

## CHAPTER VIII.

### DESCRIPTION OF THE COAL BEDS NOW OPERATED IN NORTHCENTRAL IOWA.

In areal distribution the Coal Measures of the district constitute the apical portion of the great triangle which the Carboniferous of Iowa forms, the base being the southern state boundary. To the northeastward the surface rocks are Lower Carboniferous in age and the coal bearing strata thin out in this direction. To the northwestward the Cretaceous beds soon cover the Coal Measures, the attenuated margin of the former extending nearly if not quite to the Des Moines river. The workable coal is therefore limited on the east by rocks older than the Coal Measures; but on the west the Carboniferous is known to extend beneath the Cretaceous for a considerable distance beyond the surface boundary of the two formations. Along the attenuated edge of the coal field the strata containing mineral fuel are found only in the hills, the underlying rocks extending along the larger streams in long estuary-like arms, often a distance of twenty-five miles or more into the extreme margin of the Coal Measure area.

The details of the different geological formations and their relations to one another are referred to more specifically farther on. The counties included in northcentral Iowa are Humboldt, Webster, Hamilton, Hardin, Carroll, Greene, Boone, Story and Marshall.

## HUMBOLDT COUNTY.

Although almost beyond the productive area it is not improbable that workable coal will yet be found within the limits of this county. Having a rather level surface and covered by heavy deposits of drift, natural outcrops of the indurated rocks are comparatively few in number except along the two branches of the Des Moines river. In the beds of these water-courses the Lower Carboniferous limestones are exposed from the south county line up to Rutland and beyond on the west fork of the Des Moines, and for several miles above Dakota on the east fork of the same stream. Coal Measure sandstones and shales are known to occur at several points; part of them doubtless constituting the northern extension of the Iowa coal field and part, in all probability, forming outliers. On the west fork of the Des Moines half way between Rutland and Humboldt the Lower Carboniferous limestone disappears beneath the water level, and the bluffs show light colored shales and sandstones, to all appearances of Coal Measure age. Little prospecting for coal has yet been done in the county. Recently, however, some desultory searching for mineral fuel has been carried on a mile below the town of Humboldt. At this point one seam of coal was found about twenty-five feet above the water level but is apparently not thick enough for profitable working. The occurrence of this bed of coal and its associated strata at the place mentioned clearly indicates that coal bearing strata have a much wider geographical distribution in Humboldt county than has been generally regarded heretofore, and that it is not at all unlikely that workable seams of coal will yet be found within the limits of the district. This is especially true of the southwestern quarter of the county and may be applicable also to the southeastern portion.

## WEBSTER COUNTY.

This district contains the most northerly coal mines in the state. It has long been known as one of the leading coal counties and is probably more favorably situated than any other coal county for shipping its production northward to the large areas which have no fuel supplies of their own.

The surface of the county is everywhere quite level except in the immediate vicinity of the chief water course where short deep ravines appear sloping steeply toward the river which is from 130 to 150 feet below the general level of the surrounding country. In Webster the Des Moines river valley which cuts centrally through the entire county from north to south is very narrow with scarcely any alluvial flood-plains. The sides of the valley are very steep and even precipitous. All the minor tributaries of the chief water-course likewise flow in narrow steep sided valleys very deep toward their lower extremities, but in opposite directions passing into broad shallow drainage basins. The ravines are very numerous, close together, and very tortuous, and they are separated from one another by sharp ridges. The steep sides of the streams afford numerous outcrops showing the geological characters of the stratified rocks. The entire surface of the county is deeply covered with drift material so that at a short distance from the principal stream the underlying rocks are rarely exposed. The geological formations represented in the county are the Lower Carboniferous limestone (Saint Louis), the Upper Carboniferous shales (Coal Measures), the Cretaceous deposits (gypsum beds) and the Pleistocene (glacial accumulations). In the order mentioned they lie unconformably upon one another.

The Saint Louis member of the Lower Carboniferous has a surface distribution only in the immediate vicinity of the Des Moines river from Fort Dodge to the north county line, and in some of the smaller tributaries near their mouths. This formation is the blue or ash colored, fine grained limestone which presents a very uneven upper surface and on which rests the friable sandstones and shales of the Coal Measures. Above the Coal Measures and resting unconformably upon them are the gypsum beds which, with but little doubt, are of Cretaceous age. The gypsum itself is a massive layer two to thirty feet in thickness with an average measurement of about sixteen feet. It is overlain in many places by sands and clays with thin corrugated seams of gypsum intercalated. The gypsum beds are located chiefly in the vicinity of Fort Dodge and directly to the southward. (Figure 29.) Just north of Fort Dodge they probably rest directly upon the Saint Louis limestone while five or six miles to the southward they are from 50 to 100 feet or more above the limestone basement. It is quite probable that in the western and northwestern parts of the county still more extensive Cretaceous deposits exist at no great depth beneath the drift. Outliers of the same layers probably also are present in other parts of the district.



Figure 29. Section across Des Moines River Valley, showing Arrangement of Geological Formations. Fort Dodge.

The relations of the formations are well shown in the vicinity of the mouth of Lizard creek on both sides of the Des Moines river and in the north part of the city of Fort Dodge. The Saint Louis limestone occupies the base of the section and is exposed in the bed of the creeks. Immediately overlying it, on the west side of the river especially, are clays and shales of the Coal Measures with a few thin coal seams. Resting unconformably upon both members of the Carboniferous are the gypsum and associated beds. The former comes down to the water level in Soldier creek at Kohl's brewery north of Fort Dodge and elsewhere farther up the stream. On the west side of the river the gypsum is over 100 feet higher than on the east side.

Although the coal bearing strata become greatly attenuated just north of Fort Dodge along the Des Moines river where the Lower Carboniferous limestone appears, they probably have a considerable thickness in the upland away from the river on both sides. Southward, the Coal Measures rapidly thicken until at the southern border of the county they doubtless have a maximum thickness of not less than 150 or 200 feet. In a distance of only five miles from Fort Dodge to the southward the Coal Measures increase in thickness from nothing to more than 200 feet. The coal bearing strata of Webster county are largely argillaceous shales with comparatively little sandstone. In these shales are intercalated numerous lenticular layers of coal which vary from three to five feet in thickness, in some places attaining a measurement of even eight or nine feet. Thus instead of one continuous seam there are a number of horizons yielding coal. At the present time the mines of the county are clustered around a few places; near Coalville and Kalo on opposite sides of the Des Moines river

seven miles below Fort Dodge; at Lehigh, about fifteen miles below the same town; and at points on Lizard creek near Tara four miles west of Fort Dodge. Considerable coal has also been mined at and around the latter town. For a number of miles below the place, in the bluffs of the Des Moines river and its tributaries, there are numerous outcrops of coal at various heights above the water level. They all show at first glance a remarkable uniformity of thickness, but upon closer examination it is found that the seams are really made up of many limited pockets which exhibit but little regularity. The easy accessibility of the coal in the hillsides has had a tendency to cause its development by drift mining and many of these openings are located along the river, and its larger branches. In the sides of the bluffs the coal seams are often found to dip away from the mouth of the drifts and to increase in thickness from three or four feet to six or seven in a distance of less than seventy-five or eighty yards. Then the seams may rise, at the same time gradually getting thinner and thinner until they become too attenuated for profitable working, or they run out entirely away from the bluff and consequently little prospecting has been done in those parts of the county remote from the river. When the great thickness of the drift deposits and the Cretaceous beds are taken into consideration it will be seen that deeper drillings than have heretofore been made will probably lead to the development of more or less extensive coal seams in different parts of the region.

Formerly considerable coal was mined in the vicinity of Fort Dodge, but of late years comparatively little has been taken out. Abandoned shafts and drifts are to be seen at many points in the bluffs along the river. North

of Fort Dodge on both sides of the Des Moines river a number of country banks have been opened (Tp. 89 N., R. XXVIII W., Sec. 7). At present only two of these openings are operated. One is the Smith shaft and the other is the Johnson slope. The coal averages twenty-eight inches in thickness and is considered to be of very good quality. A section of the bluff at this place gives the following measurements :

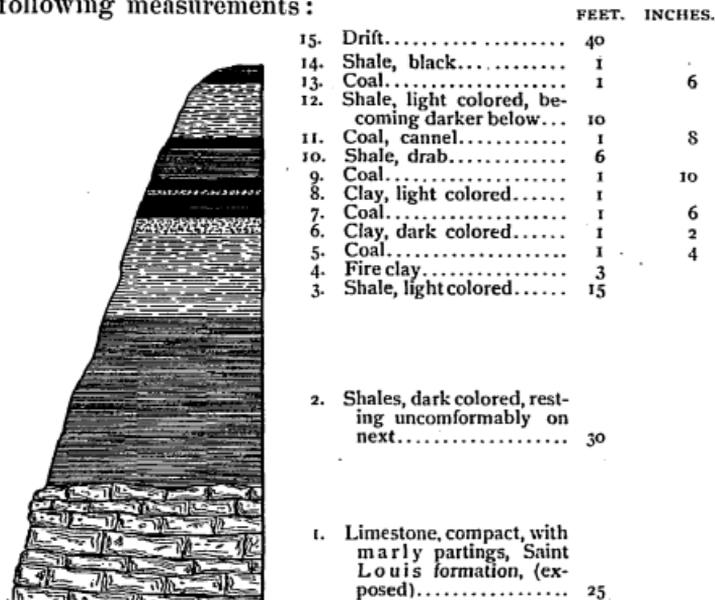


Figure 30. Coal Beds near Johnson Mine, north of Fort Dodge.

