CHAPTER XI.

COAL DEPOSITS OF SOUTHWESTERN IOWA.

This district comprises approximately the southwestern quarter of the state and includes most of southern Iowa drained by the Missouri river. The general structure is comparatively simple. The strata exposed are made up of various successions of marine beds. Everywhere the present surface is covered with a greater or less thickness of drift, and the country being comparatively even the glacial deposits hide from view most of the indurated rocks. In the northwestern half of the area, immediately beneath the drift, the Cretaceous deposits extend over considerable districts. These overlie everywhere the Coal Measure strata. By far the greater part of the region is made up of the Upper Coal Measures, a formation which is characterized by calcareous shales and massive limestones. Fully three-fourths of the district may be regarded as occupied by beds of this character. Owing to few exposures at the surface relatively little coal in commercial quantities has been mined in the region. The principal coal seam now known near the surface is the Nodaway vein, which is exposed, in several counties, along the branches of the Nodaway river. Its thickness is commonly from eighteen to twenty-five inches, though in places it is somewhat thinner. Other thin seams of coal are known to exist in different parts of the area, but none as yet

have been opened. The Lower, the most productive Coal Measures in the state, are nowhere exposed at the surface within the limits of the district. But just beyond the boundaries to the eastward, in Lucas county, shafts have been sunk to depths of from 200 to 300 feet and have successfully mined coal for some years.

The counties included in this district are: Harrison, Shelby, Audubon, Pottawattamie, Cass, Adair, Mills, Montgomery, Adams, Union, Clarke, Fremont, Page, Taylor, Ringgold and Decatur.

HARRISON COUNTY.

This is the most northwesterly of the Iowa districts in which the Coal Measures appear at the surface. The strata are exposed in Harrison only in the beds of the larger streams, in the southern part of the county. On the Missouri river the Carboniferous rocks are seen to pass beneath the Cretaceous a short distance above the south county line of Harrison. On the Boyer river the same rocks are known to crop out for a number of miles along this stream as far as Woodbine, ten miles northeast of Logan. The Cretaceous rocks occupy the surface of most of the county immediately beneath the drift and loess, both of which form extensive deposits in western Iowa. As the Cretaceous rocks spread over so much of the surface of Harrison and form such a very considerable thickness, especially in the northern part, it is not improbable that the brown coals which are known to occur in this region may be found also in workable seams within the limits of the county.

No coal has thus far been mined in the Carboniferous rocks of the district. Black bituminous shales are known to exist in the Coal Measure deposits at various points.

One of these sections showing the carbonaceous shales was examined near Logan, and is essentially the same as that observed by St. John years ago in the same vicinity. It is:

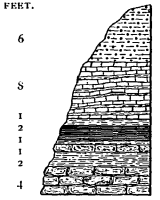


Figure 193. Bluff on Boyer River. Near Logan.

SHELBY COUNTY.

Although Shelby is deeply covered by loess and drift, allowing but few natural outcrops of the stratified rocks, it is quite probable that extensive deposits of Cretaceous exist over most of the county, and that the Coal Measures extend under all at no very great depth. The Carboniferous rocks near the surface all belong to the Upper Coal Measures, the Lower Division lying at a very considerable depth. Information pertaining to the strata passed through in the few wells and borings which have been made is quite inexact and discloses little in regard to the true character and sequence of the rocks below. At the present time no deposits of coal are known to exist at the surface nearer than twenty-five miles from the limits of the county. These localities are in Guthrie to the east, and in Adams to the southeast. In the northwestern part of Adair county coal has been opened up at a

depth of 260 feet. This is the nearest mine to Shelby which is now in operation. There is, perhaps, little reason for believing that workable seams do not exist within the limits of Shelby at depths quite considerable, yet not great enough to preclude profitable working. Owing to the few natural exposures in this and the surrounding counties, the difficulties of obtaining exact information in regard to the coal deposits are much greater than in any other portion of the coal field; and it is necessary to investigate carefully the surrounding districts in order to determine just what may be expected in Shelby county. The depth necessary to go, in prospecting for workable coal, probably need not be over 400 or 500 feet. All drill holes, therefore, should be carefully recorded as regards the beds passed through, for the reason that although no coal seams may be encountered, other easily recognizable horizons may be met with in which will be found data for more accurate estimates.

Brown coals are known to exist in certain parts of the counties towards the northwest, and it is not improbable that workable seams of lignite will be eventually found in the rocks of the same age in Shelby.

AUDUBON COUNTY.

