PRELIMINARY REPORT ON COAL STRIPPING POSSIBILITIES IN ILLINOIS

BY

HAROLD E. CULVER

ILLINOIS MINING INVESTIGATIONS

Prepared under a cooperative agreement between the Illinois State Geological Survey Division, the Engineering Experiment Station of the University of Illinois and the U. S. Bureau of Mines

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS

1925
The Forty-seventh General Assembly of the State of Illinois, with a view of conserving the lives of the mine workers and the mineral resources of the State, authorized an investigation of the coal resources and mining practices of Illinois by the Department of Mining Engineering of the University of Illinois and the State Geological Survey Division in cooperation with the United States Bureau of Mines. A cooperative agreement was approved by the Secretary of the Interior and by representatives of the State of Illinois.

The direction of this investigation is vested in the Director of the United States Bureau of Mines, the Chief of the State Geological Survey Division, and the Director, Engineering Experiment Station, University of Illinois, who jointly determined the methods to be employed in the conduct of the work and exercise general editorial supervision over the publication of the results, but each party to the agreement directs the work of its agents in carrying on the investigation thus mutually agreed on.

The reports of the investigation are issued in the form of bulletins, either by the State Geological Survey Division, the Engineering Experiment Station, University of Illinois, or the United States Bureau of Mines. For copies of the bulletins issued by the State Geological Survey Division, address State Geological Survey Division, Urbana, Illinois; for those issued by the Engineering Station, address Engineering Station, University of Illinois, Urbana, Illinois; and for those issued by the U. S. Bureau of Mines, address Director, U. S. Bureau of Mines, Washington, D. C. (See list at end of book.)
Preliminary Report on Coal Stripping Possibilities in Illinois

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Urbana, Illinois

1925
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A PRELIMINARY REPORT ON COAL STRIPPING POSSIBILITIES IN ILLINOIS

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INTRODUCTION

General Statement

There has been an increased interest the past year in the stripping method of mining coal in Illinois. The depression in the coal industry in this State, resulting from higher production costs than in some other states, has stimulated operators to turn to this less expensive method of mining. The present compilation of data has been made in response to many requests for information which will aid in the search for strip coal land. This brief and generalized statement of all information now available will serve to show what areas of the State are likely to reward careful prospecting, and at the same time indicate those portions in which there is little likelihood of any commercially important deposits being found. By implication, furthermore, the relative importance of stripping in the coal industry of the State is suggested.

The interest of the public in the quality of coal purchased has emphasized the importance of the relative heating value of strip coal and deep mine coal. For several reasons, chief of which were the extreme shallowness of coal stripped for the market and the lack of care in preparation before present methods were in use, coal obtained by stripping has had a reputation for being wet, dirty, "sooty", high in ash content and low in heating value. With the development of larger stripping machinery and improvements in methods of operation, those features which produced a prejudice against strip coal have been largely removed, and the buying public is finding that coal so obtained is wholly adequate and satisfactory.

Early Coal Stripping in Illinois

As early as 1866, a strip mine was opened on Grape Creek in Vermilion County, and about nine years later another pit was in operation in the Danville bed in the same county. In the meantime, stripping of the Rock Island coal was carried on along Rock River in Henry County. The procedure in all these cases was very simple as no
specially designed machinery was used. The surface covering was loosened with a plow and removed with a scraper, and the coal was mined entirely by hand.

A little later, operations were begun in the Mission field in the Danville region. Coal was uncovered by use of a modified dredge, but it was not until about 1890 that any coal was mined and loaded mechanically. Great difficulty was encountered in handling the surface material economically, and modification of the early types of machines appeared in rapid succession. After many failures and moderate successes, the essential features of a successful operation were worked out, and since then the development has been one mainly of dimension. Thinner coal beds and heavier overburden have been successively undertaken, until at the present time coals are being stripped at a profit which a few years ago would have been considered unavailable on any system of mining.

**Present Extent of Coal Stripping in Illinois**

In spite of the large number of attempts at strip mining that have been recorded in this State, at no time have there been many operations carried on simultaneously. In recent years, the number has somewhat increased, and the latest report of the Department of Mines and Minerals\(^1\) lists a total of eighteen pits.

Table 1 shows that stripping was confined to six counties: Fulton, Jackson, Perry, Saline, Vermilion, and Williamson. The total tonnage so mined, 1,503,541 tons, was only 217,373 tons more than was produced in the same period by a single deep mine in the State. Stripping is as yet a relatively unimportant factor in the coal industry of the State.

The restriction, prior to 1924, of these operations to three coal beds in as many counties is readily understood, when it is remembered that throughout the experimental stage it was necessary that the trials be made where conditions were fairly well known. This was essential not only from the standpoint of operation, but also from that of marketing. With increased stability of the stripping business has come a demand for increased opportunity for stripping, which means the search for and development of new territory, and involves new coal beds as well as extended markets.

**Acknowledgments**

The preparation of material for this report has been materially aided by the uniformly able and courteous assistance given by the

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\(^1\)Annual coal report of Illinois: Dept. of Mines and Minerals, p. 75, 1924.
operators of strip pits all over the State. In compiling available data, the author has drawn freely upon earlier published work, and has had the benefit of hearty cooperation of his colleagues on the Survey staff whose field work has involved some study of the Pennsylvanian beds. The author gratefully acknowledges the competent work of his assistant, Paul T. Post, in gathering information on the present operations.

Table 1.—Illinois strip mines producing during fiscal year 1293-24

<table>
<thead>
<tr>
<th>Company</th>
<th>County</th>
<th>Production (Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 *Tiger Coal Mining Company</td>
<td>Fulton</td>
<td>3,525</td>
</tr>
<tr>
<td>2 *United Electric Coal Co., No. 9</td>
<td>Fulton</td>
<td>51,950</td>
</tr>
<tr>
<td>3 *Buckheart Coal Company</td>
<td>Fulton</td>
<td>5,276</td>
</tr>
<tr>
<td>4 *Black Servant Coal Company</td>
<td>Jackson</td>
<td>171,845</td>
</tr>
<tr>
<td>5 Scott-Smith Coal Company</td>
<td>Perry</td>
<td>112,100</td>
</tr>
<tr>
<td>6 **Gayle Coal Company</td>
<td>Perry</td>
<td></td>
</tr>
<tr>
<td>7 *Harrisburg Coal Mining Co.</td>
<td>Saline</td>
<td>216,978</td>
</tr>
<tr>
<td>8 Yankee Branch Coal Company</td>
<td>Vermilion</td>
<td>38,045</td>
</tr>
<tr>
<td>9 Chicago Collieries Company</td>
<td>Vermilion</td>
<td>163,303</td>
</tr>
<tr>
<td>10 I. and I. Coal Company</td>
<td>Vermilion</td>
<td>3,800</td>
</tr>
<tr>
<td>11 United Electric Coal Co., No. 1</td>
<td>Vermilion</td>
<td>205,487</td>
</tr>
<tr>
<td>12 United Electric Coal Co., No. 4</td>
<td>Vermilion</td>
<td>130,297</td>
</tr>
<tr>
<td>13 United Electric Coal Co., No. 5</td>
<td>Vermilion</td>
<td>121,896</td>
</tr>
<tr>
<td>14 *Coal Belt Coal Company</td>
<td>Williamson</td>
<td>15,366</td>
</tr>
<tr>
<td>15 Mammoth Coal Company</td>
<td>Williamson</td>
<td>29,271</td>
</tr>
<tr>
<td>16 *Prosperity Coal Co., No. 1</td>
<td>Williamson</td>
<td>3,698</td>
</tr>
<tr>
<td>17 *Prosperity Coal Co., No. 2</td>
<td>Williamson</td>
<td>5,704</td>
</tr>
<tr>
<td>18 *Quaker Mining Company, No. 1</td>
<td>Williamson</td>
<td>105,000</td>
</tr>
<tr>
<td>19 *Quaker Mining Company, Fuel mine</td>
<td>Williamson</td>
<td>120,000</td>
</tr>
<tr>
<td>20 **Pyramid Coal Company</td>
<td>Williamson</td>
<td></td>
</tr>
</tbody>
</table>

Total strip coal production: 1,503,541

* Not producing prior to June 30, 1923.
** Not producing prior to June 30, 1924.

IMPORTANT FEATURES OF STRIP COAL LAND

In estimating the value of a given area for stripping purposes, it is necessary to consider several factors other than the presence of the bed of coal. The more important of these features are noted below, but it should be recognized that none of them can be considered separately, since in actual operations they interact. Thus, exceptionally favorable features of one sort offset unfavorable features of another, and alter the otherwise standard specifications.
Thickmess and Quality of the Coal

No absolute figure for a minimum thickness of the coal bed which may be profitably stripped can be given, since the quality of the coal, the impurities in the bed, and the amount of cover, as well as other features are important factors. A commonly accepted minimum is 48 inches for a commercial operation, but other factors may considerably reduce this in certain cases. It should not be assumed, however, that the coal will necessarily be thicker farther under cover than it appears to be at the outcrop. A safe rule is to test thoroughly by drill, auger or test pit, so that the average thickness of the bed will be known. As to quality, no definite limits can be set, other than the demands of the prospective market. The cost of production in a given instance may be so low as to offset the inferior rank of a given coal, and thus make operation commercially practicable. It is best to ascertain the actual quality of the coal by standard methods.

Thickmess and Character of Overburden

The mere figure of thickness of overburden is not adequate for accurate estimation of the value of a given tract, but the thickness should nevertheless be carefully measured. For any given field, where quality of coal and market conditions are established, there is usually a fairly definite ratio of thickness of coal to thickness of cover, beyond which it is unsafe to venture. In some areas, this ratio is as low as 1 to 3. Elsewhere, it is considered practicable to attempt 1 to 12. It is clear that the character of the overburden is just as important as the thickness and that the matter is complicated by several factors. Even though soft, unconsolidated material is most easily removed, it frequently happens that coal of better grade is found beneath more resistant strata, the difference in market value of the coal more than offsetting the increased cost of stripping. Again, if the thickness of cover is great, the loose material may slump from the spoil-bank and have to be rehandled at least once, thus greatly increasing the cost.

