# COAL FIELDS OF THE WIND RIVER REGION, FREMONT AND NATRONA COUNTIES, WYOMING.

By E. G. Woodruff and Dean E. Winchester.

## INTRODUCTION.

The following pages contain a description of the coal fields in the Wind River region,[1] west central Wyoming. These fields are distributed along the edges of a large syncline (Pl. XLIX) and are separated from one another by areas in which coal is known to be absent or in which its presence can not be determined without drilling, because the beds are concealed beneath noncoal-bearing formations which overlap them unconformably. From west to east the coal fields are named Muddy Creek, Pilot Butte, Hudson, Alkali Butte, and Powder River fields.

The primary purpose of the investigation was to obtain data for the classification of the public land and to collect information relating to the amount and character of the coal in order to fix a price at which such land should be offered for sale. During the progress of the work much geologic information was collected, and that part of it relating to the geology and coal resources is set forth in this report.

In order to collect data for the classification and valuation of the land the outcrops of the coal beds were traversed and located accurately with regard to land corners. Topographic and geologic maps were made and sections of the rocks were measured at many places. Samples of the coal were taken for chemical analysis wherever unweathered material could be obtained, but several slightly weathered samples were accepted because fresh coal could not be secured. A close study was made of the physical properties of the coal for the purpose of determining whether or not it could be successfully stocked after it is mined or whether it would slack too rapidly for such handling, and therefore must be consumed soon after it is taken from the ground.

[1] The name Wind River coal region, as used by the United States Geological Survey, includes all the area drained by Wind River, and also extends southeastward to embrace the related fields about the headwaters of Powder River and a small area in the valley of North Platte River.

The investigation began in the fall of 1908 but was interrupted by bad weather, was resumed early in June, 1909, and extended into October of that year. Again unfavorable weather prevented the completion of the work, but in 1910 the survey was extended into the Platte River district, which was the only part of the region unexamined when work was stopped the previous fall. The work of the first two years was under the direction of Mr. Woodruff, the senior author; the continuation of the work in 1910 was under Mr. Winchester.

In 1908 Mr. Woodruff was assisted by M. A. Pishel, J. H. Cather, R. L. Nelson, and Jesse Galloway. The two first named acted as scientific assistants and collected most of the data which relate to the Muddy Creek field. Mr. Pishel returned to the office of the Survey and assisted in compiling the data and preparing them for publication. Owing to an accident which destroyed some of the field notes it became necessary to reexamine part of this field in 1909; hence the map of the Muddy Creek field is compiled from two surveys and represents in part the work of D. E. Winchester, S. V. Eakin, A. J. Jarrett, and Frank Hindera, who were members of the party in 1909. During this season Mr. Winchester served as chief assistant in the field and at its close returned to the office and assisted in the preparation of the data for publication. During July, 1910, with the assistance of A. C. Reeds and Guy Scott, Mr. Winchester completed the survey of the region.

To all the men above named the writers are indebted for the successful completion of the work. Operators in the fields and residents in the region furnished data and rendered assistance in many ways. The names of those who gave aid in this way are too numerous to specify individually, but the writers wish particularly to express their obligations to Messrs. H. O. Barber, Thomas Dunne, R. H. Hall, and George White.

## LOCATION AND EXTENT.

The Wind River coal region is located in Fremont and Natrona counties, Wyo., and contains the geographical center of the State, though most of the area is to the west of that point. (See index map, Pl. XLIX.) The coal fields comprise an area of about 2,500 square miles, lying chiefly in the Wind River basin between the Owl Creek, Bridger, and Bighorn mountains on the north and the Wind River and Rattlesnake ranges on the south.

The coal beds were found generally to be lenticular and no individual lens covers a large area. Furthermore, the outcrops of the coal-bearing formations in many places are concealed by rocks which were deposited over their upturned edges. This condition of outcrop prevented the investigators from securing complete data without

drilling, which was impossible. Only a small part of this region contains coal beds at the surface, though nearly all of it may possibly be underlain by coal. In the covered areas, on account of the lenticular character of the coal beds, there is nothing to indicate the exact position of any bed or its depth below the surface, but in the few fields distributed about the edge of the region, as shown on the map, the beds are well exposed.

If the location and extent of all the coal beds in the Wind River region were known, there would doubtless be a large number of comparatively small irregular fields, most of which are now deeply buried in the interior of the syncline. There is no way of telling from surface indications where these fields are located, because they are concealed beneath a great mass of barren rock which fills the interior of the region and in many places overlaps the upturned edge of the coal-bearing formations.

## HISTORICAL SKETCH.

The Wind River region has been known to contain coal of commercial value since some of the earlier explorers examined coal beds along Popo Agie River. Only small mines were opened, however, because the sparse settlement afforded very little local market and there was no commercial market which could be reached until 1906, when the Wyoming & Northwestern Railroad was completed from Casper to Lander.