This county is so deeply covered with drift that there are few natural exposures of the stratified rocks. The Cretaceous deposits probably underlie a large proportion of the surface beneath the drift. In this formation there may be seams of brown coal of sufficient thickness for mining to be carried on, as these layers are known to exist farther to the eastward in Guthrie county. On the whole, the Cretaceous deposits probably have not a very great thickness. The Upper Coal Measures extend over much

of the county and doubtless underlie, at no very great depth, the entire district.

No coal is yet known to be mined within the limits of the county, and no systematic prospecting for the mineral has been undertaken. Six miles east of the Audubon boundary, in Guthrie, coal has been mined quite extensively, and it is not unlikely that the same seam extends farther westward into the northeastern portion of Audubon. In sinking deep wells in different parts of the county special attention should be given to preserving the records. They have a very important bearing upon the problem as to the extent of the coal deposits underlying Audubon. If workable coal is found it will be at a very considerable depth.

POTTAWATTAMIE COUNTY.

The bluffs rising on the east side of the Missouri river form a series of rather steep knobs, made up largely of loess. So thick is the deposit that few outcrops of the stratified rocks exist. Those which do appear indicate that most of the county is underlain by the Upper Coal Measure limestones and shales, with probably a considerable extent of Cretaceous rocks near the surface, especially to the northward. Prospecting for coal has been done to some extent, but with little success. A few miles north of Council Bluffs, near Crescent station, a shaft was put down some years ago to the depth of about twenty feet. In it there was passed through a layer of dark, bituminous shale, not unlike the seam exposed farther northward above Logan, in Harrison county. Beyond this, little effort has been made to search for coal. It is known that coal bearing rocks form a very considerable thickness beneath the county, and in order that the horizons which produce

coal farther eastward may be reached, depths of upwards of 500 feet must be penetrated.

CASS COUNTY.

Little of the surface of Cass is as yet deeply trenched by the water courses. The county is everywhere covered by drift and consequently there are few good exposures of stratified rocks. All the outcrops examined indicate that the entire region at no very great depth is underlain by the Upper Coal Measures. Broad areas of Cretaceous beds also occupy portions of the county, but the thickness of this formation is not very great. Little systematic prospecting for coal has been done thus far, owing, doubtless, to the fewness of natural exposures.

Coal has been mined to some extent, however, in the southeastern part of the county, just north of Briscoe in Adams county. In this vicinity coal was first discovered exposed in a deep ravine, just north of the place mentioned. The principal mines in Cass were the Briscoe and the Hughes, both being shallow shafts. The section of the strata penetrated in reaching the seam is essentially the same as in those mines a short distance southward. The vein is apparently the Nodaway coal, the same as that which occupies a considerable portion of Adams, and probably also the adjoining portion of Montgomery. It is from ten to twenty-two inches in thickness. At the Plowman shaft, just over the line in Adams county, the strata indicated in figure 194 are shown.

With the proper railroad facilities a considerable development of the seam would probably be undertaken.

In the vicinity of Lewis, in the western portion of the county, a black calcareous shale two and a half feet in thickness is exposed. The same stratum also outcrops at

a number of places near by. The proper investigation of this carbonaceous seam may eventually lead to the finding of workable beds of coal in connection with it.

FEET.	INCHES.		
2		7.	Shale, gray, clayey.
1		6.	Limestone, gray.
1	4	5.	Coal.
	3	4.	Shale, finely laminated, bituminous.
1	6	3.	Fire clay.
	8	2.	Limestone, thin bedded.
1		1.	Shale, sandy in part.

Figure 194. Coal Bed in Plowman Shaft. At Briscoe, in Adams, near south County Line of Cass.

Directly east of Cass, within a mile of the boundary, in Adair county, a short distance from the town of Bridgewater, recent borings have indicated that a seam of coal about a foot and a half in thickness exists at a depth of 160 feet.

ADAIR COUNTY.

The drift covers this county deeply. Immediately beneath it the Upper Coal Measures are known to exist. The few exposures which do occur in the various streams traversing the county show little indication of the presence of coal above the water level in the streams. At one place, near the extreme eastern margin of the county, on a small branch running into Middle river, a few inches of coal occurs in connection with two feet of black bituminous shale.

A few borings have been put down in different parts of the county, but little systematic prospecting for coal

has been done. At Bridgewater, in the southwestern part of the county, a seam of coal eighteen inches in thickness was struck at two points at depths of 150 and 200 feet. A better vein at a somewhat greater depth is reported. A few miles east of Bridgewater, at Fontanelle, two drill holes have been put down reaching to depths of 370 and 470 feet. It is reported that in the former a seam of coal five feet in thickness was struck. In the other hole, a short distance to the south, two feet of coal were encountered.