Between this point and the mouth of Soldier creek which flows through the corporate limits of Fort Dodge numerous openings have been made in the coal seams and a considerable amount of fuel extracted. The most extensive of the mines near the town were known as the Rees. Thin coal bands are shown in the clay pit of the Fort Dodge Pressed Brick Company, the section exposed being as follows :

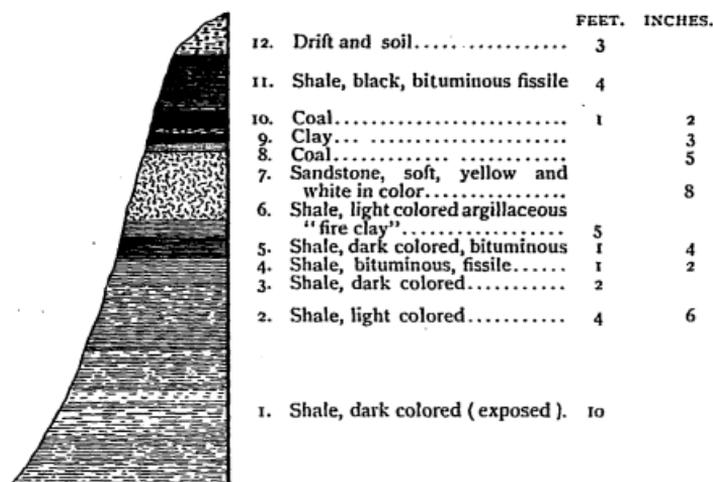


Figure 31. Section at Clay Pit of Fort Dodge Pressed Brick Works, Fort Dodge.

*Tara.*—Four miles west of Fort Dodge and about a mile east of Tara several shafts have been put down in the valley of Lizard creek. They vary in depth from forty to one hundred feet. The Martin shaft (Tp. 89 N., R. XXIX W., Sec. 23, SE. qr., SE.  $\frac{1}{4}$ ) is one hundred feet in depth and operates a vein of coal five feet in thickness. The coal is underlain by good fire clay and is covered by blue shale, which, however, in some places forms such a poor roof that some of the coal is left to protect it. The section at the bottom of the shaft gives:

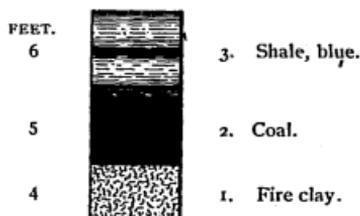


Figure 32. Coal Bed at the Martin Shaft, Tara.

Near the Martin mine was the old shaft of Collins and Myers which was sixty feet deep with coal four feet in thickness. It was operated only in the winter. The Scally mine was also located in the same vicinity but has been abandoned some time. Other mines opened in this vicinity also worked coal averaging four feet in thickness.

*Coalville.*—This place is on the east side of the Des Moines river opposite Kalo. The veins of coal vary in thickness from three to eight feet. There is also a variety of cannel coal which outcrops at the water level. It has a thickness of about six feet, though on account of the inferior quality of the upper part the lower two feet only are mined. It is said to lie from fifty to sixty feet below the principal seam worked.

For many years mining has been carried on extensively in the neighborhood of Coalville and the openings are innumerable. Among the chief mines operated at the present time may be mentioned the Collins mine No. 4, which is located near the river south of the village. The coal worked is from four to five feet in thickness. The seam is somewhat uneven but quite free from faults. Forty feet below this seam is a vein of cannel coal. The sequence of the strata is shown in figure 33 on the following page.

Some distance east of this mine is the Collins No. 16. A short distance northeast of the latter is the McClure shaft which has been recently sunk. North of the Collins mine half a mile are the Lichfield, Davis, Dupleas, and Fort Dodge No. 1, all of which are operated on a small scale. For many years the Fort Dodge Coal Company mined extensively in this vicinity, putting down a number of shafts. The company failed and since that time the mines have been worked chiefly for local use.

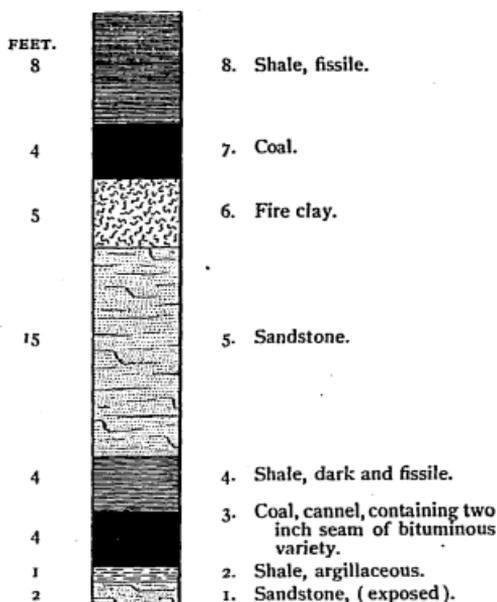


Figure 33. Portion of Shaft at Collins Mine, No. 4. Coalville.

Along the river bluffs are several drifts where the coal outcrops some distance above the bed of the stream. The seam of cannel just mentioned occurs a few feet above the water level.

*Kalo*.—This place is situated on the west side of the Des Moines river directly opposite Coalville. The coal seam crops out in the bluffs where innumerable drifts have been opened during the last twenty-five or thirty years. Six miles below Fort Dodge and within a mile of Kalo the first mine encountered is the Johnson drift (Tp. 88 N., R. XXVIII W., Sec. 8, NW. qr., NW.  $\frac{1}{4}$ ) situated not far from the river on the Kalo switch. Both cannel

and ordinary bituminous coal are taken out. The section here is as follows :

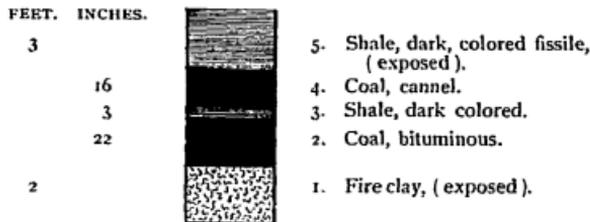


Figure 34. Cannel and Bituminous Veins at the Johnson Mine, Kalo.

A quarter of a mile south of the Johnson mine is the Irvine drift which works in a thirty inch seam of cannel. Measurements of the different beds at this place give :

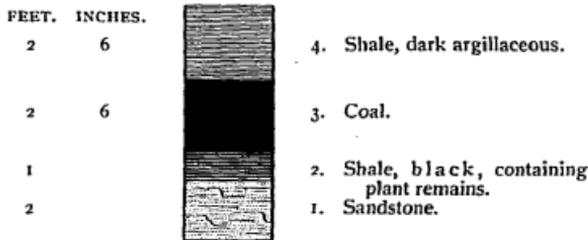


Figure 35. Bed of Cannel Coal at Irvine Drift. Kalo.

In the eastern part of section 17 and in the north-eastern portion of section 18 (Tp. 88 N., R. XXVIII W.), the Craig Coal Company has operated quite extensively for a number of years, though at present only two of the openings are worked. The first of the Craig mines is a quarter of a mile south of the Irvine drift and is known as No. 6. It was abandoned on account of the coal becoming too thin for profitable working in extending the entries westward. A short distance still

farther to the southward of these mines are two others which were operated by the same company, Nos. 1 and 5. They were also abandoned for the same reason. Between the last two mines is located the Craig Cannel Shaft. It is situated at the foot of the hill below the Minneapolis and Saint Louis railway station. The shaft is forty-two feet in depth and works the same vein of coal as is found in the Irvine mine. The seam is much more even than the bituminous vein and shows no signs of thinning out in any direction. Half a mile to the southward of the latter in a ravine leading down to Craig Hollow is the Craig slope. The seam averages two feet in thickness, but its mining is somewhat interfered with by the presence of large iron-stone concretions. The strata shown in connection with the coal seam are :

	FEET.	INCHES.
3. Shale, hard, fissile.....	1	
2. Coal.....	2	6
1. Fire clay.....	1	

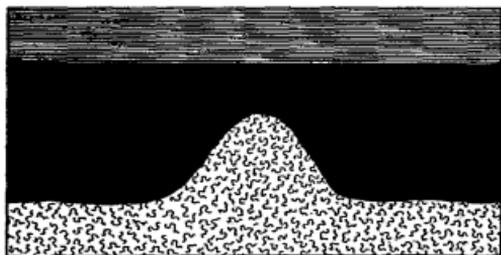


Figure 36. "Horseback" in Craig Slope. Kalo.