The first record of coal development in the region is that of a mine (No. 129, fig. 14, p. 546) near the town of Hudson, which was opened in 1870. This and other mines in the vicinity which were opened previous to 1900 were worked in an unsystematic way and the product was used to supply local trade. L. D. Ricketts,[1] in his report to the governor of Wyoming in 1888, describes coal prospects in sec. 27, T. 33 N., R. 86 W., and in sec. 14, T. 34 N., R. 88 W., and gives analyses of the coals mined at these localities. These prospects evidently correspond to the openings shown at locations 257 and 218 on Plate LVI, Powder River field. One mine near Hudson was visited by George H. Eldridge [2] in 1893 during his explorations in northwestern Wyoming. Mr. Eldridge gives a measurement of the bed and an analysis of the coal, together with a short description of the geology of the region. In 1895 W. C. Knight [3] published a short description of the coal fields of Wyoming, including analyses of coal from mines near Lander.

[1] Ricketts, L. D., Rept. Wyoming Geol. Survey, 1888, pp. 19, 20.
[2] Eldridge, G. H., Bull. U. S. Geol. Survey No. 119, 1894, pp. 60–61.
[3] Knight, W. C., Coal, Wyoming: Sixteenth Ann. Rept. U. S. Geol. Survey, pt. 4, 1894 p. 208.

The following geologists have contributed to the literature relating to the region:

RICKETTS, L. D., Rept. Wyoming Geol. Survey, 1888.
ELDRIDGE, G. H., A geological reconnaissance in northwest Wyoming: Bull. U. S. Geol. Survey No. 119, 1894.
KNIGHT, W. C., Sixteenth Ann. Rept. U. S. Geol. Survey, pt. 4, 1894.
STORRS, L. S., Twenty-second Ann. Rept. U. S. Geol. Survey, pt. 3, 1901.
TRUMBULL, L. W., Bulletin Univ. Wyoming School of Mines No. 7, 1905.
DARTON, N. H., Geology of Owl Creek Mountains: Senate Doc. No. 219, 1906.
DARTON, N. H., Geology of Bighorn Mountains: Prof. Paper U. S. Geol. Survey No. 51, 1906.
WOODRUFF, E. G., The Lander coal field: Bull. U. S. Geol. Survey No. 316, 1906.
DARTON, N. H., Paleozoic and Mesozoic of central Wyoming: Bull. Geol. Soc. America, vol. 19, 1907.

## METHOD OF FIELD WORK.

As the principal object of the survey was to classify and value the coal land, it was necessary to locate all important points with reference to the land subdivisions. To do this accurately topographic and geologic features were mapped on a planetable with telescopic alidade on the scale of 2 inches to the mile. The outcrops of all coal beds were examined, their locations determined instrumentally, and the thickness measured in prospects and in natural exposures. A large part of the mapping which did not relate directly to the coal beds was done by triangulation. In this work, whenever possible, two or more section corners were located and the distance between them used as a base line for triangulation. This distance was not measured, but was accepted as shown on the Land Office plats. Locations on the plats were also accepted as given by the land surveys. However, when it was found necessary to use a single corner, a base line was measured from that corner with telescopic alidade and stadia rod. From this base a system of triangles was expanded which included all the points whose positions were desired. The land survey under the Wind River meridian is excellent and no difficulty was found in locating section corners, but in the area in which the surveys were based on the sixth principal meridian few corners were found.

Vertical control for the topographic map of the western part of the region was obtained from the United States Geological Survey bench marks and the profile of a projected railroad along Wind River. In the area east of Popo Agie River altitudes are based on a line of elevations run from the railroad at Hudson to the railroad station at Powder River. These altitudes were determined by the telescopic alidade and stadia rod.

In addition to the general topographic and geologic map, detailed maps were made of the outcrops of all coal beds. All mines, prospects, and exposures of coal were located and their relation to section corners was determined by the telescopic alidade and stadia rod.

The coal beds were traversed and examined at many places along their outcrops and sections were measured at favorable localities, but no great amount of prospecting having been done, fresh exposures of the coal are not abundant, and at many places it was necessary to uncover the beds in order to measure their thickness. All coal mines were visited, and where possible samples of coal were taken for chemical analysis. In collecting these samples the regular United States Geological Survey method, described by M. R. Campbell in Bulletin 341, was adopted. This method is, in brief: (1) Select a representative place in the mine where coal can be taken from a dry, unweathered surface; (2) clean dirt and powder stains from the face of the coal; (3) cut a channel from top to bottom of coal bed so that a gross sample of about 5 pounds for each foot of thickness of the bed is obtained. The coal should be caught on a dry canvas. Discard partings more than three-eighths inch thick and sulphur lenses having a thickness of more than one-half inch and a diameter of more than 2 inches; (4) the sample is then crushed, thoroughly mixed, and so divided that the final sample is an average of the entire cutting; (5) the sample is then placed in a can and sealed to prevent the loss of moisture in transit to the laboratory. The results of the chemical analyses are given on pages 533–534.