The only coal known to be mined in the county at the present time is six miles directly south of Adair, at the Eureka shaft (Tp. 76 N., R. XXXIII W., Sec. 4, NW. qr., NE. $\frac{1}{4}$). The shaft is 262 feet in depth, the coal varying from twenty to thirty-two inches in thickness. The roof is a bituminous shale. The bottom of the shaft shows:

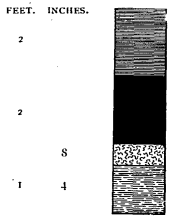


Figure 195. Coal Bed at Eureka Shaft. South of Adair.

The mine is worked on the long wall plan. There are a few unimportant clay seams, but no other breaks in the continuity of the bed. This is a new mine. The coal has been taken out only from about 150 to 200 feet to the east and to the west of the bottom of the shaft. It is

reported that there are two other seams below the one now worked, one at a depth of about forty-five and the other at a depth of about fifty-five feet from the bottom of the shaft.

MILLS COUNTY.

Mills, like Pottawattamie, has comparatively few exposures of older rocks, owing to the heavy deposits of loess which border the Missouri river and extend eastward over the county. In the northeastern corner of the county there are a few exposures of sandstone of Cretaceous age. This formation probably occupies a considerable portion of the eastern part of the district. With the exception of the sandrock just mentioned the indurated rocks all belong to the Upper Coal Measures. No exposures are known to exist in which coal is shown. As in the neighboring counties, the Lower Coal Measures can only be reached at considerable depths. Bituminous shales have been noticed in various places; one of the best exposures being near Glenwood, which is as follows:

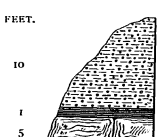


Figure 196. Bluff near Glenwood.

MONTGOMERY COUNTY.

This is one of the counties underlain everywhere by Upper Coal Measure strata; but, as in the adjoining districts, the surface is covered to a considerable depth by drift. A large outlier of Cretaceous sandstone and

shale also occupies a considerable area. The outcrops in various parts of the county show the usual characters of the Upper Coal Measure limestones and calcareous shales. Borings made in different parts of the county all agree in bringing out the predominence of limestone and light colored shale for a considerable depth below the surface. In some parts of the district a vein of coal has been struck not far from the surface. Everywhere that the Coal Measures have been penetrated for any considerable distance the thicknesses given for the coal are from a few inches to a couple or more feet, but as a rule the veins appear to be rather thin. As most of the drilling has been done with an ordinary churn drill the exact thickness and characters of the strata passed through cannot be regarded as very reliable. The few borings made by diamond drills have given much better results.

Workable coal has been known to exist in the northeastern part of the county for many years. The principal opening in this region was the Westrope mine (Tp. 73 N., R. XXXVI W., Sec. 1, SE. qr., SW. $\frac{1}{4}$). The vein was

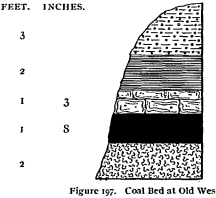


Figure 197. Coal Bed at Old Westrope Mine.

at one time exposed in a small runnel opening into the West Nodaway. The coal has an average thickness of about nineteen inches. As early as 1857 slopes were driven

into the hillsides and a considerable amount of coal removed. From 1875 to 1880 mining was here carried on quite extensively for this region. At one time as many as fifteen men were employed at the mine, the daily output being upwards of 400 bushels or nearly forty tons. At the present time the exposures here are somewhat obscured, but the section appears to be as indicated in figure 197.

About three-fourths of a mile southward a well put down near the top of a hill passed through apparently the same vein of coal. During the past twelve years but little mining has been done in Montgomery county.

ADAMS COUNTY.

The Upper Coal Measures may be regarded as underlying the entire county. In the western part the Cretaceous sandstones occupy a considerable area; and the entire region is mantled by drift. The chief outcrops of rocks are along the larger streams in the western portion of the county. The strata are very regular and have a gentle slope towards the southwest. Most of the exposures show only limestones and calcareous shales. At the present time there is but one coal seam known to exist near the surface within the limits of the county, and this is well exposed along Middle Nodaway river. The vein is from fifteen to twenty-two inches in thickness and outcrops at short intervals for a dozen or more miles along the stream mentioned. It appears to be the same bed which is exposed farther southward along the Nodaways and their branches in Taylor and Page counties. From what is at present known of its extent it may be safely said that the vein occupies at least one-fourth of the entire area of the county. Although the mining at this region

has never been very extensive in any one locality, coal has been worked uninterruptedly for more than a quarter of a century. At the present time the principal mining districts are located at Briscoe, in the northwestern portion of the county, and at Carbon and Eureka, eight and ten miles northwest of Corning.