In several places in this mine "horsebacks" have been encountered one of which, represented in the cut, is remarkably abrupt. Northeast of the last named opening is the Nichols and Todd drift which has been opened

quite recently and is apparently in the same vein of coal as is worked in the Craig slope. The deep ravine in this vicinity is called the Craig Hollow and along its sides many openings of coal have been made during the past twenty years. South of the Craig cannel shaft about half a mile are the two McGovern mines. One of these work the bituminous seam; while the other opening is in the cannel seam forty feet below. A short distance down the river from the latter named place is the Craig No. 4; and still farther to the southward on the hillside is the Harbach and Bunck mines and the Craig bituminous shaft. A short distance from the Craig slope the Carlston mine has been opened in a vein of coal three feet six inches in thickness. In addition to the mines mentioned a large number of smaller banks have been operated from time to time west of Kalo.

In the town and just south of it are several openings known as the Mills mines. Southeast of the village mines have also been opened. Down the river a distance of one and a half miles (Tp. 88 N., R. XXVIII W., Sec. 16, SW. qr., SW.  $\frac{1}{4}$ .) two openings have been made; one the Johnson and the other the Cheleen, both of which operate in a vein containing cannel and bituminous coal the former resting directly upon the latter. Both seams are removed and the production sold chiefly to local trade. Among the other mines operated in the vicinity are the Lamb, Bennett, Craig No. 2, Craig No. 3, and the Webster, besides a large number of small country banks.

*Lehigh.*—There are several veins of coal known to exist in the vicinity of this place. They vary from one and a half to five feet in thickness. The record of a drill hole put down in Tp. 87 N., R. XXVII W., Sec. 7, NE.

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qr., NE.  $\frac{1}{4}$ , beginning in the top of the bluffs is as follows:

	FEET.	INCHES.
55. Blue clay.....	50	
54. Sand and gravel .....	10	
53. Yellow clay.....	20	
52. Red sand and gravel .....	10	
51. Blue clay.....	20	
50. Sand and gravel .....	8	
49. Blue clay .....	5	
48. Light shale .....	3	
47. Sandstone.....	5	8
46. Sandstone indurated .....	3	6
45. Sandstone.....	5	2
44. Light "slate".....	4	
43. Light shale.....	5	8
42. Sandy shale .....	5	
41. Light "slate".....	12	7
40. Coal and sandstone .....	1	
39. Light shale.....	7	9
38. Dark shale.....	2	3
37. Sandstone.....	2	9
36. Dark shale .....	11	
35. White sand.....	16	
34. Dark gray sandstone.....	4	
33. Coal .....		23
32. Light sandstone.....	7	
31. Red sandstone.....	2	
30. Sandstone boulder.....	4	
29. Light sandstone.....	5	9
28. Light shale.....	5	
27. Hard sandstone.....	12	
26. Light shale.....	9	
25. Light shale.....	1	
24. Light hard shale .....	2	6
23. Coal.....	1	6
22. Dark shale.....	3	4
21. Coal.....	1	
20. Light shale.....	2	
19. Coal.....		6
18. Light shale.....	1	
17. Light hard shale.....	3	10
16. Coal .....		1
15. Dark sandstone.....	1	

	FEET.	INCHES.
14. Light sandy shale.....	4	
13. Dark shale.....	1	
12. Coal.....	1	
11. Light shale.....	1	
10. Dark hard shale.....	8	
9. Coal and pyrite.....	1	
8. Coal (pure).....	2	4
7. Fire clay.....		6
6. Dark hard shale.....	1	
5. Coal.....		6
4. Light shale.....	4	8
3. Hard dark shale.....	2	
2. Hard sandstone.....	5	9
1. Conglomerate.....		3

No less than seven coal horizons were passed through in sinking the hole. Mining has been carried on in the neighborhood of the town for a number of years past and the openings are quite numerous along the Des Moines river and its tributaries. Just north of Lehigh numerous drifts are seen in the bluffs. To the west the principal mine is the Harper. Immediately south of the town Crooked creek enters from the west. Along this stream a large number of openings have been made, the principal one being operated by the Crooked Creek Coal Company. The section at Mine No. 3, is as follows :

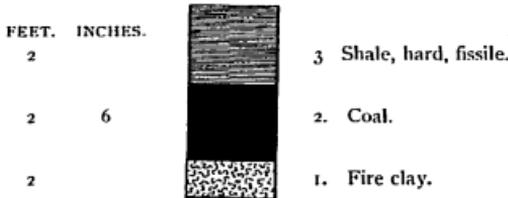


Figure 37. Coal Bed at Crooked Creek Mine, No. 3. Lehigh.

The output is shipped over a long switch from the Illinois Central railroad. A slope belonging to the company is operated on the south side of the creek in coal

two feet six inches thick and of very good quality. The roof is a hard bituminous shale and the floor of fire clay.

A short distance west of this mine is the Corey, the coal in which is from two to four and a half feet in thickness. This roof is also a hard black shale with some concretions of clay iron-stone. The coal is mined on the long wall system. South of this point a quarter of a mile the same company has sunk a shaft to the depth of eighty-one feet into the same bed of coal.

On the west side of the Des Moines river extensive mining has also been done by the Crooked Creek Coal Company which has put down several shafts. The one at present operated is forty feet deep, with coal about four feet in thickness. The bottom of the shaft exhibits:

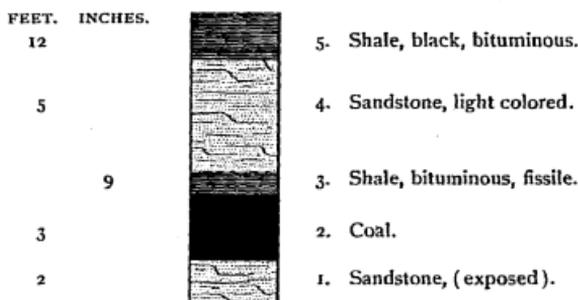


Figure 38. Section of Coal at Crooked Creek Mine, No. 1, Lehigh.

The general dip of the seam is slightly to the south-eastward. The same vein of coal outcrops in a ravine about three hundred yards to the south where numerous country banks have been opened and worked for many years. South of the Crooked Creek Mine No. 1 is the Smith mine and immediately north of it the Hiller.

Below Lehigh coal is exposed in the river bluffs at short intervals as far as the south county line. On the south side of the river three miles below the town coal

has been mined in the valley of a small stream. The section shown on the river bank half a mile farther down (Tp. 87 N., R. XXVII W., Sec. 21, SW. qr., SW.  $\frac{1}{4}$ ) is:

	FEET. INCHES.	
5. "Limerock" .....	1	
4. Coal.....	1	2
3. Shale.....		10
2. Coal.....	2	
1. Fire clay (exposed to water level).....	6	

Coal and the accompanying shales crop out in the river bank between the last named point and the south county line but no mining has been done except in the valley of a small stream five miles east of Dayton on the Chicago and Northwestern railroad. Here near the mouth of the creek in the center of section 16 (Tp. 86 N., R. XXVII W.) small country banks are in active operation during winter months. They are the Gruber and Baker, Gruber and McGovern and the Timmons. The shaft is thirty-five feet in depth. The section at the bottom shows:

	FEET.
3. Shale, gray, bituminous below.....	7
2. Coal 16 to 30 inches.....	2
1. Fire clay.....	4

Prospecting has indicated that there is a second seam of coal about twenty feet beneath the one now worked. The larger part of the output of these mines is hauled by wagons to Dayton.

A short distance beyond the south county line in Boone is the extensive field of the Pilot Mound district in which recently extensive preparations have been made for mining large quantities of coal.

#### HAMILTON COUNTY.

Hamilton county lies on the northern margin of the Iowa coal field. The southwestern half, at least, and probably

nearly all of the county is made up of Coal Measure strata while a small portion of the northern or northeastern region is composed of Lower Carboniferous limestones. Over most of the county the Saint Louis limestone probably exists at no very great depth. It is exposed at various places along the different streams traversing the county and extends in the bed of the Boone river as far southward as five miles below Webster City. The upper surface of the Saint Louis presents the same uneven character as is seen in other parts of the state, and the irregularities of the Coal Measures are consequently very marked.