In early stripping operations, it was considered that the presence of hard beds such as massive sandy shale, black “slate”, sandstone, and limestone, precluded the possibility of successful stripping. More recent work has demonstrated that the shale and “slate” do not seriously interfere with operations, and in places, even a 5-foot bed of massive limestone has been handled satisfactorily after shooting. In this connection, it may be noted that the presence of 10 or 12 feet of softer material beneath a hard limestone stratum greatly facilitates its removal, so that 5 feet of limestone at a sufficient interval above the coal is easier to remove than 2 feet of limestone capping the coal bed.
In Illinois, the large and increasing demand for agricultural limestone has led to a consideration of the crushing of the limestone occurring over coal in some strip pits. In most instances, the limestone is entirely suitable for agricultural purposes, and since it must be handled anyway, the operators would do well to consider seriously the utilization of this by-product of coal stripping. At least one pit organization has arranged to market the stone thus obtained.

**Percentage Recovered by Stripping**

Given the size of the tract from which cover can be removed profitably and the thickness of the bed of coal, the calculation of the actual amount of coal in the tract can easily be made, as an acre-foot of coal in the ground weighs about 1,770 tons. This figure does not, however, give the amount of coal that will be produced in the stripping for there are many factors to interfere with complete recovery. A loss of only five per cent is obtainable under exceptionally favorable conditions, but 90 per cent recovery is a safer factor for the calculation of reserves.

**Transportation and Market**

For a stripping operation of any size, the market situation must be fairly well canvassed with respect to a reasonably continuous demand for coal of the rank which can be produced. The matter of transportation also becomes of added importance. For small operations, the market situation can be estimated readily, since the production will be disposed of to domestic consumers. Transportation in such instances is largely outside the problem, as most of the coal is sold at the tipple.

For moderate operations, team or truck service must be planned, with highways suited to such heavy traffic in any weather. For larger operations, proximity to an established public carrier is important. A given tract might be commercially valuable if close to a freight line, and be useless ten miles away because of the increase in cost of production resulting from the demand for greater power, larger equipment, and more labor.

**Possible Strip Coal Areas in Illinois**

**General Statement**

Because so large a part of the enormous coal reserves of the State are readily accessible to underground mining, it might be expected that
Fig. 1. Map of Illinois showing locations of possible stripping areas. The solid lines within the boundary of the Pennsylvanian system represent the line of outcrop of the several coal beds.
strip mining would be practicable in most of the counties which are underlain by workable coal beds. On the contrary, only a small fraction of the total coal area is open to stripping, and this part does not contain its proportionate fraction of the total reserves, because of the concentration of the larger reserves in the deeper parts of the field.

**Geology of the Illinois Coal Field**

**General Structure of the Pennsylvanian System**

The great mass of rocks comprising the Pennsylvanian system fills a very broad and shallow depression south of the latitude of Rock Island, Rock Island County (fig. 1). Although the upper surface of the Pennsylvanian rocks is nearly flat, the lower surface slopes from the margin toward the deepest part of the basin. This gives a plano-convex lens shape to the system as a whole, with the greatest thickness of the beds where the basin is deepest. This deepest part is not situated in the center of the field, but is well to the southeast in Wayne County, making the basin unsymmetrical. Folding may have altered the angle of slope in some places, but in general, the beds show the low inclination acquired during the period of deposition and later consolidation. The ultimate effect has been to produce belts parallel to the margin of the field in which the gently inclined beds of coal are so lightly covered as to be available for stripping. The outer limit of these belts is indicated by the line of outerrop of the several coal beds (fig. 1). The width of the belts is obviously dependent upon the angle of slope of the strata, wider where the angle is low and narrower where it is high.

**Vertical Range of the Coal Beds**

Neither the uppermost nor the lowermost portions of the Pennsylvanian in this State include the commercially important beds of coal. The thicker and more extensive beds are restricted to a 500-foot section approximately in the middle of the Pennsylvanian system. For this reason, the width of the marginal belts mentioned above is greatly restricted, and on the outer side of the belts, as well as on the side toward the interior of the basin, there are extensive areas in which stripping will not be important because of the absence of suitable coal beds. As the most favorable site for stripping is along the outer edge of beds now worked by underground methods, the introduction of open pit mining does not necessarily involve the utilization of any beds not now exploited. It will, however, serve to increase the total production of coal from these beds by extraction from the portions which are too shallow for deep mining. The inner limit of
the stripping belt practically coincides with the outer limit of deep mining. In a general way, the areas available for strip mining will be found in a zone marginal to the present producing fields.

COAL BEDS ABOVE OR BELOW THE MIDDLE SECTION

In addition to the main producing districts of the State, there are numerous small areas which are known to be underlain by thin coal at shallow depths. Although most of these areas are small, the total acreage involved is appreciable. Occurrences of such beds in the lower part of the Pennsylvanian system are known, for example, in Saline County, south of the line of outcrop of the Harrisburg coal, the main producing bed of the district. In the upper part of the Pennsylvanian also are several thin coals, which in general are found in the interior of the field, as in Effingham and Crawford counties.

Where known to lie at shallow depths, these beds are mainly too thin to be valuable, so that no great importance may be attached to them on the basis of present data. As most coal testing has been confined to the immediate vicinity of the producing mines, it appears probable that an equal amount of drilling in these areas of shallow thin coal will reveal the presence of thicker portions not now known.

EROSION ALONG STREAM VALLEYS

Many Illinois streams flow through wide bottom valleys, somewhat below the general level of the surrounding region. Where such drainage lines cross areas underlain by workable coals, the overburden has been removed to a greater or less extent. The maximum depth of excavation is more than 100 feet in places, but along most streams it is less. The removal of even 20 feet might bring a deeply buried coal bed within the range of stripping operations. Such conditions are known in the vicinity of many drift and slope mines in which part of the workings have been abandoned on account of poor roof beneath drainage lines.

Much of the early stripping in Illinois was done in areas of this type, as in northern Henry County, where erosion by Rock River has reduced the very thick cover to less than 10 feet, so that the Rock Island coal could be stripped cheaply by team and hand scraper. In the Carterville field of Williamson County, and particularly in the Danville field of Vermilion County, operators have been quick to take advantage of the partial elimination of overburden in stream valleys. In places the operations have been continued to an extent that demanded a shifting of positions of stream channels. No careful esti-
mate has been made of the acreage which has been added in this way to the areas available for stripping. However important in the location of a single strip pit, it is clear that this factor is of minor importance in affecting the production of the field as a whole.

**AREAS OF POCKET COAL**

Outside the margin of the extensive swamp areas which were the site of deposition of the more widespread coal beds of the Illinois basin, there appear to have been many similar but smaller depressions in which coal-forming matter accumulated. This marginal deposition gave rise to scores of disconnected pockets of coal of variable thickness and shape. Because of the conditions under which they were laid down, these beds do not show uniform composition but are as variable in their content of impurities as in their shape. The present western edge of the Illinois field coincides roughly with this old marginal zone, and hence this region is characterized by coals that are irregular both in extent and composition. It is to be expected, therefore, that in much of the large area in which coal is known to be present at shallow depth, it will be found to be too thin or too impure to be commercially valuable.

This situation is especially well illustrated in that part of the coal basin lying west of the Illinois, but it may also be found to obtain in other parts of the State as well. On this account the available stripping area may be reduced by an unknown but appreciable amount.

**GLACIAL DRIFT**

The deposits of sand, gravel, and boulder clay which mantle practically all of the coal field, add greatly to the complexity of the problems of open pit mining. Perhaps the most important effect is in the addition to the amount of overburden, making unavailable some coal that otherwise could be stripped. This is especially true throughout the northern part of the field where the thickness of the surficial material is excessive, in some places reaching a maximum of 200 feet. A second effect is the concealment of bed rock relations, necessitating extensive drilling to ascertain the presence or absence of the coal, the total overburden and the amount of included bed rock.

In addition, although the drift materials are commonly unconsolidated, and hence easily removed, their occurrence in excessive thicknesses makes them difficult to handle in wet weather because of the tendency to slump from the spoilbank into the open cut.
Estimation of Available Area and Tonnage

In a consideration of the areas which are here suggested as possible strip coal lands, it should be remembered that the data on which the suggestions are based are very incomplete. No special field work has been done on which an estimate of the availability of coal land for stripping could be based, and it has therefore been necessary to make use of data gathered largely as an incidental phase of other studies. These include topographic maps, records of outcrops, well logs, mine workings, and similar material, from which both thickness of any given coal and its depth below the surface may be calculated.

On figure 1 are indicated approximately the stripping areas in the State, to show the relation of the fields to each other, and to the rest of the State. Accompanying the detailed discussion of each county is presented a larger scale map showing the position of possible strip lands in greater detail. It is clear that areas mapped as possible strip lands are those which available data indicate as worthy of test. It is to be expected that some portions of these areas will be found to contain coal or overburden of such thickness as to make commercial operations impracticable. Additional areas not now known will presumably be found as the search for strip land progresses. The boundaries of areas indicated are necessarily generalized and subject to revision as more accurate data become available. Similarly, the thickness of coal and the amount of overburden are calculated from present information, and are subject to corrections for the areas less well known. Because of these features, the estimation of tonnage available by stripping as presented in Table 2 is necessarily an approximation. The figures are included only in order to give some idea of the amount of coal for any given field. It should be noted that this calculation is based on a recovery of 100 per cent of the coal, as the variations from this figure due to local geologic conditions or methods of mining can not well be calculated in advance of actual operations.

The total available tonnage of strip coal in Illinois has been estimated to be 1,407 million tons from an area of 287 square miles. It has also been estimated that 197 square miles are underlain by strip coal 48 or more inches thick and can supply 1,137 million tons of strip coal. Of the original coal resources in Illinois—137,000 million tons, 1.02 per cent represents the estimated stripping resources.

Chemical Composition of Strip Coal

As noted earlier in this report, strip coal has long had a reputation for its high content of impurities. It is obvious that coal exposed
to weathering agencies deteriorates both in composition and appearance. The more readily volatilized constituents are lost to the air, or oxidized through the action of percolating water; the pyrite which always is present in coal beds is decomposed and the resulting iron oxide is scattered through the bed as a rusty stain which detracts materially from the appearance of the coal and which can not be removed as the unweathered pyrite could.