At Briscoe, coal mining was begun sixteen or seventeen years ago, and ever since mines have been operated and worked, to some extent at least, almost continuously. As the coal is worked out of an opening or the distance from the bottom of the shaft becomes too great for profitable removal, new shafts are put down elsewhere in the same area. The vein varies in thickness from twelve to twenty-two inches, and in order that the coal may be handled advantageously a considerable amount of the associated clay must be removed. With a good roof above the seam and a comparatively soft fire clay beneath, it is usually the latter layer which is taken up to make room for the proper handling of the output. At the present time there are only two shafts in active operation. At the Plowman mine (Tp. 73 N., R. XXXV W., Sec. 2, NW. qr., NW. $\frac{1}{4}$) the shaft is sixty feet deep, with coal varying from ten to twenty inches, with an average of about sixteen inches. The following is a section of the strata passed through in sinking the shaft:

		FEET.	INCHES.
10.	Soil	2	
9.	Clay, yellow	18	
8.	Sandstone	2	
7.	Shale	3	6
6.	Limestone, impure		8
5.	Coal		16
4.	Shale, black, bituminous	3	
3.	Fire clay	1	6
2.	Limestone		8
1.	Shale, gray, sandy	3	

Nos. 1 to 7 are shown in the accompanying figure. Less than a quarter of a mile to the southwest is the Miller mine, a shaft ninety-two feet in depth. The section showing the coal is:

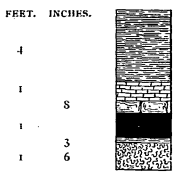


Figure 198. Bed at Miller Mine. Briscoe.

There are other mines which have been worked largely in this vein, but their strata do not differ materially from that shown in the Plowman opening.

Five miles southeast of Briscoe, a short distance west of the Nodaway river, there are located three or more

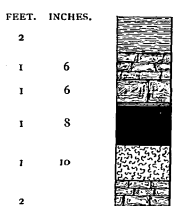


Figure 199. Coal Seam at Spurrier Opening. Eureka.

shafts which are occupied in getting out coal during six or eight months of the year. The coal seam was

formerly exposed in the banks of the branches of the stream, but at the present time all of the mining is carried on by means of shafts. The most easterly mine is the Spurrier (Tp. 73 N., R. XXXIV W., Sec. 29). The section of the layers associated with the coal seam may be taken as representative of the other mines of the vicinity. (Figure 199.)

In this mine is a small fault, having a throw of fourteen inches. A mile northwest of this shaft a pit was

FEET.	INCHES.		
2	6	11.	Soil, black.
15	6	10.	Clay, yellow.
17		9.	Sandstone.
16		8.	Shale, gray, with occasional nodules or concretions.
4	6	7.	Shale, brown.
2	6	6.	Limestone, bituminous.
	7	5.	Shale, black, bituminous.
	9	4.	Limestone, impure.
1	6	3.	Coal.
2	6	2.	Fire clay.
5		1.	Limestone (exposed).

Figure 200. Section of Wyles Shaft. Carbon.

sunk to a depth of thirty feet and eighteen inches of coal reached. A third of a mile west of the Spurrier are three shafts, the most northerly of which is the Hartshorn No. 2, which is twelve and a half feet in depth and works sixteen inches of coal. On the opposite side of a ravine, in the same valley in which all the mines are situated, is another shaft, the Hartshorn No. 1. It is thirty feet deep, with coal of about the same thickness as in the other mines. Just south is the Hinton which is sixty-four feet in depth and operates in coal fourteen to twenty inches in thickness.

Three miles down the river from Eureka and six miles directly northwest of Corning, the county seat, is the mining camp of Carbon. There are nine shafts here, but only five are in operation at the present time. The general depth at which the coal is reached is eighty feet. Near the river (Tp. 72 N., R. XXXV W., Sec. 12, NE. qr., SW. $\frac{1}{4}$) is the Wyles shaft, sixty-one feet in depth with coal twelve to twenty inches in thickness. The section of the shaft is shown in figure 200.

Directly south of the Wyles is the Gibson shaft, and to the southeast the Reese, which is seventy-two feet

FEET.	INCHES.		
2			6. Shale, light gray, clayey.
1	5		5. Limestone, fossiliferous.
1	6		4. Shale, bituminous, fissile.
1	6		3. Coal.
2	6		2. Fire clay.
2			1. Limestone (exposed).

Figure 201. Vein at Syfert and Jones Mine. Carbon.

deep and works from twelve to twenty inches of coal. A quarter of a mile to the southwest of the Wyles shaft is the Syfert and Jones mine, seventy-seven feet deep. The sequence of strata is indicated in figure 201.

