.5	9.5	3.6	5.8	61.1	1.0	19.0	11,150	4.2	12,500	
24-31N-3E	Chicago, Wilmington, and Vermilion Coal Co./ Mine No. 3	5414-16-17 (3)	1912[a]	13.6	40.9	37.8	7.7	3.7					11,350	4.3	12,460	
14-33N-1E	Mathiesser & Hegeler/ M & H Mine	5391-2-3 (3)	1912[a]	14.8	41.3	34.3	9.6	3.4					10,670	4.0	11,980	
Average				13.7	40.1	37.2	8.9	3.6	5.8	61.1	1.0	19.0	11,056	4.2	12,310	

[a] From Cady (1935)

Table D-6
Mine and county averages of proximate and ultimate analyses for Livingston County, Danville (No. 7) Coal Member.

Location Section, Township, Range	Company and mine name	Laboratory number (number of samples)	Date	As received: Proximate: Moisture	Volatile Matter	Fixed Carbon	Ash	Ultimate: Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Btu/lb	Sulfur, moisture free	Btu/lb moist, mineral free	Chlorine, moisture free
5-26N-6E	Fairbury Coal Co./ West No. 1	10520-21-22 Average of 3 samples	1918[a]	13.8	35.8	38.9	11.5	3.2					10,850	3.7	12,460	
11-26N-6E	Fairbury Cooperative Coal Co./Fairbury Mine	A-90315 Composite of 3 samples		12.5	33.9	39.1	14.5	3.2	5.5	59.1	.9	16.8	10,630	3.7	12,678	
9-27N-6E	Northern Illinois Gas Co./ Drill Hole #PON-63	C-13613 Core	1964[b]	12.2	33.6	42.5	11.7	5.4	5.3	61.2	1.4	14.9	11,055	6.2	12,780	.08
15-28N-5E	Pontiac Coal Mining Co./ Mine No. 1	10519-23-24 Average of 3 samples	1918[c]	9.4	35.7	41.1	13.8	4.7					11,258	5.2	13,360	
Average				12.0	34.7	40.4	12.9	4.1	5.4	60.1	1.1	15.8	10,948	4.7	12,819	.08

[a] From Clegg (1972)
[b] From unpublished ISGS chemical analyses
[c] From Cady (1935)