Coal overlain by a thin mantle of glacial drift is likely to have the character of weathered coal. The earlier stripping done in this

Table 2.—Estimate of stripping resources in Illinois

<table>
<thead>
<tr>
<th>County</th>
<th>Thickness</th>
<th>Area</th>
<th>Tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inches</td>
<td>Sq. mi.</td>
<td>Millions of tons</td>
</tr>
<tr>
<td>Adams</td>
<td>30</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Brown</td>
<td>24</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Fulton, Springfield (No. 5) bed</td>
<td>48</td>
<td>60</td>
<td>272</td>
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<tr>
<td>Fulton, Colchester (No. 2) bed</td>
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<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Gallatin</td>
<td>72</td>
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<td>20</td>
</tr>
<tr>
<td>Grundy (including Will)</td>
<td>30</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>Hancock</td>
<td>30</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Knox</td>
<td>72</td>
<td>8</td>
<td>54</td>
</tr>
<tr>
<td>Knox (No estimate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perry</td>
<td>72</td>
<td>35</td>
<td>238</td>
</tr>
<tr>
<td>Randolph</td>
<td>72</td>
<td>19</td>
<td>129</td>
</tr>
<tr>
<td>Richland</td>
<td>24</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Saline, Herrin (No. 6) bed</td>
<td>36</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Saline, Harrisburg (No. 5) bed</td>
<td>60</td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>Schuyler</td>
<td>66</td>
<td>12</td>
<td>74</td>
</tr>
<tr>
<td>St. Clair</td>
<td>60</td>
<td>30</td>
<td>170</td>
</tr>
<tr>
<td>Vermillion, Danville (No. 7) bed</td>
<td>54</td>
<td>10</td>
<td>51</td>
</tr>
<tr>
<td>Vermillion, Grape Creek (No. 6) bed</td>
<td>72</td>
<td>4</td>
<td>27</td>
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<tr>
<td>Wabash</td>
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<td>Warren</td>
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<td>20</td>
<td>56</td>
</tr>
<tr>
<td>Williamson</td>
<td>72</td>
<td>10</td>
<td>68</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>287</strong></td>
<td><strong>1407</strong></td>
<td></td>
</tr>
</tbody>
</table>

State was of coal in just this situation, so that the marketed product was necessarily of lower grade than that from the more deeply buried portions of the bed.

Again, both upper and lower surfaces of the bed of coal are likely to be uneven. Unless the stripping and loading of such a bed be done with extreme care, a considerable admixture of shale, bone coal, and floor clay will probably result. Early stripping, done with inadequate equipment, resulted in the loading of much incombustible material with the coal.
Table 3.—Comparative analyses of strip and deep mine coal from the same bed*

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<tr>
<td>13.79</td>
<td>37.62</td>
<td>39.28</td>
<td>9.31</td>
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<td>10956</td>
<td>43.64</td>
<td>45.56</td>
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<tr>
<td>14.89</td>
<td>35.48</td>
<td>40.75</td>
<td>8.88</td>
<td>3.78</td>
<td>10959</td>
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<td>10.44</td>
<td>4.43</td>
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<td>14.70</td>
<td>5.80</td>
<td>10036</td>
<td>40.50</td>
<td>42.43</td>
<td>17.07</td>
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<td>8.70</td>
<td>3.94</td>
<td>10628</td>
<td>41.71</td>
<td>47.83</td>
<td>10.46</td>
<td>4.74</td>
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<tr>
<td>13.75</td>
<td>35.59</td>
<td>37.38</td>
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<td>2.92</td>
<td>10560</td>
<td>42.42</td>
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<tr>
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<td>3.46</td>
<td>10721</td>
<td>42.04</td>
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<td>Single</td>
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<td>36.69</td>
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<td>10.65</td>
<td>3.00</td>
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<td>41.67</td>
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<td>2.96</td>
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<td>38.89</td>
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<td>44.42</td>
<td>44.54</td>
<td>11.04</td>
<td>3.83</td>
<td>12852</td>
<td>Average of 6</td>
</tr>
</tbody>
</table>

*Figures in italics refer to strip coal.
A thicker cover of drift means greater protection from weathering, resulting in a higher grade of coal. A hard, relatively impermeable boulder clay is obviously a better cover than one of sand and gravel of even greater thickness. Where the overburden includes bed rock, weathering is still further prevented. A stratum of well bedded shale beneath a limestone of moderate thickness makes an especially good cover, as the limestone stratum diverts much of the ground water and the shale transmits but little of the rest of the moisture to the coal.

The large size of present equipment for stripping permits the removal of a much thicker overburden than was formerly possible, and the great strength of the machines now in use allows the handling of the more resistant bed rock. Coal of excellent quality is therefore uncovered in modern pits. With greater care in cleaning the surface of the strip bed, and better control of loading shovels than was formerly possible, the loaded coal may be as clean as that from deep mines. Impurities that are present in all coal beds, such as lenses or balls of pyrite and bands of shale or bone may be as completely eliminated on the picking tables of a strip mine as those of a deep mine. From the geologic point of view, therefore, strip coal is not inherently of poorer quality than deep mine coal.

The analyses in Table 3 which represent face samples of coal, show the composition of coal from strip mines and from deep mines working the same bed. In order to conceal the identity of analyses, it has been necessary to omit the designation of the bed or of the county in which it was sampled. Each pair of analyses, however, is of the same bed, the deep mine sample being chosen from a location as near as possible to that taken from the strip mine. It must be remembered that the samples are of face coal, and hence not exactly indicative of commercial output. Depending on methods and care in mining, the loaded coal will be better or poorer in grade than the face sample. Even casual inspection of the analyses will show that the coal at the face of a strip pit is fairly comparable with that at the face in a deep mine.
COUNTY REPORTS

Adams County

The Adams County coal beds belong to that part of the Illinois field which has been cut off from the main basin by Crooked Creek and Illinois River (fig. 1). The whole series is relatively thin in this area, and the included coals are of comparatively little value.

A small area surrounding the southeast corner of T. 2 N., R. 8 W. lying northeast of the village of Mendon (fig. 2), is known to contain coal which might be stripped. Elsewhere in this county conditions appear to be unfavorable for commercial stripping, although there are small patches where thin coal is so lightly covered that small scale stripping may be possible.

The coal northeast of Mendon has an average thickness of 48 inches, but it is nearly 60 inches at its maximum. The bed is distinctly limited in extent, however, and shows the high content of impurities common to marginal deposits. A measured section shows a 2-inch bone band 8 inches from the top of the bed, and a 2-inch band of shale 28 inches above the sandstone floor.

The original shale roof material has been replaced locally by glacial drift. Over the small area observable, the cover ranges from 2

![Index map of Adams, Brown and Hancock counties.](image-url)
to 30 feet, and probably contains little bed rock. In sec. 36, T. 2 N., R. 8 W., a small stripping operation was producing coal in 1922, but no later reports are available.

**Brown County**

The major portion of the large area of Brown County north and east of McGees Creek is probably underlain by the Colchester or No. 2 coal. Most of this region is so heavily covered however, that it is doubtful if any commercial strip land is included. In two places, one northwest of Mt. Sterling, in T. 1 N., R. 4 W., and the other north of Siloam in T. 2 S., R. 4 W. (fig. 2) local stripping has been attempted, and these points are noted on the map as worthy of investigation.

The coal in either place is about 2 feet in thickness, varying but little over wide areas, and having some impurities but no regular partings. The covering is less than 20 feet thick locally, but it is not known over how large an area such relations obtain. Where thin, the cover is largely glacial drift and the coal relatively soft and weathered. The thicker cover includes varying amounts of bed rock which is mainly sandstone and shale, but which in places includes a massive limestone. In the character of cover, this field resembles Schuyler County to the north.

Over a small area just north of Mt. Sterling, a coal stratigraphically above the Colchester (No. 2), locally called No. 5, has been mined in the past. It is near the surface, the cover along the creeks being thin but including a considerable thickness of bed rock, in part limestone. In outcrops, this coal is less than 2 feet thick and bony, and is not listed among the probable coal resources of the county.

**Clay County**

Described on page 57.

**Edwards County**

Described on page 57.

**Effingham County**

Described on page 57.

**Fulton County**

Fulton County has long been recognized as containing within its boundaries some very desirable stripping areas, but it is only within
the last few years that development on a commercial scale has been attempted. The large scale operations in the vicinity of Cuba will probably be followed by others. The Cuba coal appears to be present throughout a considerable area under approximately the same conditions of cover, thickness of coal and relation to drainage. Part or all of each of the following townships seem to merit some exploratory work:

T. 5 N., Rs. 3 and 4 E.  
T. 6 N., Rs. 2, 3, 4, and 5 E.

T. 7 N., R. 3 E.  
T. 8 N., R. 3 E.

The coal is the Springfield (No. 5) bed, which has long been worked underground in this county, and even more extensively in the counties east and south. The character and general relations of the coal are already well known,\textsuperscript{1,2} leaving only the matter of thickness of bed and thickness and character of overburden to be determined in exploratory work.

The thickness of the coal is remarkably uniform, ranging from 48 to 60 inches wherever measured. The characteristic feature of this bed, namely, the presence of clay-slips or "horsebacks" is of importance in any projected operation. The slips range from a few inches to several feet in width, and are very irregular in distribution, some areas being quite free from them, others, having as many as twelve slips in a distance of 15 feet.

The overburden is extremely variable both in thickness and in character. Throughout the areas indicated in figure 3, the cover is believed to be less than 65 feet, which may be the limit of practicable operation for the thickness of coal uncovered. The size of tracts in which the cover is of uniform thickness depends more on the surface configuration than on any other factor. Where undisturbed by erosion, the common sequence of strata over the No. 5 coal is 2 feet of black laminated shale composing the roof, overlain by limestone less than 1 foot thick, over which lies shale up to 25 feet in thickness with a variable amount of till over the whole. This group of beds is common in the eastern part of the county, but is not uniformly present over the coal farther to the west and south where the interval between the No. 5 and No. 6 coals is locally as small as 8 feet. At points where the interval is small, the shale is commonly replaced by sandstone. In places, the sandstone cuts out the limestone cap of the No. 5 coal. In this connection, it is of importance to note that where the sandstone is of appreciable thickness, the coal bed is essentially free from clay-slips. In such areas the prospective operator of a strip pit

\textsuperscript{1}Savage, T. E., Geology and mineral resources of the Avon and Canton quadrangles: Ill. State Geol. Survey Bull. 43, p. 209, 1922.