A little farther to the southward are three mines, the Gebbie, the Chafey and the Jones. A short distance down the river from the Wyles shaft is the location mentioned by White where a pit was sunk years ago by Bartlett and Smith with a view of finding a deeper and better seam of coal. The following is the section given for a distance of forty-five feet below the seam of coal worked:

		FEET.
6.	Limestone, dark gray, somewhat shaly	5
5.	Shale, dark colored, carbonaceous	2
4.	Limestone, dark colored, fossiliferous	1
3.	Limestone, light colored	5
2.	Shale, gray, clayey	6
1.	Limestone, alternating with shale	25

Two miles west of Carbon (Tp. 72 N., R. XXXV W., Sec. 10, NW. qr., NW. $\frac{1}{4}$) considerable coal has been taken out at the Barker and Hart shaft. It is ninety-two feet in depth with the seam quite regular and from fourteen to sixteen inches in thickness. Two miles directly south of the latter is the Neill shaft, which, however, for the past year or two has not been in operation.

UNION COUNTY.

Drift covers Union county to a very considerable depth, but the entire district is known to be underlain by Upper Coal Measure strata. The chief natural exposures are along the Grand river, yet few of the outcrops appear to show that coal in workable seams is to be expected above the level of the water courses. In many places a bituminous shale is found. One, a short distance east of

Talmage (Tp. 72 N., R. XXVIII W., Sec. 20, NW. qr., NW. $\frac{1}{4}$), is shown on the east bank of the river.

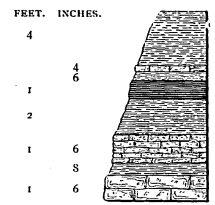


Figure 202. Section on east Bank of Grand River. Talmage.

Although no coal is at present known to be exposed near the surface in Union county, considerable deposits are known farther westward at the same horizons; and the deeper horizons which are nearer the surface farther eastward will doubtless be found to extend beneath Union county.

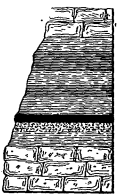
CLARKE COUNTY.

Clarke county forms another one of those counties which is entirely underlain by Coal Measure strata, but which is deeply covered with drift, and in which no coal has yet been mined. The few natural outcrops which are exposed within the limits of the county show the characteristic features of the Upper Coal Measures with few or no indications of workable coal at the surface. Although no coal is yet known to be mined in the county, some of the largest mines in the state were located within a mile of the east county line. The shafts were fully 300 feet in depth. In order to reach this horizon in the eastern part of Clarke it would, therefore, be necessary to

prospect to this depth at least, and in the central and western part of the county perhaps 100 feet farther. Mining has also been carried on near the surface in Warren county, not far from the north county line of Clarke, and it is not improbable that some of these veins also extend into this district.

FREMONT COUNTY.

This is the most southwesterly county in the state. The stratified rocks belong entirely to the Upper Coal Measures and are made up largely of limestones. The superior portion forms the lower section of the so-called Permian of the Kansas-Nebraska region, but all of the layers occurring in Iowa may be regarded as properly



		FEET.	INCHES.
9.	Limestone, in two layers.....	2	6
8.	Shale, yellowish, calcareous	1	3
7.	Shale, dark, bituminous	1	9
6.	Shale, bluish.....	1	3
5.	Shale, black, carbonaceous..... ...	1	
4.	Shale, bluish, calcareous, fossiliferous	1	6
3.	Coal.....		10
2.	Clay, light colored (fire clay).....	2	
1.	Limestone, bluish.....	4	

Figure 203 Section of Bluff southeast of Hartlett.

forming part of the Coal Measure formation. There are in the county numerous good exposures. All of the sections show clearly the predominance of the indurated calcareous rocks. The entire county is deeply covered with the loess or bluff deposit and considerable drift.

No coal is known to have been mined yet within the limits of the county. Prospecting for the mineral has been carried on only in a desultory manner and, consequently,

with but little success. The only seam of coal at present known is in the northwestern part of the county, three miles southeast of Bartlett station (Tp. 70 N., R. XLIII W., Sec. 23). It is known as the section at Wilson's. The upper portion, as also given by White, is shown in figure 203.

If deep prospecting is to be carried on in the search of coal in this county it will probably be necessary to sink borings to depths of from 800 to 1,200 feet. Down the Missouri river at Leavenworth, Kansas, coal is mined extensively at a depth of 750 to 800 feet.

PAGE COUNTY.