The Coal Measures of the southwestern part of Hamilton belong to the main body of the Iowa field. Toward the northeast other cases of similar strata are reported but they are doubtless outliers of greater or less magnitude. In the formations of this age the clay shales predominate, affording inexhaustible supplies of the best of material for the manufacture of all kinds of clay products. Although doubtless well furnished with coal, in the southern and southwestern portion of the county the only locality where mining has been carried on to any extent is along the Boone river a few miles below Webster City. Passing down the Boone river, from Webster City, the first opening met with is the Brockshink mine on the west side of the stream (Tp. 88 N., R. XXVI W., Sec. 25, SW. qr., SW.  $\frac{1}{4}$ ). This is a local mine working coal three feet in thickness. The seam is overlain by a thick roof of sandstone. A mile east, on the opposite side of the river, are two openings, the Morrow and the Claffin (Tp. 88 N., R. XXV W., Sec. 31, NW. qr., SW.  $\frac{1}{4}$ ). The coal is two feet six inches in thickness and is obtained chiefly by mining along the outcrop. A mile southeast of the Brockshink on the same side of the river (Tp. 88 N., R.

XXVI W., Sec. 36, SE. qr., SE.  $\frac{1}{4}$ ) is the Silver mine. The coal outcrops in a small ravine and was first obtained by stripping along the line of exposure. During the past few years coal taken out has been sold chiefly to local trade. During one season 2,000 tons are said to have been removed. The section of the bluff near the opening shows :

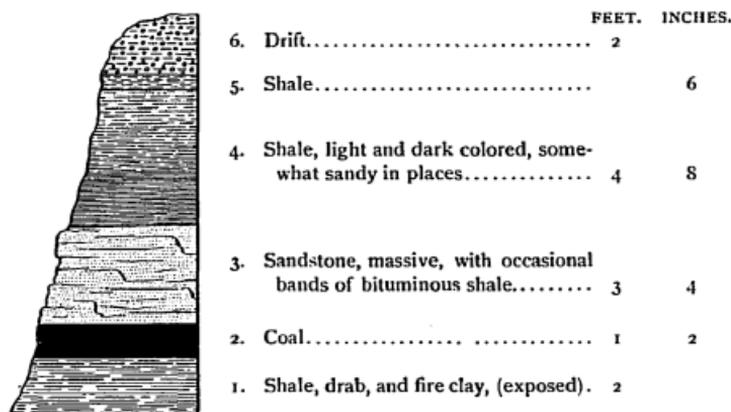


Figure 39. Section of Bluff near the Silver Mine. Below Webster City, Hamilton County.

The roof is quite variable sometimes being sandstone, often slaty coal or bituminous shale. A thin seam of cannel coal is also found in connection with the vein, but is not thick enough for profitable working.

A short distance southeast of the Silver drift is the Martin mine. The coal crops out in the sides of the stream and is obtained in part by working along the line of the exposure. The seam is from two to two and a half feet in thickness. Near by is the Louis mine where the coal is three feet in thickness in some places.

Two miles south of the last mentioned bank on the east side of the river is the Maxwell shaft, fourteen feet

in depth. The coal is about two and a half feet in thickness. This is a new mine recently opened. A mile to the southwest, near the river bank, is the Shaw and Wilson mine. It is a shaft seventy-five feet in depth, with coal four feet in thickness. Two miles to the westward on the north side of the river is the Stockdale mine (Tp. 87 N., R. XXVI W., Sec. 10, SE. qr., SW.  $\frac{1}{4}$ ). The seam of coal is quite regular and from three to four feet in thickness; the roof is a bituminous shale and sandstone and the floor a fire clay. The vein dips to the north and west. This is one of the oldest mines in the vicinity, having been worked for more than thirty years, though until lately not very systematically. Several small rolls have been encountered but none of sufficient importance to interfere with mining. The section is as follows:

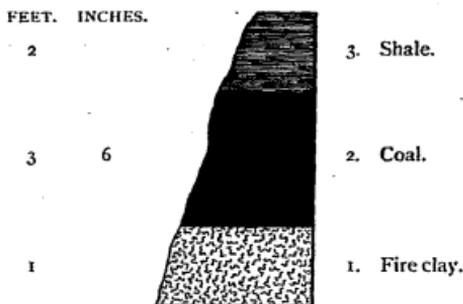


Figure 40. Coal Bed at Stockdale Opening. Ten miles below Webster City.

Farther down the stream openings have been made at various times, the most important of which perhaps is the Prim, which has been operated more or less continuously for upwards of fifteen years.

#### HARDIN COUNTY.

This may be regarded as one of the border counties of the coal field. Fully two-thirds of the entire area of the

county is probably underlain, immediately beneath the drift, by Coal Measure strata. The coal bearing rocks in all likelihood are continuous with the coal field proper; though it is quite possible that they represent large outliers. In that part of the county north of the Iowa river the rocks are of Lower Carboniferous age and consist chiefly of limestones. These strata are well exposed at numerous points along the river from the north county line down to the neighborhood of Steamboat Rock where they suddenly disappear beneath the water level. Beyond the latter place the Coal Measure sandstones rise abruptly along the river in high perpendicular cliffs. From this point to the southern county line the Coal Measures are exposed at short intervals, a considerable portion of the distance being occupied by bluffs eighty to one hundred feet in height and capped by massive sandstones. A few miles below the county line in Marshall coal has been mined successfully for a number of years. Drill holes show the thickness of the Carboniferous strata to be not less than one hundred and fifty feet. In places a massive brown sandstone occupies over half of the entire thickness. It is to this indurated formation principally, which is everywhere underlain by softer beds, that the rugged topography of eastern Hardin county is due. Below the sandstone the shales have a very considerable thickness and carry several seams of coal. A drill hole put down in the vicinity of Gifford in the southeastern part of the area revealed a small seam of coal at a depth of more than one hundred feet.

The workable coal in the county is at present known only in the immediate vicinity of Eldora. The mines are mostly on the east side of the river, commencing at a point a mile below Steamboat Rock and extending to

within a short distance of the first named place. Almost the entire distance the Iowa river flows through a deep gorge which has been cut entirely through the massive yellow sandstone, the bed of the river now being some feet below in the softer shales.

The most northerly point where coal has been mined in the district is the opening known as the Gilman mine situated two miles below Steamboat Rock on the east side of the river (Tp. 88 N., R. XIX W., Sec. 32, NW. qr., NE.  $\frac{1}{4}$ ). In this vicinity coal has been mined for nearly forty years. The section is as follows:

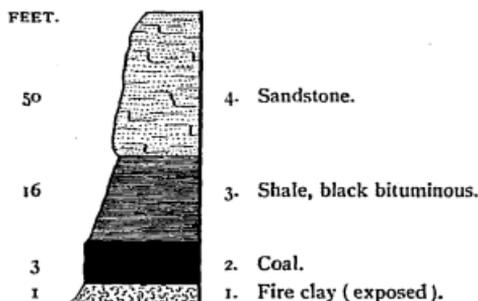


Figure 41. Bluff at Gilman Drift. Steamboat Rock, Hardin County.

A short distance above the latter named mine just below the bridge (Tp. 87 N., R. XIX W., Sec. 5, NW. qr., NE.  $\frac{1}{4}$ ) is situated the Langworthy drift which, however, has been abandoned recently. The coal here was four feet thick and was mined on the long wall system. Not far from the Langworthy opening is the Hall mine where the coal is also four feet thick. A drill hole put down near this place, beginning below the sandstone, is said to have passed through the following strata:

	FEET.	INCHES.
12. Surface deposits.....	5	
11. Limestone brown impure, somewhat fossiliferous.....	2	
10. Coal.....	1	2
9. Fire clay.....		6
8. Shale.....		18
7. Coal.....		11
6. Fire clay.....	1	
5. Shale.....	12	
4. Coal.....	4	
3. Fire clay.....	4	
2. Coal.....		8
1. Shale.....	5	

About a mile from this place Robert Smith, in sinking a well, is said to have passed through practically the same layers.

By far the greater number of openings are situated near the line between townships 87 and 88, range nineteen, in the bend of the river. Toward the eastern limit of these openings they are called collectively the Chaffin mines. Most of them have been abandoned for a considerable time, only one being operated at present. The coal at this opening is four feet thick with a hard shale roof four feet in thickness, above which is the thick stratum of sandstone already referred to. In an old opening twenty-five yards directly south of this the roof shale has disappeared and the sandstone rests directly upon the coal. The section here is :

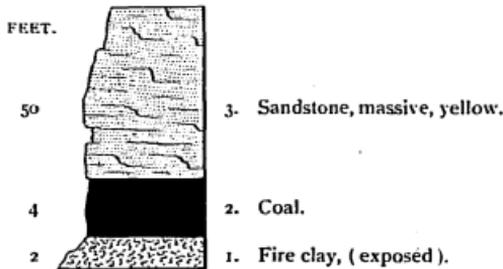


Figure 42. Coal Bed at Chaffin Mine. Eldora.