\textsuperscript{2}Cady, G. H., Coal resources of District IV: Ill. Min. Inv. Bull. 26, 1921.
must consider the removal of at least 25 feet of hard sandstone, in order to reach a coal that will show few interruptions of the "horseback" type.

The Springfield coal has been stripped in a small way for many years in places where the cover is unusually thin. Within the past three years, however, extensive drilling in the Cuba area has shown the feasibility of pits on commercial scale, and two such pits are being operated in secs. 28 and 29, T. 6 N., R. 3 E. at the present time. One other pit in T. 6 N., R. 4 E. has been reported.

At the time of visit by a Survey representative, the following section of coal and overburden was exposed at the pit in sec. 28, T. 6 N., R. 3 E.:
Section exposed at pit in sec. 28, T. 6 N., R. 3 E.

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and till, with boulders up to 18 inches in diameter;</td>
<td>26</td>
</tr>
<tr>
<td>becomes plastic when wet</td>
<td></td>
</tr>
<tr>
<td>Shale, light gray, not well bedded</td>
<td>4</td>
</tr>
<tr>
<td>Limestone, medium gray, argillaceous, fossiliferous (locally</td>
<td>8</td>
</tr>
<tr>
<td>nearly 2 feet thick)</td>
<td></td>
</tr>
<tr>
<td>Shale, very tough, dark, slaty at base</td>
<td>2</td>
</tr>
<tr>
<td>Coal</td>
<td>4 9</td>
</tr>
<tr>
<td>Underclay, light gray, without grit</td>
<td></td>
</tr>
</tbody>
</table>

The stripping is done by three electric shovels, two with 90-foot booms carrying 6-yard dippers and one with an 80-foot boom carrying an 8-yard dipper. The pit equipment is well shown in figure 4. In operating, the stripping shovel makes a straight cut, the loading tracks being shifted as the stripping shovel returns. The surficial material not removed by the stripping shovel is handled by a shovel gang followed by sweepers. The coal is shot with blasting powder, preparatory to being loaded out by the electric shovels having a dipper capacity of one and three-fourths yards. Haulage from the pit is accomplished by use of locomotives pulling trips of twelve 6-ton cars. A rotary 2-car dump operated by compressed air turns the loads on to a steel conveyor which takes the coal to the tipple for cleaning and sizing. Four loading booms handle the coal from tipple to railway cars.

In addition to the areas above noted in which the Springfield (No. 5) coal lies at shallow depth, there probably are small fields in
the western part of the county in which the Colchester (No. 2) coal is near enough to the surface to be stripped. One of these tracts is in the northwest quarter of T. 7 N., R. 1 E., south of Avon (fig. 3.)

In this field, the Colchester coal has an average thickness of 30 inches, varying but little from that amount over considerable areas. This bed is regularly without partings, and contains only a small amount of impurities. Its thinness obviously prevents its being considered where the overburden averages more than 30 feet in thickness, and it is probably of only local interest as a stripping coal.

The overburden is largely shale, which in places includes some thin black "slate" and nodular limestone. It seems probable that in part or all of secs. 3, 4, 5, 6, 7, 8, 17 and 18, T. 7 N., R. 1 E., the overburden does not exceed 60 feet, and that limited tracts of lesser cover will be found. Extensive drilling will be necessary to prove the presence of the coal in parts of this tract.

A similar area, somewhat larger, has been reported is Tps. 3 and 4 N., R. 1 E., but recent geologic work in this field indicates that the Colchester coal is here too deeply buried to be available for shovels.

**Gallatin County**

So little is known of the coal geology of Gallatin County that it is not possible to define the stripping areas adequately. As noted in the discussion of strip land in Saline County (p. 40), there is an extension of the geologic conditions found in eastern Saline into western Gallatin (fig. 20). The outcrop lines of both the Harrisburg (No. 5) and Herrin (No. 6) coals pass through T. 9 S., R. 8 E., but their trend beneath the lowland to the east and north is not known.

In this area the Herrin coal is from 36 to 68 inches thick, as shown in drill records, and exhibits the usual parting of shale near the bottom of the bed. For detailed description of this coal, the reader is referred to the report on Williamson County.

The overburden is heavy, except just at the outcrop, so that only a narrow belt can be included in the stripping field. Immediately over the coal is thin black shale, locally slaty, and over this a limestone cap rock which may be as much as 5 feet thick and which is in places separated from the black shale by several feet of gray shale.

The Harrisburg coal in Gallatin County has essentially the same character as noted in the Saline County report. Partings of pyrite may be slightly more common in this field, and the coal on the whole less thick.

The chief difference in the overburden above the Harrisburg coal in Saline and Gallatin counties is in the absence of the limestone in the
latter. This leaves only the gray and black shale with an overlying sandstone in places in the bed rock portions of the overburden. Surficial clays, here as elsewhere, cover the bed rock.

In the area tentatively mapped as worth testing for stripping possibilities, the total overburden is thought to be under 60 feet. It is probable that along stream lines, erosion has reduced this to a smaller figure and that fair sized tracts will be found to be available for stripping the Harrisburg coal.

![Index map of Grundy and southwestern Will counties.](image)

**Grundy and Will Counties**

Although more than the southern half of Grundy County is underlain by workable coal, it is only along the north margin of the field that the cover is so slight that stripping appears practicable (fig. 5). In the south central part of T. 34 N., R. 7 E., available records show 2 to 3 feet of coal at less than 60 feet below the surface. Early mining in this area has probably rendered at least half of this coal unminable, and records do not show precisely what parts have been mined out. It appears probable that west of the area mapped for investigation north of Morris, the coal is too deeply buried for stripping. Even along the boundary of the coal to the northwest, the heavier morainic covering
prevents stripping. On the south side of the Kankakee in T. 33 N., Rs. 8 and 9 E., there is another tract of about 2½ square miles mostly in Grundy County, but extending across the line into western Will County in which similar conditions obtain.

In both areas, the available coal is the La Salle Third Vein or Morris coal, correlated as No. 2 of the Illinois series. This ranges from 30 to 42 inches in thickness, and is exceptionally uniform for considerable distances. The thin cover over the coal in the south tract has resulted from erosion by glacial waters passing down Kankakee Valley. Because of this fact, it is to be expected that locally the coal, as well as the heavier overburden, has been removed, a feature which should be given consideration in future prospecting. The coal is of good quality, generally free from bedded impurities and without prominent interruptions, with the possible exception above noted.

The overburden, as shown by logs, consists of the roof shale, a somewhat massive gray, slightly sandy bed, and the usual boulder till. The latter has been removed over much of the area north of Coal City and Braidwood and replaced by unconsolidated silts and sands of the glacial streams. In places, heavy gravels may be encountered. The cover is probably less than 50 feet thick in general, and some fairly large tracts will probably be found in which the cover is less than 30 feet.

**Hancock County**

Although patches of Pennsylvanian beds are found in many parts of Hancock County, the only area in which stripping possibilities appear to warrant testing lies south of Augusta in T. 3 N., R. 5 W. (fig. 2, p. 20).

In this area the Colchester (No. 2) coal, with an average thickness of 30 inches, has been worked both north and south of William Creek. The bed has no persistent parting, although the upper part is commonly harder and brighter than the lower. Over part of the field, a slightly thinner coal, known as "the cannel", underlies the Colchester at a distance varying from 2 to 8 feet. It is probable that any stripping operation opened in the Colchester coal could in places be profitably carried down to the next lower coal.

The overburden ranges from less than 10 feet to 100 feet or more in thickness. The uneven surface of the coal itself results in a cover of uneven thickness, which prevents accurate estimation of thickness in advance of testing. Where thin, the overburden is largely glacial drift, but where it is more than 15 feet, it normally includes some bed rock. Shale and sandstone in considerable thickness
are reported in drill logs, and a 9-foot limestone appears in some records. On account of the thinness of the coal, it is probable that not more than 25 feet of cover could be handled profitably.

No stripping has as yet been reported from the Augusta field, although the coal has been worked from several openings, both shaft and drift.

Near Nauvoo at the western edge of the county, a thin coal was stripped by the Mormons at an early date, but this bed appears to be of so little value that it is not included in the present estimate of stripping resources.

**JACKSON COUNTY**

The only field in Jackson County in which stripping is known to be a possibility, is in the vicinity of Elkville in T. 7 S., Rs. 1 and 2 W. (fig. 6). Beds in this field constitute an extension of the strip
lands of southeastern Perry County. A heavy cover of glacial drift prevents determination of the position of the outcrop, and hence the exact area of strip land can not be described. Because of the eastern dip of the coal on the east side of the Duquoin fold, the stripping area is limited in that direction. To the north and west, and possibly to the south, even beyond the mapped boundary for the coal, are lands well worth testing for shallow coal.

The coal in this field is the Herrin (No. 6) bed, which has been mined by underground methods throughout the area to the north and east. In this region it appears to maintain a thickness of about 84 inches, but this may be reduced nearer the outcrop. As elsewhere in southern Illinois, this bed carries the "blue band", a persistent shale parting, below the middle of the bed. Other partings of shale or pyrite are noted locally, but none are as widespread as the "blue band".

The coal is immediately overlain by shale, locally black and slaty, elsewhere gray and more massive. Above this appears the usual cap limestone, in places more than 5 feet thick, but not uniformly present. This in turn is overlain by more shale and glacial materials of varying thickness. Figure 7 shows the character of the overburden, the steep walls of uncut surficial material are seen at the right, the spoil bank showing the blocks of underlying limestone at the left. In places the coal apparently has an overburden less than 25 feet thick, but some records indicate a thickness of more than 60 feet. The prospector must consider the probability that the surface of the coal is uneven, so that, although the land surface is flat over the area indicated on the map, the variation in thickness of cover due to that feature alone may be more than 10 feet.

Up to the last few years, commercial stripping had not been attempted in this field, on account of the cap limestone which had been considered an insurmountable difficulty. In the pit, which is now operating about a mile and a half west of Elkville, this difficulty seems to have been satisfactorily overcome, by use of extra large and sturdy equipment. Here, the stripping shovels are two in number, both electrically operated and handling 8-yard dippers. The coal is hauled from the pit over a 36-inch gage track by steam locomotives, dumped through a hopper (fig. 8) to an endless conveyor which carries it to the shaker screens where standard Illinois sizes are prepared. Picking tipples and loading booms are installed to permit the loading of clean and properly sized coal. The tipple is planned for a capacity of over 2500 tons per day.

