

## CHAPTER IV

### GENERAL SECTION OF THE DES MOINES STAGE OF IOWA

BY JAMES H. LEES.

It has been already emphasized in preceding pages of this report that the strata of the Des Moines stage present such rapid variations that a close correlation of beds and horizons as developed in different areas of the Des Moines Measures is impossible. Hence it will be understood that the accompanying general section of the Des Moines stage or Lower Coal Measures is intended to represent in very broad outline only the succession of these beds as they are exposed in central Iowa. It is without question true that only in rare cases are beds which are developed in one locality to be identified with those which occur at other places some distance away. Thus the Chariton conglomerate of Appanoose county cannot be considered as belonging to the same beds as the fragmentary limestones and ripple-marked sandstones of similar age in Dallas and Guthrie counties. But the presence of these beds in these widely separated localities shows that the same conditions which were prevalent in what is now southeastern Iowa were also active to the northwest and possibly elsewhere within the area now covered by the sediments of this period. The same situation holds good for the coals of the time. While the individual beds are in most cases quite local and limited in extent yet they usually lie in somewhat definite horizons. This indicates that while the coal swamps were relatively small they were fairly abundant at a given time and the conditions which favored the accumulation of the plant remains were widespread. This is of necessity true since plant growth and the factors which favor the preservation and purity of vegetable remains as coal are dependent upon

climatic and crustal conditions. These conditions are more or less uniform over extensive territories and for considerable periods of time. As an instance of this the peat bogs of northern Iowa and other regions may be cited. These speak of conditions which have been stable for thousands of years, ever since the retreat of the last glacier from the surface of the United States. These bogs also serve to illustrate the situation of the beds of coal—basins of variable size and extent separated by considerable stretches of barren territory.

The beds of the Des Moines stage are usually divided in a broad way into three general divisions. These, as indicated in the section, are, from above downward, the Pleasanton, the Appanoose, with its equivalent beds farther northwest, and the Cherokee. Of these three the lower division, the Cherokee, is the most important, in Iowa as well as in Missouri and Kansas. This is true not only as regards areal extent, but still more markedly from an economic standpoint, since it is said that from eighty to ninety per cent of the coal mined in the Western Interior coal field comes from this member of the Lower Coal Measures. It will be seen from the section that shales are the preponderating element in this division, while sandstones are also quite important. Coal beds and fire clays play a minor part, although economically the former are exceedingly important. All these beds are wonderfully irregular in distribution. They thicken and thin with amazing rapidity and grade from one to another horizontally as well as vertically in a way to puzzle the most experienced of drillers as well as of geologists. The beds of coal vary in thickness up to seven feet with an average of about four feet. Their areal extent is usually not above a few hundred acres and many of them are much below this maximum. Many of them lie in depressions in the Saint Louis limestone and their limits are determined by this formation. The Cherokee beds form the eastern line of outcrop of the Lower Coal Measures from Van Buren to Webster counties. Their maximum thickness will probably average 500 feet, although over most of their area they are considerably thinner. The numerous outliers of Des Moines beds which are scattered over the eastern part of Iowa probably belong with the lower phase. For the most part

these are related to the Iowa coal field, although a few, notably the large area in Muscatine and Scott counties, are extensions of the Illinois field.

The Appanoose formation is typically developed in Appanoose and neighboring counties, as well as across the state line in Missouri. The beds composing this division are much more regular in structure than those underlying them, and the coals, while thinner, are more continuous and dependable. The most important of these coals is the Mystic seam, which underlies an area of about 1,500 square miles in the two states. Although only about thirty inches thick on the average its persistency enables it to be economically and profitably mined while other coals as thick but occurring under less favorable conditions are of necessity left to supply more urgent needs.

Accompanying this coal seam are several relatively thin limestone beds marked, like the coal, by great continuity and uniformity of character. Some shales and a conglomerate are also present. As has already been indicated there are in several counties along the western exposure of the Lower Coal Measures, beds which correspond stratigraphically to these just described. If the correlation made in the accompanying section is correct the correspondence of strata is quite close and indicates more widespread uniformity of conditions than prevailed during Cherokee times. None of the coals of these western counties, however, rank in importance with the Mystic seam.