The banks of the river in this vicinity for a quarter of a mile are covered with refuse coal and bituminous shale taken from the numerous openings showing that large quantities of coal have been taken out. There are also a number of small mines which are worked to some extent in the winter. A decade ago very considerable quantities of coal were shipped from the mines of this district the Chaffin alone producing annually over 4000 tons. At present, however, the mining is carried on in a very desultory manner and probably not more than 100 tons a year are taken from any of the openings. They are worked only in the winter and in the summer the roof is allowed to cave in, a new entry being made the following season. Near the old Chaffin mine (Tp. 88 N., R. XIX W., Sec. 32, SW. qr., NE.  $\frac{1}{4}$ ) is the Madden drift which operates in the winter an 18-inch seam of coal. On the opposite side of the river the arrangement of the coal and its associated beds is essentially the same and a number of drifts have been opened under the sandstone. Very little is now being done to develop the coal at this place.

Twenty years ago Eldora was quite a coal district; the chief mines being operated by the Eldora Coal Company which worked quite extensively, shipping coal northward to many points in Iowa.

#### CARROLL COUNTY.

No coal is known to have been mined within the limits of this county. The surface beneath the drift is made up largely of Cretaceous and Coal Measure strata, the latter probably extending over the entire county and containing workable seams of coal. Like in Audubon and some of the neighboring counties no systematic prospecting for coal has ever been undertaken. That coal seams of workable thickness do exist within the borders of Carroll seems

to be fully indicated by the presence of good veins a few miles from the county line in Guthrie. As in other counties along the eastern margin of the Cretaceous area the coal must be sought for at somewhat greater depths than in the counties immediately to the eastward.

#### GREENE COUNTY.

Like Webster and Guthrie, the adjoining counties north and south, Greene lies on the eastern margin of the Cretaceous. Although at the present time the exact limits of this formation are not definitely known it is quite probable that the beds of Cretaceous strata present are largely a part of the main body which occupies much of the northwestern portion of the state. Beds which correspond in all particulars to the well known Cretaceous deposits of Guthrie county outcrop at a number of places in the central part of Greene, near Jefferson, and also in the western part of the district. These strata are chiefly incoherent sands or friable sandstones, more or less ferruginous, and alternated with clays. The deposits of this age farther westward are found to contain layers of lignite, or brown coal, some of the beds having a thickness of four feet and upwards and it is not improbable that similar depositions may yet be found within the limits of the county under consideration. The extensive mantle of drift greatly obscures the underlying stratified rocks over most of the county so that there are comparatively few natural outcrops except in the immediate neighborhood of the larger streams.

The Coal Measures probably underlie all of Greene county. In the eastern part they are near the surface, immediately beneath the drift, and are exposed in the beds of many of the streams. In the western portion they are some little distance below the glacial deposits.

Up to the present time workable seams of coal have only been opened in the extreme eastern part of the county; yet doubtless they extend, through a greater depth perhaps, much farther to the westward. On account of the heavy drift and Cretaceous deposits very little systematic prospecting for coal has been done except along the eastern border of the county. The natural outcrops of coal are few and are confined to thin seams along the Raccoon river chiefly in the southeastern part of the region. The veins range from a few to eighteen inches in thickness and while they are not as important as a more extensive seam which exists at a great depth they have served to draw attention and to develop the coal industry of the region.

At Grand Junction a seam of coal averaging one and one-half feet in thickness is known to exist at a depth of from 140 to 160 feet. Just west of the town (Tp. 83 N., R. XXIX W., Sec. 4, NW. qr., NW.  $\frac{1}{4}$ ) the Dale and Goodwin mine has been opened for some years. The shaft is 150 feet deep, with eighteen inches of coal covered by twenty inches of black shale having thin layers of good coal intercalated. Beneath the coal is an excellent bed of fire clay having a very considerable thickness. It is used for the manufacture of brick and tile. In fact the mining of the clay forms the principal output of the mine the coal taken out in connection with it being used largely for fuel in the kilns.

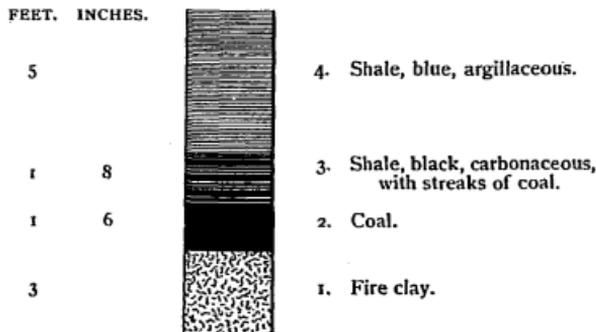


Figure 43. Coal Bed in Dale and Goodwin Mine. Grand Junction.

Eight miles south of Grand Junction, at Rippey, coal has been mined for some years. A short distance east of the railroad station (Tp. 82 N., R. XXIX W., Sec. 11, NW. qr., NW.  $\frac{1}{4}$ ) is the Kennedy mine. This is a well equipped shaft working a seam at a depth of 125 feet. The following sequence of beds at this place is:

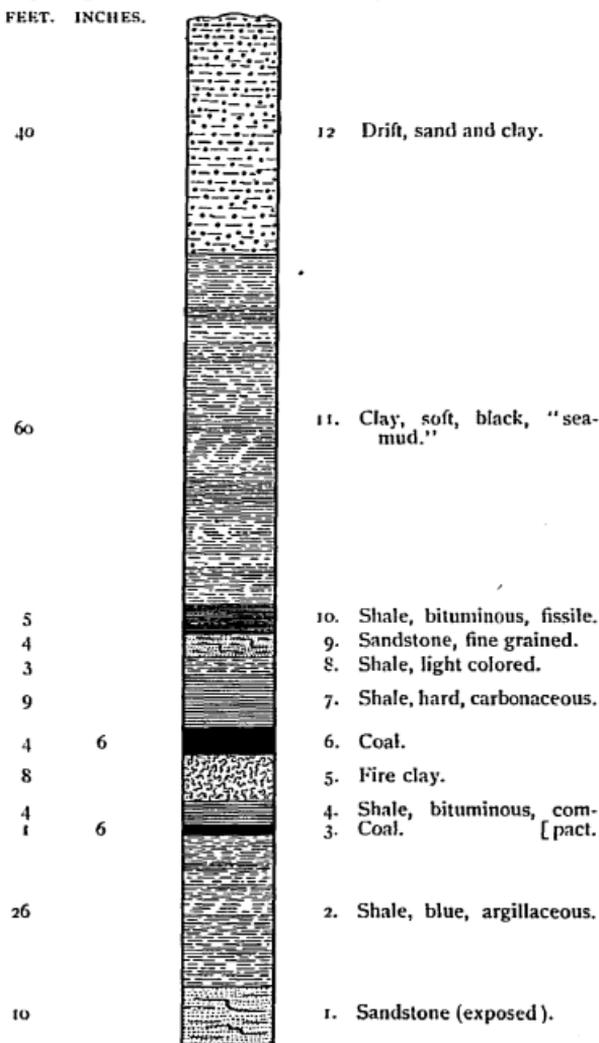


Figure 44. Section at Kennedy Shaft. Rippey.

The coal is from four to five feet in thickness and exhibits three well marked benches: the upper eleven inches is rather soft and contains considerable mineral charcoal; the middle twenty-four inches is quite hard, pure, lustrous and contains some pyrite; while the lower portion, thirteen inches, is a hard, lustrous variety. Below this is a six-inch bed of impure coal or "black-jack" resting upon fire clay. The details of the principal coal bed are:

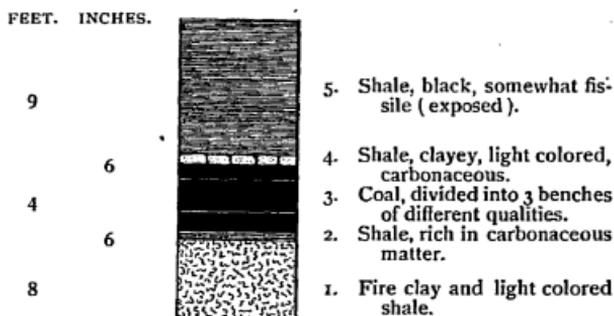


Figure 45. Tripartite Seam at Kennedy Mine. Rippey.

There are no clay seams in the vein, the differences in the three divisions being based entirely upon the physical properties. Immediately over the coal seam is a thin band of gray clay above which comes the nine feet of black shale forming an excellent roof. The main entry near the shaft is fifteen feet wide and has stood nine years without timbering. The seam is rather undulatory and has a general dip to the northeast of about two feet in a hundred. It is quite free from faults though occasionally small slips occur. In a few places the roof has been disturbed through erosion.