In the southeastern part of T. 7 S., R. 3 W. near Oraville is a
Fig. 7. Strip pit at Elsville, T. 7 S., R. 1 W., Jackson County.
Courtesy of Black Servant Coal Company.

Fig. 8. Tipple and layout at Elkville pit, T. 7 S., R. 1 W., Jackson County.
tract of small size that may repay investigation for stripping. The coal in this field appears to lie too low to be at the horizon of the Herrin (No. 6) bed, and too high for that of the Murphysboro (No. 2) bed. It may be a local development of the No. 5 coal, such as occurs south of the Sparta field in Randolph County. The coal has been mined by drift and shallow shafts for many years, but it is possible that testing will show some valuable tracts. The bed ranges from 72 to 90 inches in thickness, and appears to be of excellent quality, although no analyses of standard type are available. Little is known of the character of the overburden, but it appears to include some sandstone, although it may be mainly shale. The known thickness of cover is less than 60 feet in places, but since so little is known of the lay of the bed, it is impossible to gage the size or value of the tract. This bed is not included in the estimate for the county.

Jefferson County
Described on page 57.

Johnson County
Described on page 58.

Knox County

In spite of the fact that four different seams of coal have been worked by underground methods in Knox County, it is not evident from available data that there are any considerable areas of strip coal within its limits. Two regions might be mentioned as being perhaps worthy of some exploratory work (fig. 9).

The first of these lies along the outcrop of the Herrin (No. 6) coal, in the vicinity of Oneida and Wataga. The overburden may be light enough, especially along drainage lines, to permit shovel work in uncovering the coal, which ranges from 30 to 60 inches in thickness. The immediate roof is shale overlain by massive limestone 3 to 4 feet in thickness. To the southeast near Dahinda, T. 11 N., R. 3 E., one drill record reports a 33-inch coal at a depth of only 30 feet. It is improbable that so little cover is found over any extensive tracts in this part of the county.

The other possibly favorable area is in the southwest part of the county between Knoxville and St. Augustine, underlain by the Colchester (No. 2) coal and locally by the Rock Island (No. 1) coal. Along stream flats and to some extent in the upland areas, coal 24 to 30 inches thick may be present at depths less than 40 feet. So few records of drilling are available, however, that it is not possible to
say to what extent the coal is present. No estimate of tonnage available for stripping in Knox County has been made.

**Marion County**

Described on page 57.

**Perry County**

Including within its boundaries somewhat more than 30 miles of the line of outcrop of the Herrin (No. 6) coal, Perry County appears to hold some of the most promising areas for stripping in the State (fig. 6). Although not determined with great accuracy, the boundary of this important bed is mapped to lie within the following townships: T. 5 S., Rs. 1, 2, and 3 W.; T. 6 S., Rs. 1, 2, 3, and 4 W. The rather extensive field for exploration results from the presence of the Duquoin fold, which trends approximately north and south through the eastern part of the county near Duquoin, and brings the Herrin coal near the surface all along the crest. The effect of this structure is better understood when it is realized that the coal which practically outcrops at Duquoin lies 400 feet beneath the surface three miles to the east.

![Index map of Warren and Knox counties.](image)
Throughout most of the outcrop area in this county, the Herrin coal is about 72 inches thick, slightly thinner on the crest of the Duquoin fold, and reaching a maximum of 96 inches down the dip to the east. Drilling has shown the presence of some erosion channels in the Pennsylvanian beds and in places the coal itself is cut out. In general, however, the presence of the coal in its regular thickness can be counted on for mining. The coal in the western part of the county differs from that on the east side of the Duquoin fold, where it is thicker and contains less dirt and a smaller percentage of sulphur. The shale band known as the "blue band" is everywhere present; partings of charcoal and pyrite are not rare, although none of them are especially persistent. The bed commonly shows the division into three benches, of which the top bench is commonly the best coal, the middle being softer, and the bottom containing more impurities.

The overburden is fairly uniform where traced along the outcrop, and shows the expected variations in thickness and character back of the outcrop. Thus, at the edge the cover is the shale and limestone roof with glacial materials above, and farther back the amount of bed rock increases as the coal dips northward beneath the surface. Throughout the area mapped for exploration, the cover is
probably less than 60 feet thick. Because of the small amount of information available, it is probable that local variations from this maximum will be found. It is not unlikely that considerable areas of relatively thin cover may be proved up.

Immediately over the coal is shale, commonly black and sheeted, but in places gray and slightly sandy. This averages about 3 feet thick, but is reported to reach a thickness of 23 feet in places. Over the shale is the cap limestone 2 to 5 feet thick overlain by shale and thin limestone beds. Figure 10 shows the character of the overburden where it includes about equal amounts of loose and bed rock material.

Two commercial pits are now being operated in Perry County. These are both on the crest of the fold, and hence show essentially identical conditions and character of coal. At the north pit the stripping is done with an electric shovel having a $6\frac{1}{2}$-yard dipper on an 86-foot boom. The stripping shovel makes north-south cuts, working eastward across the property. A bulldozer followed by shoveling and sweeping gangs finishes the cleaning of the surface of the coal, which is then shot with a “strip special” powder. A 2-yard electric shovel (fig. 11) loads the coal into railway cars in the pit, which are hauled to the sidings to await shipment. As the coal is used as railroad fuel, it is sent out as mine run without screening. Where measured, the overburden included 9 feet of till underlain by 1 foot of shaly sandstone, 2 feet of black shale and 8 feet of very argillaceous sandstone, practically shale. On the east side of the property boulders of limestone were encountered, which represented the usual cap of the Herrin bed. These are reported to have come in above the upper sandstone.

The top coal had been removed and the base was not exposed in the following measured section:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal, practically all bright, some calcite facings</td>
<td>8 6/8</td>
</tr>
<tr>
<td>Pyrite lens 8 inches long</td>
<td>7/8</td>
</tr>
<tr>
<td>Coal, alternately dull and bright</td>
<td>27</td>
</tr>
<tr>
<td>Pyrite lens 5 inches long</td>
<td>6/8</td>
</tr>
<tr>
<td>Coal</td>
<td>3</td>
</tr>
<tr>
<td>Charcoal parting</td>
<td>3/8</td>
</tr>
<tr>
<td>Coal, with small pyrite balls and lenses</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>70 3/4</td>
</tr>
</tbody>
</table>

Pope County

Described on page 58.
Fig. 11. Loading equipment at Duquoin pit, Perry County. Courtesy of Gayle Coal Company.
Randolph County

Conditions in Randolph County are practically identical with those of St. Clair County to the northwest. The heavy overburden of glacial deposits prevents precise delineation of the line of outcrop of the Belleville (No. 6) coal, and the eastward dip of the Pennsylvanian strata carries the coal within short distances from the outcrop beneath too heavy an overburden of bed rock for stripping (fig. 12). From available data, however, the following townships appear to be underlain by coal at shallow depths:

- T. 4 S., R. 6 W.
- T. 5 S., R. 6 W.
- Twps. 5 and 6 S., R. 5 W.

Some testing has been done in T. 5 S., R. 6 W., but no commercial opening has been reported.

The Belleville coal in this field is approximately 72 inches thick. The "blue band" or shale parting in the bottom third of the bed is everywhere present and the coal shows the same quality that marks it in the Belleville district.
The overburden is similar to that in St. Clair County. Below surficial materials of variable thickness the bed rock cover includes the roof shale, having a maximum thickness of about 5 feet, the cap limestone, about 3 feet thick near the outcrop but thicker a short distance eastward, and overlying shale up to more than 40 feet. Locally a second limestone several feet thick overlies the thick shale bed, and the top of the section toward the west includes a sandstone in places. In prospecting, it must be recognized that the conditions of deposition following the period of coal formation were variable in short distances, so that uniformity of overburden is not to be expected and relatively close spacing of tests will be necessary to show the actual conditions.

**Richland County**

Little testing has been reported from Richland County, and the general relations of the coal underlying the surface is not known in any detail. Sufficient work has been done to show that in some parts of the county, notably near the boundary between Tps. 2 and 3 N., R. 14 W., a thin coal lies at workable depths (fig. 13).

Lack of detailed data prevents the correlation of this coal with others in the general Illinois section, but the available evidence indicates that the coal in this field is rather high in the section, that is, above the Herrin (No. 6) bed rather than below it.
In sections measured, the coal ranged from 22 to 26 inches in thickness. It is not clear that the coal at any point will greatly exceed 36 inches. The bed is relatively clean, and shows well developed cleat, so that it breaks into rectangular blocks which are readily handled without much breakage. Little pyrite appears in the bed itself, although the contact at the top is generally marked by a zone of mixed shale and pyrite from one to two inches thick. In places the top 2 inches is bony. Another shaly zone comes in locally about 6 inches from the bottom. The bedded impurities loosen readily from the coal, and in general cause little trouble.

The roof materials vary in different parts of the field. The immediate cover of the coal is uniformly shale, although it ranges in thickness from less than 1 inch to several feet. Where thin, it is little more than clay, but in the thicker portions it is massive and locally so gritty that it might properly be classed as sandstone. It should not, however, give any serious trouble in removal. In the upland areas, the thicker cover appears to include a limestone bed immediately over the thin clay above the coal. This limestone is as variable in thickness as it is in occurrence, appearing as a row of concretionary boulders in some places, elsewhere as a massive bed nearly 4 feet thick. It is medium to dark gray in color, finely crystalline, and contains abundant fossils. In the limited area mapped as probable strip land in Richland County, the cover is probably not greater than 35 feet in thickness. Too little is known at present of the extent of and the depth to the coal to indicate even tentatively any extensions of the area mapped. On the other hand, the topography of the adjacent region, especially to the east and west, is such that if the coal maintains an essentially horizontal attitude it may be workable by stripping methods at least as far east as the Lawrence County line, and perhaps as far west as Clay County.