The upper division of the Des Moines, the Pleasanton, is not of great importance in Iowa. While in Kansas these beds attain a thickness of about 200 feet and carry some important coal seams, they thin to the north and in Iowa are characteristically barren of coal and scarcely distinguishable from the next lower division. They thin rapidly in Guthrie county and probably do not extend beyond the northern limit of this county.

It is not to be understood that these three divisions are sharply set off one from the other, for they are for the most part conformable each to each and hence there are no clear dividing lines. The divisions are made because each phase exhibits certain well-marked features which set it off in a general way from the others.

In the section certain counties are given with each number of the series to indicate where these members are best developed. They also indicate the correlation of beds which seems most probable. Of course the lower beds or their equivalents will pass under the next succeeding ones to the west and may be penetrated here by deep drillings. As coal prospecting is carried to deeper and deeper levels in the western portions of the coal field, those horizons which have proved so productive in the eastern counties are being reached and proven to be rich in their coal content. Naturally the Coal Measures thicken westward from their eastern outcrop and this thickening is maintained at least as far west as the margin of the Missouri and Cretaceous strata where these overlie the Des Moines beds. The thicknesses given for the various members represent their maximum and minimum development in the various parts of their exposures. The total thickness of the Des Moines stage is probably about one-half the maximum here given, or 750 feet. However, in few localities where the entire body of sediments has been penetrated is this maximum approached. Most of these show about 500-600 feet as belonging to this stage.

Attention is again called to the fact that the correlations here given are general and tentative. Only the important coal horizons are noted although many drill holes and other sections show from four to eight, ten or even twelve seams in vertical series. The succession of strata indicated is such as would be encountered in crossing the coal field from west to east rather than in penetrating the series from above downward at any given locality, although the correspondence would doubtless hold good to a fair extent even in the latter case.

- |   | FEET.     |
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| 32. Sandstone, sandy shales and shales, with occasional limestone bands, one quite persistent, a little above the middle of the bed. These beds appear to thicken toward the south and west (equivalent of Pleasanton shales of Missouri and Kansas)..... | 30 to 100 |
| 31. Coal, the Lonsdale seam, sometimes divided by one or two clay partings .....  | 1 to 2½   |
| Warren, Guthrie, Dallas, Madison. (Nos. 31 to 23 constitute the equivalent of the Appanoose formation of southern Iowa and the Henrietta formation of Missouri. The Appanoose formation is marked by great persistence of the strata.)                    |           |

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30. Shale, variegated, in places arenaceous, with very persistent seams of limestone and sandstone, a few inches to several feet in thickness.....25 to 100  
Warren, Dallas, Madison, Guthrie.
29. Coal, in places split up by thin beds of shale, fire clay, etc. ....1 to 3  
Guthrie, Warren, Madison.
28. Fire clay .....3 to 13  
Warren, Guthrie.
27. Chariton conglomerate, in several beds alternately coarse and fine in character, the former more typical. Pebbles are chiefly limestone, with coal fragments and fossils, embedded in a matrix in part arenaceous, in part magnesian-calcareous .....15 to 25  
Appanoose, Monroe. In Guthrie county one of the limestones of No. 26 shows rolled pebbles and the sandstones are ripple-marked, showing conditions similar to those which formed the Chariton conglomerate of the southeast.
26. Shales and limestones. In Appanoose county the shales are variable in color, gray to black, some arenaceous, bituminous or pyritiferous, in beds one to thirty feet thick; the limestones are gray, subcrystalline, in beds one to ten feet thick. In Dallas are two beds of sandstone, one to twenty feet thick and three or four persistent bands of limestone, some fragmentary and fossiliferous, one to four feet thick. In Guthrie there are thin limestone beds with shales and a heavy bed of sandstone.....50 to 100  
Appanoose, Dallas, Guthrie, Madison, Warren.
25. Coal, in Appanoose county the Mystic seam, one and one-half to three feet thick, usually divided by one or two clay partings two to six inches thick; in Dallas and Guthrie the Marshall seam, six to twenty inches thick.....½ to 3  
Appanoose, Dallas, Guthrie, Greene, Warren, Madison, perhaps represented in Polk by one of the thin seams above the "first vein."
24. Fire clay .....1 to 8  
Appanoose, Guthrie, Madison, Polk.
23. Limestone, "bottom-rock," in Appanoose county one to five feet thick; in Dallas and Guthrie two beds alternating with heavy beds of shale, average.....15 to 35  
Appanoose, Dallas, Guthrie, Warren.
22. Shales, sandstones, limestones; shales diversified, red, blue, gray, some fossiliferous bands, some transitional from sandstone, some sandstones heavily bedded. Limestone sometimes forming a "cap rock".....25 to 130  
Warren, Dallas, Polk, Guthrie, Boone.