The Upper Coal Measures occupy nearly all of the county immediately beneath the drift. The Cretaceous outliers, which are so well developed northward, extend into this county but short distances. Wherever the stratified rocks come to the surface they present a remarkable similarity of lithological and stratigraphical details. The strata are almost entirely limestones and light colored shales which are arranged very evenly with no perceptible dip.

Although Page cannot be regarded as one of the important coal counties of the state, mining has been carried on within its limits for a long period. The coal near the surface appears to form a single bed and probably occupies at least one-fourth of the entire area of the district. It is apparently the Nodaway seam and presents all the usual characters which are found associated with it farther to the northeast, in Adams county. In Page county there appear to be very slight undulations in the strata, by which the coal vein is brought a few feet higher above the water level in the Nodaway river at some points

than at others. Coal mining in the county has been carried on chiefly in the valley of the West Nodaway river, east and south of Clarinda, the county seat.

Near Hawleyville the Coal Measure limestones and shales are well exposed in the banks of the East Nodaway river. Although coal has been mined quite extensively just over the line, in Taylor county, no extensive openings have yet been made in Page, in this neighborhood.

A mile southeast of Clarinda, on the east side of the river, coal has been mined near the Shambaugh mill (Tp. 68 N., R. XXXVI W., Sec. 7, SE. qr., NW. $\frac{1}{4}$) where the bed crops out in the river bluffs. At the mill there is a good exposure showing the coal seam with both the underlying and overlying layers. The section is represented below:

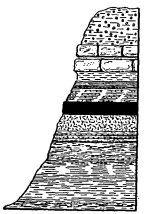


Figure 204. Bluff at Shambaugh Mill, on West Nodaway River, Clarinda.

		FEET.	INCHES.
9.	Drift	4	
8.	Limestone, in two layers, gray, compact	3	
7.	Shale, light colored	1	
6.	Shale, bituminous		9
5.	Limestone, impure, fragmentary	1	6
4.	Coal	1	6
3.	Fire clay	1	8
2.	Shale, light colored, with calcareous nodules	1	
1.	Shale, light colored, (exposed)	8	

Mining has been carried on here on a small scale, entries being driven into the perpendicular bluffs. Considerable trouble, however, has been met with on account of the weathering of the various beds associated with the coal vein. The roof thus became too soft and friable to withstand the removal of the coal, and consequently the

mining has been transferred to the sidehill, a short distance below the mill site. Several openings were made at this place, and altogether a considerable amount of coal taken out.

About a mile northwest of the town of Shambaugh, five miles south of Clarinda, several shafts have been put down and are in active operation from September to April. The principal opening is the Howard mine (Tp. 68 N., R. XXXVII W., Sec. 36, NW. qr., SE. ¼). The entire output from these mines is consumed within the county.

The Nodaway seam is also exposed farther down the stream at and just beyond the south county line, in Missouri. The section, also measured by White, near the Braddy mill is:

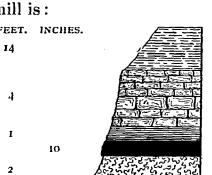


Figure 205. Section on the Nodaway River, below Braddyville. Near the south County Line of Page.

A few miles still farther southward, at Quitman, several shafts are in operation, the coal being from thirteen to fourteen inches in thickness.

Northwest of Clarinda about ten miles, in the valley of the Middle Tarkio river, coal has been mined on the land of Charles Linquist (Tp. 70 N., R. XXXVIII W., Sec. 24, NW. qr., NW. ¼). The coal was first discovered at the base of a low hill near the river. Tunneling was attempted, but here the "caprock" was too badly weathered to form a good roof. A shaft was then sunk to a

depth of twenty-two feet, reaching coal eleven to eighteen inches in thickness. At this point sections were obtained by combining the record found in the shaft and the exposure at the quarry just south of where the coal is taken out, the cut showing from number 6 upwards:

FEET.	INCHES.		
3		12.	Soil, black.
4	6	11.	Clay, reddish, with sand and gravel.
9		10.	Clay, yellow.
2	6	9.	Sand and gravel.
3		8.	Limestone, rather impure, with shaly partings.
1	8	7.	Coal.
3		6.	Fire clay.

Figure 26. Shaft at Linquist Mine. Near Nyman.

		FEET.	INCHES.
5.	Shale, light gray and bluish	1	6
4.	Limestone		6
3.	Clay, gray		6
2.	Limestone, gray and blue	2	
1.	Shale, reddish, (exposed)		4

The coal and associated strata appear to have a slight southerly or southeasterly dip. During the first season about 600 bushels of coal were taken out of the mine, the output being utilized in the immediate neighborhood. The coal is of good quality, firm and well adapted to domestic uses.

TAYLOR COUNTY.