Within the past two years a local pit has been operated just east of Calhoun. No attempt at extensive production is being made, although the local needs of the county are well met. The cover is removed by a steam shovel operating a 4-yard dipper on a 70-foot boom. Straight north-south cuts are planned for the shovel, the overburden being placed in the cuts from which the coal has been removed. The coal is wedged and loaded by hand, and the impurities are picked out as the loading proceeds. By this method, the product is largely lump, and but little loss through slack is sustained.

Saline County

Conditions in regard to strip mining are much the same in Saline County as in Williamson County to the west. One important point of
difference should be emphasized. The Herrin (No. 6) coal is of little consequence in Saline County, as it is generally too thin to be valuable, while the Harrisburg (No. 5) coal is thicker and of better quality.

The surface cover prevents accurate determination of the line of outcrop of either bed, and hence the lines mapped are subject to later correction. As mapped, the outcrop line of the Herrin coal may be followed across the county in an east-west line near the middle of T. 9 S., Rs. 5, 6, and 7 E. (fig. 20), and that of the Harrisburg coal lying about 125 feet lower crosses the county similarly but nearer to the boundary between 9 and 10 S. Because of the rather sharp dip and the consequent increase in thickness of cover toward the north, the belt in which the Harrisburg (No. 5) coal can be profitably stripped appears to be narrow, but drilling may show it to be considerably wider than indicated on the map (fig. 20). It is obvious that the limit of stripping coal is closely related to the rather rough topography of the area, which, if the variable dip of the coal bed is considered, may cause either enlargement or reduction of the stripping field.

The Harrisburg coal is commonly described as bright and hard. Very thin bands of glance coal alternate with somewhat thicker bands of dull coal, and charcoal layers up to 1 inch in thickness appear at intervals throughout the bed. In general, it is somewhat brighter than the Herrin coal, and is somewhat harder, but it is doubtful if physical appearance serves to distinguish coal from the two beds. The Harrisburg coal ranges from 54 inches to more than 90 inches in thickness. Inspection of the available sections fails to reveal any persistent partings like the "blue band" of the Herrin bed, although a parting of clay and pyrite near the top of the bed is not uncommon.

The immediate roof of the Harrisburg bed is in most places slaty shale, less than one foot thick, and overlain by dark gray shale which locally reaches a thickness greater than 40 feet. Commonly a limestone from 3 to 10 feet thick appears within the basal 20 feet of the gray shale, and very sandy beds come in on top of this limestone. Above the bed rock is 10 to 30 feet of yellow clay, generally without boulders. In the narrow belt mapped the total cover is thought to be less than 70 feet at the maximum.

Stripping for local needs alone has been done from time to time in this field, and it is only recently that any commercial operations have produced coal. At the pit near Ledford, southwest of Harrisburg, T. 9 S., R. 6 E., the stripping is done with a steam shovel equipped with a 6-yard dipper on an 80-foot boom (fig. 14). The strip cut is from 30 to 50 feet wide, making an irregular trench trending approximately north of west and working northward across the property. The
steam shovel is followed by shovel and broom gangs. After shooting, the coal is loaded with a steam shovel having a 1 1/4-yard dipper into 5-ton pit cars with side gates. The cars are hauled in 10- to 15-car trips by steam locomotives. The pit cars dump the coal to a hopper, whence it is loaded to a pan conveyor by a reciprocating boom. From the conveyor, the coal passes over reciprocating screens giving four standard sizes and 2-inch screenings for shipment. Impurities are hand picked from the booms.
The coal bed in this pit thins from a maximum of 108 inches at the east to a minimum of 72 inches at the west. The bed lies essentially flat, and is remarkably regular except for the gradual change in thickness.

The overburden handled here includes about 40 feet of gray gritty shale of rather irregular bedding with some 20 feet of yellow clay above it (fig. 15). The latter stands well when undisturbed, but is inclined to slump into the pit from the spoil-bank in rainy weather.

West of Saline County in T. 9 S., R. 4 E., and possibly in the northeast part of T. 10 S., R. 4 E., Williamson County (fig. 20) there is probably a continuation of the outcrop line of the Harrisburg coal. Here also the conditions are possibly favorable for stripping, but the extent or thickness of the coal can not be determined from available data.

Similarly cast of Saline County in T. 9 S., R. 8 E., Gallatin County there is probably an extension of the strip areas, but how far the coal is thick and under thin cover is not known. Some of this field is tentatively mapped as probable strip land.

The Herrin (No. 6) coal, lying stratigraphically above the Harrisburg bed is also present in the north half of Saline County. In general, it is thinner than the Harrisburg coal in Saline County, and although available in limited areas for stripping, will probably not be commercially as important as No. 5. The few available records show this coal to be less than 5 feet thick, commonly less than 3 feet, and to dip northward so that it is too deeply buried for stripping within a short distance from the outcrop. Except for less thickness, the conditions for this bed are similar to those described for the main field in Williamson County.

Schuyler County

The most favorable area for stripping so far reported from Schuyler County lies in the south half of T. 2 N., R. 1 W., north and east of Rushville (fig. 16). Elsewhere, although the county is quite generally underlain by the Colchester bed, except along the drainage lines of Crooked and Sugar creeks, the only probable strip sites will be found along stream valleys near the line of outcrop.

The Rushville coal has been tentatively correlated with the Springfield (No. 5) bed of Fulton County. It ranges from 57 to 78 inches in thickness, and averages about 66 inches. No regular parting or band is reported in the bed. Although it is affected by "clay-slips" in some places, they are not large, so far as known, and do not cause
much trouble in mining. The coal itself is soft, of easy and irregular fracture, and has a dull luster because of the few bands of glance coal in the bed.

The immediate roof is black shale, with a thin limestone cap. Over these is sandy shale, and in the eastern part of the field some thicker limestones have been reported in drill logs. Till of variable thickness overlies or replaces the bed rock. The maximum cover reported is 90 feet, but over large areas it is probably less than 60 feet.

Examination of the map (fig. 16) will show that several small areas in the western part of the county have been indicated as possibly worthy of testing. These are merely typical of the region in general, and no attempt has been made to include all of them. In general

![Index map of Schuyler County](image)

**St. Clair County**

The western limit of the Belleville (No. 6) coal passes in a south-easterly direction across St. Clair County. Because of the thick cover of unconsolidated material and the eastward dip of the Pennsylvanian beds, however, very little of the area underlain by this valuable coal can be classed as strip land. The coal appears to lie at shallow depth
in two narrow fields just east of the outcrop, first, in T. 1 S., Rs. 7, 8, and 9 W., an area between Freeburg and Millstadt, and second, in T. 3 S., Rs. 6 and 7 W. in the vicinity of Marissa and Lenzburg (fig. 17). In each area, the Belleville coal ranges from 60 to 84 inches, and shows the three benches which characterize it in this part of the State. The top 12 to 24 inches is commonly the purest coal of the whole bed; the middle or thickest bench, is commonly duller than the rest and contains numerous bands of dirt, pyrite, and charcoal; the bottom bench, below the "blue band", is extremely variable in composition and ranges from 12 to 24 inches in thickness. In places it is little more than carbonaceous shale, although elsewhere it is as good as the middle bench.

Below the surficial materials, the coal is covered by bed rock of increasing thickness as the bed is traced eastward. This includes the black shale roof and the cap limestone, above which lies thick hard shale. The roof shale ranges from 8 feet to less than an inch in thickness within relatively short distances and the limestone cap shows near-
ly as great variation. Near the outcrop of the coal, the overburden rarely includes any bed rock above the cap limestone, but farther east the upper shale is prominent. In the vicinity of Millstadt, the cover is less than 35 feet and it is probable that other fields may be found in which similar conditions obtain.

Early in the preceding decade, a single operation in St. Clair County was producing at the rate of more than 15,000 tons annually. No information is at hand regarding the details of the methods of handling either the overburden or the coal. Within the past year, some acreage west of Freeburg has been taken up and equipment for a commercial pit may soon be installed.

Vermilion County

In no county in the State has stripping been so important as in Vermilion County. Here were worked out many of the improvements both in equipment and the method of working which have made it possible at the present time to strip coal that earlier was far too deeply buried for such recovery. Geologic reports for Vermilion County show the outcrop lines of the Danville (No. 7) and Grape Creek (No. 6) coal beds drawn in a general north-south direction through T. 20 N., R. 12 W.; T. 19 N., Rs. 11 and 12 W.; T. 18 N., R. 11 W., and T. 17 N., R. 11 W. (fig. 18). Is some places this outcrop is accurately determined; in others the overburden prevents detailed mapping. Along the main channel of Vermilion River, both coals are above drainage, but upstream above the main fork, the westward dip of the coal beds carries them well below drainage and also below too great a thickness of overburden for stripping. It is mainly along the widened river valleys that stripping is practicable, and in the thirty-five years that mechanical stripping has been practiced in this field, a large percentage of the available strip land has been worked. On this account, the Vermilion County field is of interest more for its historical background than for its probable place in the coming development of the stripping industry.

Two coal beds underlie the Vermilion County field, and each has been worked by stripping methods. The upper bed, commonly called the Danville coal and correlated as the No. 7 in the Illinois section, ranges in thickness from about 36 inches to more than 60 inches in the stripping area. The bed varies locally in thickness, especially where the bed rock cover has been removed and the glacial drift lies directly over the coal. In some places, a shale parting not unlike the "blue band" of the No. 6 coal, divides the bed into two benches. As a rule, the partings are not as persistent as in the lower bed. Pyritic masses of
various sizes are especially abundant in parts of the bed. Equipment for operating and cleaning this material was installed in one plant, and during the war period the demand for sulphuric acid provided con-

![Index map of Vermilion County. Figures accompanying strip pit symbols refer to mines listed in Table 1.](image)

siderable profit on this by-product. Of late years, this separated material has not been marketed.

The roof of the Danville bed is commonly black shale of variable thickness, overlain by gray shale which in places reaches a thickness
of more than 50 feet. Its thickness in the stripping field depends upon the extent of erosion that the area has undergone. Above the bed rock is the usual glacial drift of the region. Where untouched by stream erosion, this is generally too thick for removal by shovels. The stripping areas are largely restricted to the vicinity of the larger stream channels.