21. Coal, in Dallas and Guthrie, the Redfield seam; in Polk probably one of the thin upper seams.....1 to 5  
Warren, Dallas, Polk, Guthrie, Greene. Perhaps present in Boone as the upper horizon.
20. Fire clay .....1 to 5  
Polk, Guthrie, Boone. The numbers below and also probably those from 22 to 20 correspond in general position and character to the Cherokee shales of Kansas.
19. Shales and sandstones alternating, the shale beds from two to twenty-five feet thick, the sandstones from two to five. Some calcareous layers and true limestones locally developed. Several thin veins of coal accompanied by beds of fire clay are present locally.....25 to 150  
Appanoose, Monroe, Wapello, Polk, Dallas, Guthrie, Webster Boone.
18. Coal, doubtless represented in different counties by various seams. "First vein" of Polk county. Perhaps "upper vein" of Boone county where it is sometimes bipartite .....1 to 6  
Appanoose, Warren, Guthrie, Dallas, Greene, Webster. The coal beds of Webster county are local. They may belong in this part of the Des Moines stage.
17. Fire clay .....1 to 15+  
Polk, Warren, Webster, Boone.
16. Shales, black, light-colored, etc., limestone, in thin layers, sandstone .....25 to 80  
Polk, Dallas, Guthrie, Webster, Boone.
15. Coal, "second vein" of Polk county.....2 to 5  
Dallas, Guthrie, Webster, perhaps lower vein of Boone.
14. Fire clay .....1 to 8  
Polk, Guthrie, Dallas, Webster, Boone.
13. Shales, black to gray, sandstone; thin bands of limestone .....20 to 70
12. Coal, "third vein" of Polk county, in places separated by bands of pyrite or shale. Probably deeper beds of Dallas and Guthrie. Perhaps represented in Webster county 3 to 8
11. Fire clay .....1 to 6  
Polk, Dallas, Webster.
10. Shale, vari-colored; sandstone, ferruginous, etc., limestone locally developed.....5 to 50  
Jefferson, Hardin, Polk, Wapello, Guthrie, Webster.
9. Shales, variegated, in places arenaceous; fire clay; in places some relatively thin seams of coal in the shales; local layers of limestone and sandstone.....25 to 180  
Warren, Appanoose, Mahaska, Jefferson, Monroe, Polk, Jasper.

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8. "Cap rock," an arenaceous limestone, locally developed. 0 to 2  
Jasper, Wapello.
7. Coal, in places a number of seams from a few inches to two  
feet thick, separated by a few to many feet of shale and  
sandstone of the overlying and underlying members. 1 to 4  
Wapello, Jefferson, Marshall, Warren, Jasper, Mahaska, Mon-  
roe, Appanoose.
6. Shales, black, gray, blue, etc. In some places sandstone  
layers are intercalated and locally a thin limestone bed  
is present .....10 to 130  
Appanoose, Wapello, Jefferson, Keokuk, Van Buren, Monroe,  
Warren.
5. "Cap rock," developed in places.....1 to 2  
Jasper, Wapello, Keokuk, Marion.
4. Coal; in places two or more seams are present, divided by  
several feet of shale. In places rests directly on St. Louis  
limestone .....1 to 7  
Keokuk, Van Buren, Jefferson, Mahaska, Wapello, Monroe,  
Appanoose.
3. Fire clay, in places rests directly on St. Louis limestone.  
In places absent.....2 to 15  
Van Buren, Keokuk, Wapello, Mahaska, Monroe.
2. Shales, of various colors, in places arenaceous. Locally true  
sandstones are developed as intercalated layers. In places  
all are absent.....10 to 100  
Van Buren, Wapello, Appanoose.
1. Sandstone, in places a gradation from arenaceous shales,  
not always present.....0 to 25  
Van Buren, Keokuk, Appanoose, Wapello.