In the southeastern corner of the county coal has been extensively mined around Angus both in the adjoining portion of Boone and Dallas counties as well as in Greene. The mines in Greene have worked in two veins. A few of these have mined a seam near the surface which is thought to be the same as that outcropping along the Raccoon river a few miles to the westward. The greatest amount of coal, however, has been taken from the lower vein 100 to 120 feet beneath the surface. It is three and a half to four feet in thickness, hard and of good quality. The roof is a good black shale, which is covered by a considerable thickness of gray clay shale. Beneath the seam of coal the fire clay is said to be eight feet thick in places. The vein is more or less undulatory and has been disturbed but little. The faults are small and of quite local extent. There were at one time twelve mines working in this part of Greene county. The bed of coal, as shown in the Angus mine in Boone county, near the eastern limits of Greene, has the following association of strata :

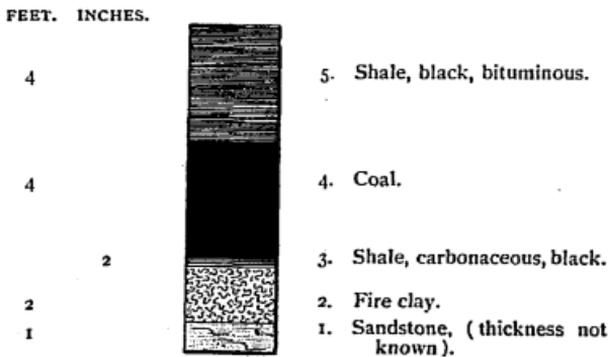


Figure 46. Bed in Angus Mine. Near southeast corner of Greene County.

The principal mines of this neighborhood were the Keystone, Craig, Moingona, Standard, Hager, Buckeye, Armstrong and Morris. These have all been abandoned though the Buckeye slope was in full operation until quite recently.

An interesting example of the method often employed in opening a coal district is shown by the Angus region. Within an area of seven or eight square miles including portions of Greene, Boone and Dallas counties eighteen or twenty mines were opened in the vein known to exist. In the course of time the coal was entirely removed throughout the available territory. A few desultory attempts were made to discover a lower seam though no systematic search was carried out and the Coal Measures were not penetrated very far at any point. These attempts not meeting with immediate success the mines with the exception of two or three were successively closed up and abandoned, the tracks taken up and the machinery and top works moved away. Subsequently a boring was made near the deserted shaft of the Keystone mine and carried to a depth of ninety feet beneath the level of the old workings and a vein of coal four feet four inches in thickness located.

Five or six miles southwest of Rippey and about the same distance west of Angus near the Raccoon river coal has been mined for a long time. The principal openings are the Dicholm and Bussey mines. The coal is about one foot and a half in thickness. In the bluffs the coal seam is exposed about twenty-five feet above the river bed. The section is as follows :



	FEET.	INCHES.
8. Drift.....	3	
7. Sandstone, yellowish, shaly and somewhat argillaceous.	3	
6. Shale, clayey, blue, containing irregular bands of impure, fossiliferous limestone.	1	6
5. Shale, bituminous, fossiliferous.....	3	
4. Coal.....	1	6
3. Shale, clayey, blue.....	1	6
2. Limestone, bluish, compact, fossiliferous.....	3	
1. Shale, yellowish.....	1	

Figure 47. Section of Bluff near Bussey Drift. Southwest of Rippey.

In Guthrie county three miles from the southwestern corner of Greene county coal has been mined to a considerable extent the vein being twenty-two inches thick. It is mined at a depth of from sixty to one hundred feet. It probably extends northward into Greene county but to what extent is not at present known. The section found in the Hughes mine in Guthrie near the southwest corner of Greene is:

FEET.	INCHES.	
2		4. Shale, light colored.
5	6	3. Shale, dark, bituminous, somewhat fissile.
1	6	2. Coal, a two-inch clay parting four inches from the bottom.
4		1. Fire clay, (exposed).

Figure 48. Coal Seam in Hughes Mine. Near southwest Corner of Greene County.

BOONE COUNTY.

Boone is surrounded on all sides by coal counties and has long been known among the leading producing

districts of the state. The drift deposits have a very considerable thickness over the greater part of the region yet they have been completely cut away along the Des Moines river which flows southward through the center of the county in a deep, gorge-like valley. Both on the main stream and all its principal tributaries the stratified rocks are well exposed at short intervals.

The Lower Carboniferous limestones while present at no very great distance below the surface are nowhere exposed within the limits of the district; but a few miles beyond the east county line the Saint Louis limestone crops out in the valley of the Skunk river. The county may, therefore, be regarded as entirely underlain by coal bearing strata.

Boone was one of the first counties in the state to assume prominence in the coal industry and mining has gone on steadily for upwards of a third of a century. In the central part of the county where coal has been taken out for the greatest length of time two principal seams have been opened up. In the southwestern portion of the region, around Angus, several veins are known to exist. It is also quite probable that other beds than those at present generally known occur lower down. In fact some of the deeper borings in different parts of the county clearly indicate the presence of other coal horizons at greater depths than have yet been reached by shafts.

At the present time preparations are being actively carried on for more extensive mining than ever before, especially in those localities along the Des Moines river in the central part of the county.

*Angus District.*—In the extreme southwestern portion of Boone county is a region which a few years ago was one of the most important mining localities in the state.

It forms a part of the district which lies in portions of three counties: Boone, Dallas and Greene. The leading mines, however, were located in Boone. Altogether upwards of a score of shafts have been operated here. At the present time only a few are working; the principal ones running being the Angus and Dalby mines. Among the operators of the district considerable confusion exists as to the exact arrangement of the coal seams. There is one which is worked in the Angus mine and was formerly also in the Craig, Ramsey and Panic shafts. Above this is a thinner seam which has also been worked to some extent in the Craig and the Hagger mines. This is the same vein which is said to crop out in the bluffs of the Raccoon river a few miles to the westward, but there is considerable doubt as to the correctness of the correlation. Lower down than the chief bed worked at the Angus mine is another seam which has been opened in the Dalby shaft. Beneath the first mentioned seam there has been reported a third coal bed which, though not yet worked, has been encountered in borings. Other veins are also known to exist but none have yet been found thick enough for profitable working. The "third" seam is five and one-half feet in thickness according to the best information obtainable, and is located at a depth of ninety feet below the bed opened in the Keystone mine. All the mines are situated southwest of the Angus station. Drillings show that the seams extend beneath the town, but they are somewhat thinner and the roof is poor. A shaft put down east of the place was flooded after working but a short time.

The Angus mine, one of the largest now in operation, is located a short distance from Angus station (Tp. 82 N., R. XXVII W., Sec. 31, NW. qr., NW.  $\frac{1}{4}$ ). It is a

shaft fifty feet in depth, and is thought to be working in the "middle" seam. The coal is from three and one-half to five feet in thickness, with an average of about four feet. The section shows :

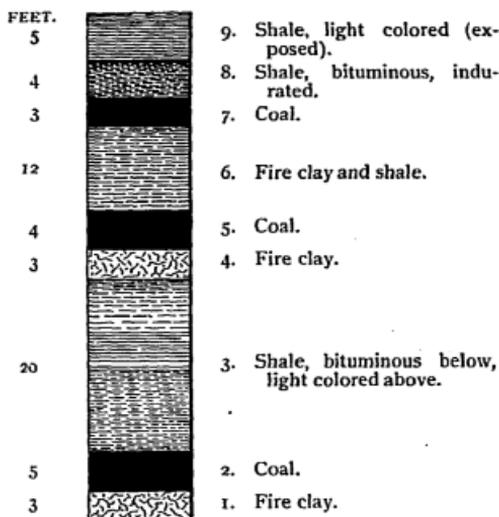


Figure 49. Part of Shaft in Angus Mine. Angus.

The seam is quite undulatory. A few faults have been met with and also several "horsebacks." The mine is worked on the room and pillar plan. As the coal is worked out over all the available territory in any one direction the pillars are "robbed" and the roof finally allowed to fall in.

Half a mile south of the Angus mine is the Dalby. This mine is a shaft 120 feet deep and works in the "lower" vein. The seam is from three to four and one-half feet in thickness; the roof a hard black shale and sandstone but in some places rather poor. The bed is somewhat undulatory; faults are rare. The bottom of the shaft shows :

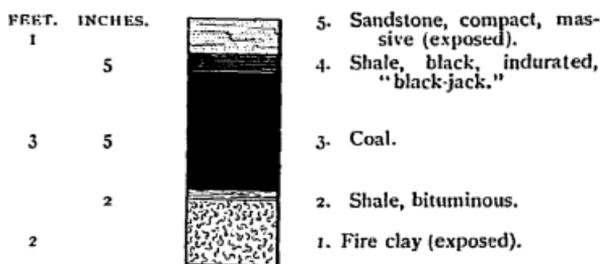


Figure 50. Bed in Dalby Shaft. Angus.

In several places a soft fire clay is found pressing up into the entry forming "creeps" one of which is represented in the accompanying figure 51.