There are comparatively few natural exposures within the limits of Taylor county; and these are largely in the western part along the east side of the East Nodaway. From what is now known, however, there is but little doubt that in the entire county the stratified rocks at the surface all belong to the Upper Coal Measures. In the valley of the stream just mentioned, and along the small tributaries entering it from the east, outcrops are numerous. There are also a number of exposures on the East Fork river in the vicinity of Bedford.

Coal has been mined in this county only in the western and northwestern portions. The vein is manifestly the Nodaway seam, which is also exposed to the westward in Page county, and to the northward in Adams county. It doubtless occupies a very considerable area in Taylor. Considering the fact that there is but one vein of coal yet opened and that this one averages not more than eighteen inches in thickness, the mining industry of the district has proven to be quite important, increasing in extent from year to year. The coal mines now in operation are situated chiefly in two localities, one in the most northwestern township of the county, northeast of Hawleyville, along the bluffs and confluents of the East Nodaway, and the other near Newmarket, eight or nine miles northwest of Bedford, in the valley of the West Fork river and along a branch flowing into this stream from the west. For nearly thirty years coal mining has been carried on in this county. The mineral was first discovered in the northwestern part, and for some years the mining industry was unimportant, the annual output being quite small. In more recent years a rapid development has taken place, other mines having been operated in different localities.

On the East Nodaway, a short distance from Hawleyville, mines have been opened from time to time, and altogether a considerable amount of coal taken out. Farther northward mining on a small scale has been carried on for a number of years. One of the principal openings at the present time is the new Beynon shaft (Tp. 70 N., R. XXXV W., Sec. 20, NE. qr., SW. ¼). The section passed through in sinking the shaft is as follows:

FEET.	INCHES.		
3		11.	Soil.
3		10.	Clay.
10		9.	Gravel and boulders, with but little clay.
1		8.	Sand, white.
1		7.	Gravel.
1	4	6.	Shale, light colored, with calcareous nodules in the lower part.
3	2	5.	Limestone, with clay partings.
1		4.	Shale, black.
1	6	3.	Limerock, impure.
1	6	2.	Coal.
2		1.	Fire clay.

Figure 207. Section at Beynon Shaft. Near Hawleyville.

Just west of the Taylor county line (Tp. 69 N., R. XXXVI W., Sec. 12, SE. qr., SE. ¼) there is an exposure of strata above the bed of a small brook emptying into the river, the top of which lies apparently immediately beneath the fire clay. It shows:

		FEET.	INCHES.
6.	Shale, yellowish, with limestone bands	4	6
5.	Limestone, impure, dark gray in color		6
4.	Shale, black, compact	1	
3.	Limestone, hard	5	
2.	Shale, compact, black	2	4
1.	Limestone, bluish	1	2

A quarter of a mile west of the new Beynon, on the opposite side of the creek, is the new Burnside mine. It is eighty-three feet in depth. At the Ankeny mine, on the east bank of the river, a mile and a half southward from the Beynon shaft, the strata met with are very similar in character and thickness to those shown in the latter. At both places the coal is from twelve to twenty inches in thickness. Much coal has been mined in the several slopes and shafts in this vicinity. A mile southeast of the Ankeny shaft is the Wilcox mine (Tp. 70 N., R. XXXV W., Sec. 32, NW. qr., SW. ¼), where the coal is from twelve to eighteen inches in thickness. The section here is:

FEET.	INCHES.	
2		7. Limestone, gray, fossiliferous.
1	6	6. Limestone, more compact, massive layer.
3		5. Shale, black, finely laminated, with masses of clay ironstone, a bituminous, calcareous, ferruginous ore.
2		
1	3	4. Shale, bituminous, with streaks of impure coal, ("black jack").
2		3. Coal.
2		2. Fire clay.
		1. Shale, light gray (exposed).

Figure 208. Coal Bed at Wilcox Mine. Five Miles north of Newmarket.

On the south side of a ravine known as Coal Hollow, along which the shaft just mentioned is being worked, there are a number of abandoned slopes. Some of these were opened more than a quarter of a century ago. In one place the coal crops out just above the bed of the creek, but the dip of the stratified beds is quite perceptible and the coal soon disappears below water level.