The Grape Creek (No. 6) coal in the probable stripping area is generally more than 72 inches thick. It commonly lies in two benches separated by the shale parting known as the "blue band", which comes somewhat below the middle of the bed. The two benches are not unlike, consisting of alternating dull and bright layers with interlaminated charcoal, dirt, and pyrite. The Grape Creek coal has in most places a smaller amount of impurities than the Danville bed.

In the stripping area, the bed rock over this coal is shale, although in the immediate vicinity of Danville there is a persistent limestone caprock somewhat above the coal. The more common shale is relatively unconsolidated, and is readily handled by the shovel.

Six commercial pits are now being operated in Vermilion County, four of them working the Danville coal, and two working the Grape Creek bed. In the westernmost of these pits, the stripping is done with a steam shovel operating a 6-yard bucket on an 80-foot boom. The coal has been stripped in a series of east-west cuts, working northward to a limit fixed by former underground mines long since abandoned. Shovel gangs finish cleaning off the coal, brooms being used only when necessary. The coal is then shot with black powder, loaded into 5-ton pit cars with a standard steam shovel using a 1½-yard dipper. The cars are hauled by 20-ton steam locomotives in trips of twelve to the foot of a long incline leading to the tipple at the top of the bluff. On account of the long steep pull, the pit cars are handled one at a time up this incline. At the tipple, most of the coal is passed over screens and picking tables, although some mine run is also marketed. Water in this pit is pumped over the spoil bank to the main drainage line of the region.

The overburden, though thinner near the river valley to the south and east, is rather uniformly about 35 to 50 feet where it is now being removed. It includes about 10 feet of surface soil and slightly bouldery clay and from 25 to 40 feet of light gray shale, fairly hard and usually well bedded. Practically no variations in character of overburden are met in this tract. The coal ranges from 5½ to 6 feet in thickness, and is essentially flat. The only interruptions of the bed are found where the shale roof and some of the coal have been removed by earlier erosion, producing a down-roll which in places cuts out all but two feet of the bed.
Another pit, also working the Danville coal bed, is operating two steam shovels, one equipped with a 3-yard dipper on a 70-foot boom, the other with a 6-yard dipper on a boom about 80 feet long. Throughout this pit, the stripping is done essentially along lines which parallel the drainage of the area, the limit of stripping is determined by the main valley walls, back of which the overburden is too great for present methods and equipment. Shovel gangs follow the stripper, and the coal is loaded out to 5-ton, side gate, pit cars with a 1½-yard steam shovel. The pit locomotives carry about fifteen cars in a trip to the foot of a long incline leading to the tipple, which is situated along the railroad track at the top of the bluff. Cars are hauled up the incline by a cable in trips of four. At the tipple, they are dumped into a hopper which feeds the coal on to an endless steel conveyor by which it is carried to the screens. On this first conveyor, the larger lumps are sledged and two pickers remove impurities. After screening, the coal again passes over picking tables before being loaded by booms to railway cars below. This tipple was equipped during the war period for separating and cleaning the pyrite which occurs rather abundantly throughout the coal bed. Since the demand for this material has lessened, it is merely separated and buried to prevent firing.

The coal in this pit ranges from 5 to 6 feet in thickness, and although it includes the many impurities of pyrite and shale characteristic of this bed, no regular partings are recognized. The overburden is extremely variable, depending on the location of the cut with reference to the valley. In much of the middle portion of the valley, there is as little as 6 feet of shale immediately overlying the coal, with perhaps no more than 12 feet of till or alluvial sands above. As the shovel approaches the main valley wall, however, the overburden changes in character and increases in thickness. At points where maximum cover is removed, the cut shows as much as 15 feet of surface material, including some bouldery clay and 35 feet of light gray shale, well bedded and rather hard.

In working the Grape Creek coal southeast of Georgetown, the overburden is handled with a steam shovel operating a 5-yard dipper on an 80-foot boom. The coal is recovered from a stream valley, and, as usual in such situations, the direction of cut is determined by the topography of the field. The shovel gang completes the cleaning of the coal, as sweeping is usually unnecessary because of the character of the overburden. The coal is loaded out with a steam shovel using a 1½-yard dipper. Pit cars of 5-ton capacity with side gates, and running on a 36-inch track are hauled out in trips of four to the tipple at the west end of the pit. The coal is dumped into a hopper, thence fed to a steel
conveyor, by which it is taken to screens and picking tables. Two sizes are made in this mine; all coal passing one-inch bar screen is classed as lump and the rest as screenings. Lump coal is loaded over booms, the screenings through chutes. The overburden in this pit varies as different parts of the valley are worked, but on the average shows from 10 to 15 feet of surface material with perhaps a maximum of 25 feet of shale below. The coal bed averages about 5 feet in thickness and commonly shows some pyrite and shale partings.

**Wabash County**

Wabash County has never been more than a local producer of coal, for the known beds are thin or lie deeply buried. In the south central part of the county, however, a coal of moderate thickness appears to lie at shallow depth in T. 1 N., Rs. 12, 13 and 14 W., and in Tps. 1 and 2 S., Rs. 13 and 14 W.

The only coal in the county which appears to be workable by stripping methods is the thin bed known as the Friendsville coal, which has been mined in wagon pits near Friendsville, Maud, Bellmont and Keensburg. It has been reported generally at shallow depths elsewhere in this field, so that its area is fairly well known. At the north, however, the limit is not fixed, and the coal is possibly continuous with the similar bed near Calhoun in Richland County.

In Wabash County, the Friendsville coal ranges from less than 12 to more than 48 inches in thickness, and perhaps does not vary much from 36 inches over most of the area mapped (fig. 19).

In this field, the cover ranges from less than 10 feet to more than 65 feet. It is believed that along the rather wide stream valleys of the region, considerable tracts will be found in which the coal lies at less than 35 feet below the surface.

The roof of the coal is commonly gray shale but where the bed rock cover is thick, the shale may be topped by sandstone. Locally, as reported in a few tests, the coal is accompanied by a limestone roof and this, too, is in places overlain by sandstone. In these variations, the Friendsville coal closely resembles the Calhoun bed which is mined a few miles to the northwest.

So far as has been reported, this bed has not been stripped, and no analyses are at hand to indicate its composition. From early reports, the coal appears rather high in impurities, so that the yield of ash is large. It burns rather freely, but does not coke.

**Warren County**

Warren County shows but little territory which appears to be valuable as strip coal property. In general, the coals of the county are
thin and rather too deeply buried to be accessible to the shovel. In the southwestern part of the county, however, especially in the east half of T. 9 N., R. 3 W. and in most of T. 9 N., R. 2 W., the conditions seem to warrant testing (fig. 9, p. 33).

There are two coals under part of these townships, the upper being the Colchester bed and the lower, a thicker bed, tentatively correlated with the Rock Island bed. It is possible that there are small tracts in which both coals may be stripped, since the interval between them ranges from 40 to less than 20 feet.

The Colchester coal appears to maintain a rather uniform thickness of 24 to 30 inches in the area above noted, although on account of its somewhat irregular distribution, it may be thinner locally. All preliminary testing should take account of this probable variation. The coal is of fair quality in most places, mostly dull with but few bright bands, but shows no persistent partings of shale or bone. Facings of calcite and gypsum and small lenses of pyrite are common.

The overburden consists of a rather massive shale roof and till. The shale commonly includes a band of black fissile shale but is more
sandy in the upper part than below, commonly grading laterally into sandstone. It is not believed that this stratum will seriously interfere with stripping operations. In the area indicated on figure 9, the surface material seems to be from 5 to 55 feet thick, but it is recognized that this maximum will be exceeded locally.

The lower coal, which is present in at least the eastern part of T. 9 N., R. 2 W. is about 40 inches thick, but is relatively soft and notably laminated with prominent bright and dull bands. A bony or shale parting near the middle is usually present, and the lower bench is softer than the top. Facings of calcite, gypsum and pyrite are so common in exposures now known that the ash and sulphur content is generally high. It is not improbable that, when opened farther from the outcrop, the impurities will be of less importance, a feature which should be carefully noted in any tests for commercial operations. The overburden, obviously greater than that of the Colchester bed, is essentially the same as that noted for the upper bed, with the additional bed rock which normally intervenes between the two coals. This interval at the maximum includes about 30 feet of shale below the Colchester bed, and from 2 to 8 feet of limestone coming between that shale and the roof clod of the lower coal bed. It is not probable that there are any extensive areas in which the lower bed can be stripped.

**Wayne County**

Described on page 57.

**Will County**

Described on page 26.

**Williamson County**

Williamson County includes between thirty and forty miles of the outcrop line of the Herrin (No. 6) coal, and an unknown amount of the outcrop line of lower beds such as the Harrisburg (No. 5) and the Murphysboro (No. 2) coals. Since the areas in which these lower beds may perhaps be stripped can not be defined on present data, this report will deal with the Herrin bed only. Some mention of the Harrisburg coal was made in connection with the discussion of that bed in Saline County.

Because of the relatively steep northward dip of the Pennsylvanian beds in this part of the State, the stripping area for the Herrin coal is limited to a narrow belt just north of the outcrop line. The cover of glacial drift in this county, as elsewhere in the coal fields of Illinois, renders it difficult to determine the limit of any coal bed accurately. Particularly in the area between Herrin and Crab Orchard Creek valley to the south are the relations indefinite.
Strip pit.

Boundary of Pennsylvanian strata.

Outcrop of Herrin (No. 6) coal.

Areas of Herrin (No. 6) coal worthy of investigation.

Outcrop of Harrisburg (No. 5) coal.

Areas of Harrisburg (No. 5) coal worthy of investigation.

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Fig. 20. Index map of Williamson, Saline and western Gallatin counties. Figures accompanying strip pit symbols refer to mines listed in Table 1.
With the above modification, the following townships may be considered as including the outcrop of the No. 6 coal in such relations of thickness and cover as to be worth testing for stripping purposes: T. 8 S., R. 1 E.; and T. 9 S., Rs. 1, 2, 3, and 4 E.

Throughout practically all of this field, the coal is 7\(\frac{1}{2}\) inches or more in thickness, although in some pits it averages as much as 8\(\frac{1}{4}\) inches. As elsewhere, on account of pre-glacial erosion, the coal is thinner and shows greater variation in thickness near the outcrop than farther back. The following descriptions of this coal now mined so extensively underground in the northern part of this county and in Franklin and Jefferson counties is generally applicable to this field.\(^1\)

"The coal is shining black, commonly banded, and on close inspection appears laminated with alternating bright and dull lines. A 'blue band', or dirt band, found almost everywhere 18 to 30 inches above the floor, generally consists of bone or shaly coal or of gray shale. Its thickness varies from one-half to 2\(\frac{1}{2}\) inches with an average of about 1\(\frac{3}{4}\) inches.