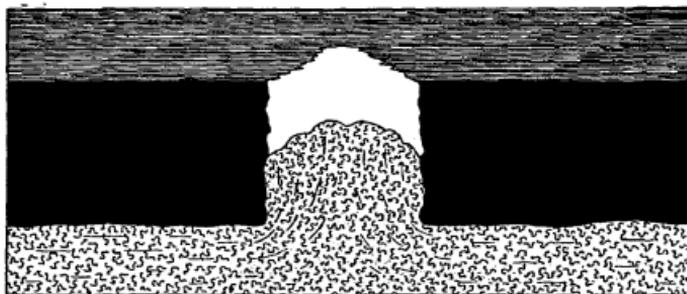


Figure 51. "Creep" in Dalby Mine. Angus.

*Des Moines Valley.*—Local mines have been opened from time to time along the river west of Madrid, but most of these are operated only to supply the immediate neighborhood with fuel during the winter season. The more important mines are in the central portion of the county. About eight miles from the south boundary line is the Potter slope (Tp. 82 N., R. XXVI W., Sec. 15, SW. qr., NW.  $\frac{1}{4}$ ). The section near the coal bed is as follows:

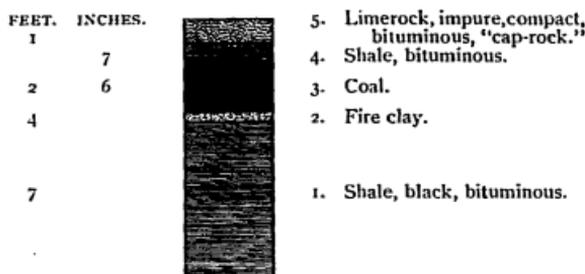


Figure 52. Coal Seam at Potter Slope on the Des Moines River. Below Moingona.

The so-called "cap-rock" is a black, very compact and brittle calcareous shale separated from the coal by a few inches of dark fissile shale which is quite-fossiliferous. The vein of coal is about fifty feet above low water in the Des Moines river. A mile farther up the stream in the southeast quarter of section 9, is the Knox slope. The seam operated appears to be the same as that worked farther down the river but here it is fully seventy feet above the water level. It varies from two and one-half to three and one-half feet in thickness. Two miles beyond near a sharp bend in the river, in section 5, is the Blyth slope. Two veins of coal are exposed, the lower one being about three feet above low water in the Des Moines and the other about forty feet higher up. The lower seam ends abruptly towards the southward, being cut out, through Carboniferous erosion, and the channel filled in with clay. This vein is three feet in thickness; while the "upper" one is two and one-half feet to three feet thick, with a good roof. Between this point and Moingona the bluffs form high mural escarpments of sandstone through which deep labyrinthine ravines have been gouged out by numberless small tributaries as they approach the larger water course. A mile below the town

on the west river bank (Tp. 83 N., R. XXVI W., Sec. 18, NE. qr., SW.  $\frac{1}{4}$ ) is the Highland Chief mine which has been in operation for many years. It is a shaft sixty feet in depth and working the "upper" vein, which is here from two to three feet in thickness. A half a mile directly west is the Moingona shaft No. 6, the last mine opened by the company in the neighborhood. In the vicinity of the town coal crops out in many places in the sides of the Des Moines valley and along the minor streams flowing into the river. Directly opposite the railroad station at Moingona is the White Smoke mine. This is a shaft recently put down. It is about fifty feet in depth and reaches the "upper" vein which has a thickness of two and one-half feet. The section is:

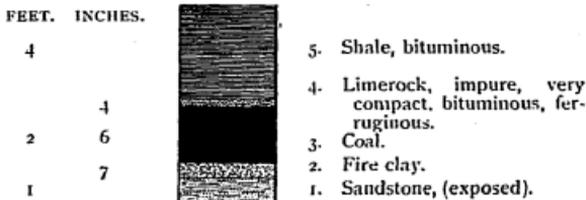


Figure 53. Vein at White Smoke Mine. Moingona.

There are several country banks in the neighborhood which furnish considerable fuel for local use. This locality was formerly an important mining region, but at the present time comparatively little coal is being taken out. North of Moingona about a mile and a half is the old Clyde Mine No. 2, which is now deserted; and farther northward is the Ogden (Tp. 84 N., R. XXVII W., Sec. 27, SE. qr., NE.  $\frac{1}{4}$ ). The coal mined at the latter place is the "lower" vein which, however, seems to be distinct from the similarly named bed of the Milford district a few miles to the northward. A mile north of the Ogden is the Clyde No. 1, now abandoned. This is the southernmost

of the more important mines which are comprised in the Milford area. Near by is the Rogers and Crow shaft (Tp. 84 N., R. XXVII W., Sec. 14, SW. qr., SW.  $\frac{1}{4}$ ). It is located on the summit of the bluff and is 206 feet in depth. The drift deposits at this point are 100 feet in thickness. There are two veins of coal the "upper" being about ten feet above the "lower". The latter is three and one-half feet in thickness on an average. It is somewhat irregular, becoming considerably thicker and thinner in places than the average measurement given. The upper vein is somewhat thinner than the other but more uniform. There is also a third vein said to be present about forty feet below the "lower" vein. About two hundred yards to the northeastward is the Milford shaft which is located at the base of the bluff. It is 100 feet in depth and also works in the "lower" vein which here has a thickness of four feet. At the bottom of the shaft there are :

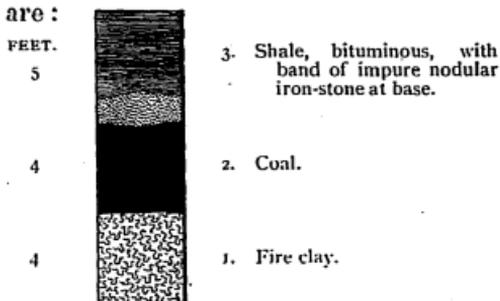


Figure 54. Bottom of shaft, Milford Mine. Boonsborough.

The upper seam is ten to twelve feet above this and three feet in thickness. Several thin veins were passed through in sinking a shaft before reaching the upper seam. Half a mile southeast of the Milford is the Boone Valley shaft which is seventy feet in depth. The coal is three and one half feet in thickness. A second vein is

eight feet higher but only the lower one is mined at the present time. The same company also operates two mines three miles to the northward. Directly to the east are several shafts known as the Marshall mines. They are all located on the river bottom and work coal from two and a half to four feet in thickness.

On the opposite side of the Des Moines river a number of mines are in active operation, the most important of which is the Hunt (Tp. 84 N., R. XXVII W., Sec. 13, NE. qr., SE.  $\frac{1}{4}$ ). Half a mile to the southward is the Marshall slope and about the same distance beyond this, the Johnson mine. The latter is the oldest and largest mine in the county. It is still in operation though opened more than thirty years ago. For about a quarter of a century it has been under the present management. Two workable seams of coal are found, both being worked by the long wall method. The section of the shaft which was prepared from small samples obtained by the foreman at the time of sinking is as follows :

	FEET.	INCHES.
29. Soil .....	5	
28. Clay, yellowish.....	20	
27. Clay, bluish.....	40	
26. Clay, yellowish.....	40	
25. Shale, bluish, massive, dark below.....	9	
24. Sandstone, light colored, shaly.....	9	
23. Shale, dark.....	3	
22. Shale, with iron-stone concretions.....	3	
21. Sandstone, fine grained, friable.....	12	
20. Shale, bluish and drab.....	6	
19. Sandstone, ash colored.....	12	
18. Shale, fossiliferous, hard, compact.....	7	
17. Shale, light colored.....	5	
16. Sandstone, whitish, argillaceous.....	13	
15. Sandstone, compact, somewhat coarse in texture.....	8	
14. Shale, black, bituminous, fissile below.....	3	
13. Fire clay, light colored shale.....	9	
12. Shale, hard.....	5	
11. Fire clay,.....	1	

	FEET.	INCHES.
10. Shale, dark, highly bituminous.....	3	
9. Coal.....		6
8. Limerock, impure clay, iron-stone, highly fossiliferous.....	2	
7. Coal, "upper vein".....	4	
6. Fire clay.....	3	
5. Shale, with irregular iron-stone concretions..	4	
4. Coal, "lower vein".....	4	6
3. Fire clay.....	3	
2. Shale, light colored.....	3	
1. Shale, dark, bituminous.....	2	

The "lower" vein is quite variable in thickness but reaches a maximum measurement of five feet. A mile to the southeastward is the Heap mine which is a shaft 208 feet in depth. Only the "lower" vein is mined at present; it appears to be the same as the similarly called seam in the Johnson mine. The coal is from two to four feet in thickness. About a mile to the southward is the McBrinie shaft 175 feet deep. The coal seam is from three to four feet in thickness, with an excellent roof. The strata shown in connection with the coal at this point are as follows:

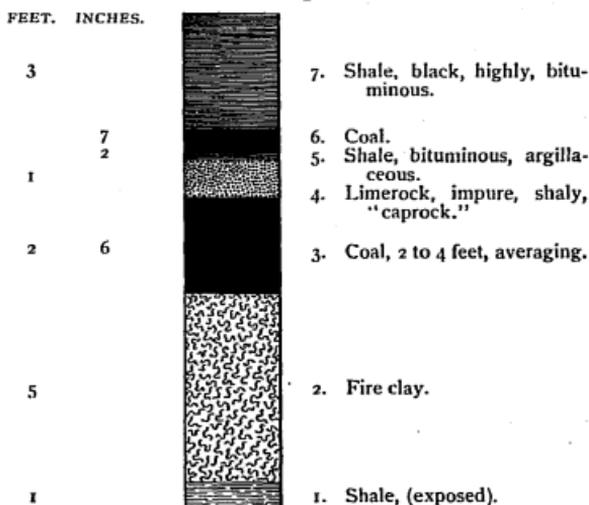


Figure 55. Section in McBrinie Shaft. Boonsborough.