The second locality where coal has been mined extensively is seven or eight miles south of the last, and from a mile to two miles and a half east of Newmarket, on the

Humeston and Shenandoah railroad. This road runs alongside all of the mines and switches have been extended to some of the shafts. Two miles directly east of Newmarket station are two shafts known as the Campbell mines (Tp. 69 N., R. XXXV W., Sec. 33, SW. qr., SE. $\frac{1}{4}$). They are shafts 120 and 110 feet respectively in depth with coal from fourteen to twenty-two inches in thickness. A few hundred feet to the east are three openings, called the Anderson shafts, though only two are now used as hoisting shafts, the other answering as an air shaft. Two of them are 132 and the other is 120 feet in depth with the thickness of the coal averaging about the same as in neighboring mines. More than twelve acres of coal have been removed from these shafts during the past nine years. The section at the most westerly of the Anderson shafts may be taken as typical of all the others in the vicinity, Nos. 2 to 6 being given in the cut:

FEET.	INCHES.		
2			6. Limestone, bluish.
2			5. Shale, black, bituminous, with nodules of impure limestone.
1	10		4. Coal.
1	8		3. Fire clay.
	8		2. Sandstone, soft, somewhat clayey.

Figure 209. Seam at Anderson Shaft. Newmarket.

	FEET.
10. Soil and drift clay	20
9. Sand and gravel	2
8. Clay, tough, dark gray	24
7. Shale, light gray	80
2 to 6 given in figure 209.	
1. Shale, bluish, with thin layers of limestone	12

At the bottom of the shaft a boring 200 feet in depth was put down, but no accurate record was kept. On the east side of West Fork river, near the railroad bridge, is the Adams mine. It is a shaft fifty-two feet deep with coal fifteen to eighteen inches thick. The section, with Nos. 1 to 4 given in the cut, is:

		FEET.	INCHES.
8.	Soil, black, alluvial	6	
7.	Clay	20	
6.	Shale, dark gray	12	6
5.	Shale, light colored	6	

Figure 210. Bed at Adams Mine. Newmarket.

Directly north of the Adams is the Powell and Lathrop mine, sixty feet in depth, with coal averaging seventeen inches in thickness.

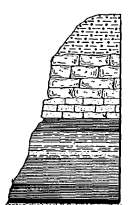
RINGGOLD COUNTY.

There are few indications of the existence of commercial seams of coal near the surface in Ringgold. The entire county is underlaid by the Upper Coal Measure strata, which are largely limestones and light colored calcareous shales. Yet coal has been mined successfully for over a quarter of a century, in apparently the same horizons as are found here, in the county immediately to the west.

Dark colored shales are met with in a number of places throughout the county. One of the thickest strata of this kind known to have been passed through is at Knowlton station, in the northwestern part of the county, where a well was sunk to a depth of sixty feet. Like in several other counties of southwestern Iowa the outcrops of the Coal Measures are so few that it requires careful investigation in some of the neighboring counties before reliable estimates can be made in regard to the probable depth at which coal can be found and the character of the rocks to be encountered.

DECATUR COUNTY.

The stratified rocks of Decatur county belong to the Upper Coal Measures which are deeply mantled everywhere with drift. The outcrops in the county are comparatively numerous but as yet give little indication of the existence of workable coal seams above the water levels of the streams. Nevertheless, several thin beds



		FEET.	INCHES.
9.	Limestone	1	
8.	Shale, yellow, calcareous	1	3
7.	Limestone, gray	10	
6.	Shale, buff and gray	2	6
5.	Shale, black, fissile		10
4.	Shale, with thin calcareous bands	3	
3.	Shale, dark drab	1	
2.	Coal		1
1.	Shale, gray (exposed)	2	8

Figure 211. Section on Creek, near Spring Valley.

have been recognized at different points along Grand river. Two miles directly west of the town of Decatur,

on Sand branch, which flows into Grand river (Tp. 69 N., R. XXVI W., Sec. 29, NW. qr.) a section showing one inch of coal is indicated in figure 211.

Two miles south of the latter section and three miles directly southwest of the same town, on the river just mentioned, a very similar section is shown. The same bituminous shale, but with greater thickness, is also found farther down the river, at Davis City and elsewhere.

In the southern part of the county, two miles west of Spring Valley, a thin seam of coal is exposed on a small branch (Tp. 67 N., R. XXV W., Sec. 14, NE. qr., NW. $\frac{1}{4}$). At the face of the outcrop the coal is three inches thick, but in driving back into the hill about twenty feet it was found to increase to eight inches. The section given is:

		FEET.	INCHES.
9.	Drift	6	
8.	Limestone	6	
7.	Limestone, arenaceous	3	
6.	Shale, black, fissile	2	
5.	Shale, with hardened bands	4	
4.	Shale, light colored	4	
3.	Shale, bituminous	2	
2.	Coal		8
1.	Shale, gray (exposed)	1	

So far as known no prospecting for coal has been carried on systematically or to any great depth. It is probable that in order to reach the same horizons which supply the coal in Lucas and Wayne counties a depth of from 200 to 400 feet would have to be penetrated.