"A clean persistent parting of mother coal lies 14 to 24 inches below the top of the bed and a second parting generally appears 5 to 8 inches down. Above the upper parting the coal is in layers 3 to 6 inches thick, with partings of mother coal between them. Local lenses of mother coal, 6 inches to 5 feet in length and 1 to 4 inches thick, are common in the upper third of the bed. Small pyrite lenses and streaks of bone, a few inches to a foot or more in length and one-fourth to 1 inch in thickness are found here and there in the middle portion of the bed, a short distance above the 'blue band'. In the middle and lower parts of the bed the lamination is less distinct but the bedding is still evident."

The cover of the Herrin (No. 6) coal near the line of outcrop is similar to that described for Jackson County on the west. In the area mapped for testing (fig. 20), the cover is believed to be less than 70 feet thick. The glacial drift, including some boulder clay but more commonly fine clay without stones larger then pebbles, ranges from about 5 to 25 feet in thickness. Near the margin of the coal bed the cover is about half of surficial and half of bed rock materials. As the deeper part of the field is entered, the increased thickness of cover includes a greater proportion of bed rock.

The immediate cover of the coal is normally 3 feet of black shale, slaty in places. Above this is the cap limestone, ranging from a thin stratum of boulders to a massive bed more than 5 feet thick. The limestone is overlain by another bed of shale more or less sandy and

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grading to sandstone in places. In some pits, clay shale comes in between the coal and the slaty black shale. Near Spillertown, T. 9 S., R. 2 E., this gray shale is commonly in the form of lenses, but elsewhere, as near Carterville, T. 9 S., R. 1 E., it is a thick massive bed, and no other strata appear over the coal.

These several beds above the coal vary considerably from place to place, so that no standard cover can be described. Where thin, the overburden may include some 15 feet of glacial clay with an equal thickness of gray shale or of limestone and slate above the coal. Where the total cover is thicker, the glacial drift may be no heavier, but the additional overburden includes greater thicknesses of limestone and of overlying gray shale. It is believed that only rarely will areas be found in which cover is of such character as to be too difficult to remove with modern stripping equipment.

Stripping has been practiced for many years in this county so that equipment and mining methods vary from pit to pit. At one of the larger pits southeast of Herrin, the stripping shovel makes a straight north-south cut working westward across the property. The surface of the coal is well cleaned with shovel and broom, so that after shooting the coal can be loaded directly to the railway cars for shipment. No screening equipment has been installed at this pit since mine run only is shipped.

The coal at this pit ranges from 72 inches to 102 inches in thickness, except where part of the bed has been removed by erosion. The bed dips gently northward, but shows local rolls as much as 5 feet high. Figure 21 shows the relative positions of coal, shale, and limestone, as exposed at the time of examination of this pit. It will be noted that the shale bed just over the coal thickens to the south. Where

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**Fig. 21.** Diagrammatic section of overburden in a Williamson County pit.
the pit was opened, no other bed rock appeared over the coal. The coal itself has shown but little variation in character or thickness with the change in the overburden. Where measured, the bed was 8 feet thick and showed few partings except the regular "blue band" of shale about 2 feet above the floor clay.

Whatever water accumulates at the bottom of the pit is pumped over the uncut bank into the regular drainage channel of the area.

South of this pit is another which has been worked with varying degrees of success for several years. At the present time, the stripping is done by a steam shovel operating an 80-foot boom which carries a 6-yard dipper on a 58-foot dipper-stick. The plan of opera-

Fig. 22. Coal and overburden at Spillertown pit, T. 9 S., R. 3 E., Williamson County.

tions has been changed from time to time as various factors have necessitated modification of the original plan. Recently the coal has been stripped in a circular belt, the first cuts being as far from the outcrop as present equipment seemed to permit. The surface of the coal is cleaned by means of team and scraper, followed by shovel gangs. The coal is then shot with black powder and loaded directly into railway cars. With this equipment coal is loaded out at the rate of 2000 tons per 8-hour shift, the stripping shovel working three shifts.

The coal bed is interrupted in this pit by a small vertical fault which trends about north 25° west and is crossed at both ends of the semi-circular pit. This is of slight consequence, except as it slows up the loading and makes it necessary for the loading shovel to spend
some time cleaning up the mixed coal and shale at the fault zone. Some shifting of the track grade is obviously necessitated by the fault also.

In the Spillertown area, T. 9 S., R. 2 E., no large pits are now being worked, but several local pits are usually in operation. These commonly work on as little as ten acres, so that there may be three or four pits on a single forty-acre tract. In the main, these are wholly hand worked, the mule and hand scraper followed by sweepers or not, as the market may demand. Most of the surface dirt is cleaned off but the elimination of the hard roof shale is not as thorough. Water is usually taken care of by gasoline driven pumps.

The coal is not worked far down the slight northeast dip, since the stripping equipment does not permit handling any great thickness of overburden economically. The exposures examined show coal from 6 to 8 feet thick, about 3 feet of black fissile shale with highly weathered limestone nearly 10 feet thick, and from 5 to 15 feet of surface clay on top. Figure 22 shows the general appearance of the pits in which the bed rock cover is slight and includes no limestone.

**Other Counties**

**general statement**

As stated in the general discussion earlier in this report, some of those counties lying outside the main producing fields of the State are known to contain more or less extensive deposits of thin coal at depths which in general are slight enough to permit stripping. These beds have been worked in a small way for a great many years, but little or no systematic drilling has been reported so that their actual extent is not known. Commercial operations have not been started in any of these counties, nor does it seem likely that any will be in the near future. On the other hand, some of these deposits may be of value in meeting the present local needs of communities commercially less accessible to present coal production, and certainly will be important in the future when the thicker coal beds are worked out.

The coal immediately below the surface material throughout these minor fields is uniformly thin, ranging from a few inches to a little more than 3 feet. In general, the deposits are less than 24 inches thick, but further drilling may show greater average thickness in places. The beds are essentially flat lying when large areas are considered, but within a given township or even a single square mile, considerable difference in elevation may be noted. The coal lies in a series of irregularly shaped, nearly discontinuous basins, so that several distinct
fields may be found within a single county. In places the coal has been found to be of excellent quality. Elsewhere, even within a short distance, it has been found to vary from good to very poor grade, with abundant partings of shale or pyrite. In other words, these deposits exhibit the variation in both chemical and physical properties which are to be expected in coals of local deposition in small swamps where conditions were not uniform either over large areas or during long periods of time.

Comparable to variations in the coal bed are the differences in roof conditions. Shale is the most common roof for these beds of thin coal, but it may be sandy, or slaty, or soft and massive. Locally, the roof is sandstone or in a few places limestone.

**EFFINGHAM AND CLAY COUNTIES**

A coal which Worthen called No. 16 of the general coal section, lies beneath relatively light cover in the southwestern portion of Effingham County. It has been reported 36 inches thick, but where measured, proved to be less than 24 inches. The bed dips eastward so that it is too deep for stripping a short distance from its outcrop. The overburden is variable in character, locally including calcareous black shale. In places the coal is overlain by a 4-foot limestone and loose drift. Probably the only stripping areas will be found near the drainage lines. Northwestern Clay County may include an extension of this field.

**MARION AND JEFFERSON COUNTIES**

Thin coal underlies practically all of Marion County, and all but the southwest part of Jefferson County, ranging in thickness from a few inches to 2 feet. Worthen reported coal at nearly forty places in Marion County alone, and stated that the quality was “in most instances very fair.” With but few exceptions, he referred all these discoveries to the same coal bed. If this is the case, the deposition of coal seems to have been rather more uniform here than in Effingham and Clay counties to the northeast. The overburden includes black sheeted shale with limestone overlying it in places. Elsewhere, the black shale grades upward into softer shale, capped by sandstone. In Jefferson County, the bed rarely includes more than 18 inches of good coal, the rest being pyritic and bony. In places the bed is split by a shale parting, which locally becomes too thick to permit mining the coal.

**WAYNE AND EDWARDS COUNTIES**

Only a small part of Wayne and Edwards counties contains coal of any thickness suitable for stripping. In the northeast portion of
Wayne and the adjoining part of Edwards County, a coal ranging from 1 to 2 feet in thickness lies relatively near the surface, but it is commonly too deeply buried to be stripped. The bedrock overburden includes a few feet of shale with sandstone above. The surficial deposits are usually less than 15 feet in the interior of the counties, but somewhat thicker toward the east margin of Edwards County along Bonpas Creek and the Wabash. In southeastern Edwards County, a coal bed ranging from 30 to 36 inches in thickness lies at less than 40 feet beneath several small areas. The coal is reported to be hard, of splinty or semi-block grade, and is probably to be correlated with some of the beds across the Wabash in Indiana. It was tentatively regarded by Worthen as identical with his No. 13 of the Illinois section.

JOHNSON AND POPE COUNTIES

Both Johnson and Pope counties lie at the south end of the Illinois coal field, and do not appear to contain coal deposits that are especially valuable for stripping purposes, but as stripping has been done in places in them, a brief discussion is included in this report.

Coal has been stripped in sec. 32, T. 11 S., R. 3 E. and secs. 3, 19 and 32 of T. 11 S., R. 4 E., all in Johnson County. The areas suitable for stripping are limited to the rather sharply incised valleys. The coal ranges from 18 to 36 inches in thickness, and commonly lies beneath a sandstone roof. Only limited thicknesses of this rock can be removed profitably in the local stripping operations afforded by this thin coal.

In Pope County, stripping coal is known in secs. 14 and 32, T. 12 S., R. 6 E. Here, the coal outcrops along streams, and the cover is too thick for stripping, except close to the channels. The coal is about 2 feet thick, and is usually overlain by from 5 to 12 feet of dark gray shale. Where the bed rock is heavier, the cover includes several feet of sandstone.

Both of these coals are thought to lie low enough in the general coal section of the Illinois field to be at or below the horizon of the No. 1 coal.

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