Opened in the same vein are a number of other mines; though at the present time they are not in operation. Among these may be mentioned the Flock and Clarke mines, and the McBrinic and Nelson shaft.

About five miles to the northward from the Milford district and a couple of miles from Pilot Mound station several large mines have recently been opened. They are shafts sixty to one hundred feet in depth. Preparations are actively going on for extensive mining in this vicinity. The openings are known as the Boone Valley mines. Considerable land on both sides of the river is controlled by the company and a railroad is being built from the Pilot Mound to the mines. On the opposite side of the river country banks have been opened from time to time. With better railroad facilities than those now existing in this district they will doubtless soon form mines of commercial importance.

*Squaw Creek Valley.*—Considerable mining has been carried on in the vicinity of Zenorsville in the eastern part of the county. The principal mines are three in number. The Hutchinson, No. 1 (Tp. 8 $\frac{1}{2}$  N., R. XXV. W., Sec. 12, SW. qr., SE.  $\frac{1}{4}$ ), is a shaft 125 feet deep with coal twenty-eight inches in thickness. The section of the shaft is as follows:

	FEET.	INCHES.
11. Soil, gray and sandy.....	1	
10. Clay, joint.....	40	
9. Shale, bluish.....	53	
8. Shale, light colored.....	1	
7. Shale, bituminous, fissile below.....	2	
6. Coal.....	2	
5. Fire clay.....	3	
4. Sandstone, rather soft and friable.....	2	
3. Shale, light colored.....	4	
2. Shale, dark, bituminous.....	3	
1. Coal.....	1	6

Hutchinson shaft No. 2 is located about 300 yards to the northward. It is 105 feet in depth with coal nearly four feet in thickness. There is an upper vein present at this point about six feet above the lower, the latter only being mined at this point. The section at the base of the shaft is:

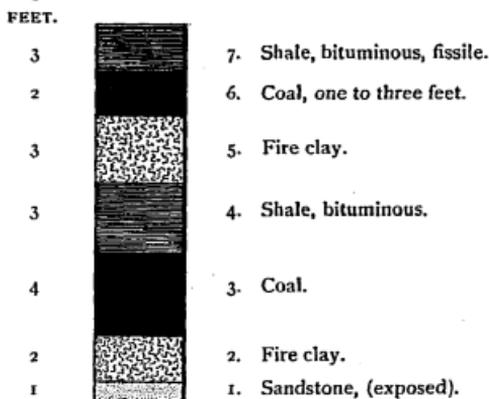


Figure 56. Coal Bed in Hutchinson Mine near Squaw Creek. Zeunorsville.

Northeast of the Hutchinson mine about a quarter of a mile are the York and the Clemens mine, which at the present time are not in operation.

#### STORY COUNTY.

Probably more than one-half of Story county is underlain by Coal Measure strata. These, however, do not form a very great thickness over most of the district since the Lower Carboniferous limestones outcrop along the Skunk river and its tributaries for a distance of several miles to the north of Ames. On Squaw creek a short distance north of Ontario station coal is now being mined (Tp. 84 N., R. XXIV W., Sec. 21, SE. qr., SE.  $\frac{1}{4}$ ) at a place known as the Johnson shaft. The coal is said to be four and a half feet in thickness, with two thinner veins some distance above. Considerable coal has already been

taken out. The following is the section of the strata exposed near the coal seam :

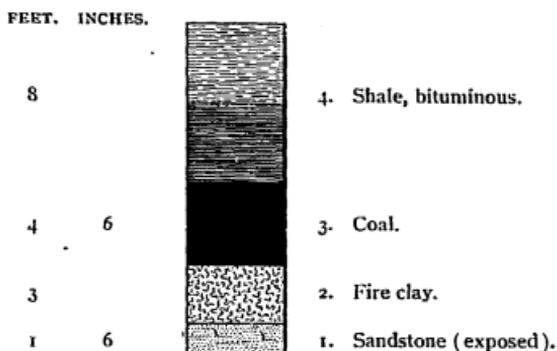


Figure 57. Section of Coal in Johnson Shaft.  
Gilbert.

Only four miles to the eastward the Saint Louis limestone crops out at the surface. The coal area seems to be an eastern portion of the Squaw creek region which has been operated more extensively in Boone county.

#### MARSHALL COUNTY.

This is one of the marginal counties of the Iowa coal field. About one-half of the district is probably underlain immediately under the drift by Lower Carboniferous rocks. These are well exposed along the Iowa river east of Marshalltown. At the extreme eastern edge of the county in the neighborhood of LeGrand quarry and vicinity, thick limestone beds are exposed on both sides of the river showing a thickness above the water-level of seventy-five or eighty feet. The greater part of the rocks exposed belong to the lowermost member of the Lower Carboniferous—the Kinderhook. At the top of the bluff certain strata appear to form a part of the Burlington limestone so well represented in the southeastern part of the state. It is quite likely also that the Saint Louis

limestone crops out at different places within the limits of the county. Away from the immediate vicinity of the Iowa river, which flows across the northeastern corner of the county, the drift has such a great thickness that few outcrops of the stratified rocks are visible.

The Coal Measures occupy fully one-third to one-half of the district underlying the western and southwestern portions especially. Coal pockets also doubtless occur in different parts of the area. Four miles southwest of Marshalltown is the easternmost exposure at present known of the Coal Measure rocks in this county. At this place, on Linn creek, the section is chiefly shale and sandstone the latter being compact enough to be used as a building stone and has been quarried for a number of years. Other large outlyers of Coal Measure are known twenty to twenty-five miles to the eastward, in Benton and Iowa counties.

The principal locality where coal has been mined in Marshall county is on the Iowa river at a place called Mormon Ridge three miles from Albion, a short distance northwest of Marshalltown (Tp. 85 N., R. XIX W., Sec. 34, SW. qr., SE.  $\frac{1}{4}$ ). A shaft forty feet deep was sunk a few years ago and was known as the Mormon Ridge mine. The coal was three feet in thickness.

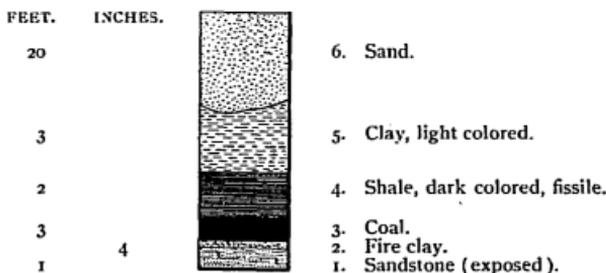


Figure 58. Bed at Mormon Ridge Mine.  
near Albion.

At one time fourteen men were employed. The shaft was operated only a short time for the reason that only three or four feet of shale intervened in the roof between the coal and a thick stratum of sand and water. The water gave so much trouble that the mine was abandoned after being operated about a year. Not more than one hundred tons of coal were taken out. A few years later another company leased the property and attempted to work the coal, but owing to defective pumps made little progress.

A quarter of a mile directly north of this shaft on the north side of Mormon Ridge in an old bed of the Iowa river a considerable quantity of coal is reported to have been taken out some years ago; but at present the bed is not exposed.

In a drill hole, put down one mile northwest of the Mormon Ridge shaft, on the farm of W. C. Radduck (Tp. 85 N., R. XIX W., Sec. 28, SW. qr., SW.  $\frac{1}{4}$ ), a bed of black shale with some coal was encountered, at a depth of 118 feet. The layer was several feet thick and immediately underlain by a thin seam of fire clay.

Some years ago a shaft was sunk on the farm of A. R. Pierce on Minerva creek five miles north of Bangor (Tp. 85 N., R. XX W., Sec. 9, SE. qr., SE.  $\frac{1}{4}$ ). Coal was found here, but to what extent it is not now definitely known.

Like some of the other bordering counties of the coal field systematic prospecting in Marshall will doubtless enable it to rank, at no very distant date, among the districts of the state producing coal in commercial quantities.