In various parts of the region stratigraphic sections were measured in detail, and the thickness of each bed was determined by the use of the telescopic alidade and stadia rod or by direct measurement with a tape.

## TOPOGRAPHY AND DRAINAGE.

In a broad way, the Wind River region is a gently undulating plain, sloping gently toward the interior from the mountain barriers which surround it. The Owl Creek, Bridger, and Bighorn mountains lie to the north and the Oil Mountain anticline forms a low boundary on the northeast, whereas to the south and southwest are the Rattlesnake Mountains and the lofty, rugged Wind River Range.

The topography is characterized by sharp-crested, steep-sided ridges between narrow V-shaped valleys which descend rapidly toward the main streams that rise in the mountains and cross the coal-bearing rocks to reach the trunk streams of the region. Some of the creeks flow continuously, though most of them are intermittent. In general the more uneven parts of the surface are in the coal fields, where the topography is controlled by upturned beds of hard sandstone which resist the action of weathering, and therefore stand out as more or less pronounced ridges. Where the beds dip at low angles they present an escarpment on one side and a dip slope on the other, but where they stand at high angles they form sharp-crested ridges. Detailed description of the surface features is presented in the description of each field.

The drainage of the region is mainly through Wind River, but in the eastern part the surplus water is discharged into Powder and North Platte rivers. Popo Agie River is the main branch of Wind River and crosses the Hudson field. Dry, Fivemile, and Muddy creeks flow from the northwest and Poison Creek from the east. Several branches of Powder River drain the Powder River field. Poison Spider Creek and other minor tributaries of Platte River drain the Efell and Platte River districts. In general the main creeks are bordered by narrow plains that can be traversed by wagon roads from settlements along the rivers to the coal fields, which are commonly in uninhabited areas.

## GEOLOGY.

### STRATIGRAPHY.

#### SEQUENCE OF FORMATIONS.

The rocks exposed in the Wind River region belong to the Upper Cretaceous and to the Eocene series of the Tertiary. The following table presents the sequence and stratigraphic relation of the formations:

*Geologic relation of the formations in the Wind River region.*

| System. | Series. | Group. | Formation. | Character. |
|---|---|---|---|---|
| Tertiary. | Eocene. | | Wind River formation. | Banded, sandy shale, sandstone, and conglomerate. |
| | | | Unconformity | |
| | | | Fort Union formation. | Sandstone and sandy shale, with beds of coal. |
| Cretaceous. | Upper Cretaceous. | Montana. | Mesaverde formation. | Tan-colored sandy shale and a few sandstone lenses, with beds of coal. |
| | | | | Slightly ferruginous sandstone and a small amount of sandy shale with beds of coal. |
| | | | Mancos shale. | Thick beds of tan-colored sandy shale, shaly sandstone, and local lenses of massive sandstone. Only the upper part exposed in the coal fields. |
| | | Colorado. | | |

The formations enumerated in the foregoing table include the rocks variously classed as Montana, Fox Hills, and Laramie, by Ricketts,[1] Eldridge,[2] and Darton.[3]

Extensive work by the field parties of the United States Geological Survey during the last few years has led to a revision of the names and the sequence of the formations in many areas. This work has

[1] Ricketts, L. D., Ann. Rept. Terr. Geologist to the Governor of Wyoming, January, 1888.

[2] Eldridge, G. H., A geological reconnaissance in northwest Wyoming: Bull. U. S. Geol. Survey No. 119, 1894.

[3] Darton, N. H., Paleozoic and Mesozoic of central Wyoming: Bull. Geol. Soc. America, vol. 19, 1908, pp. 403–470.

included the Wind River basin, and the classification shown in the table given above has been determined with a fair degree of accuracy. The areal distribution of the formations is shown on Plate XLIX.

### MANCOS SHALE.

The rocks on which the coal-bearing strata rest are sandy shale with both thick-bedded and shaly sandstone intercalated in the upper part. The beds have been described by the senior author in his report on the Lander oil field,[1] where their correlation with the Mancos shale of southwestern Colorado was discussed. The formation contains no coal except unimportant beds in the lower part.

The Mancos shale is about 6,000 feet thick. It was called Pierre and Benton by Darton[2] in the report of his reconnaissance work in 1906, but a careful study of fossils collected from these rocks and identified by T. W. Stanton confirms the earlier opinion in so far as it referred the upper part of the formation to the Montana group, but disagrees with the correlation of these beds with the Pierre. The fossils upon which this opinion is based are listed below.

*Fossils from the Mancos shale collected in the Wind River region.*

Sec. 20, T. 34 N., R. 98 W., 1 mile northwest of Hudson:
- Anomia sp.
- Modiola regularis White ?
- Corbula undifera Meek.
- Corbula subtrigonalis M. and H.
- Siliqua ? sp.
- Melania insculpta Meek.

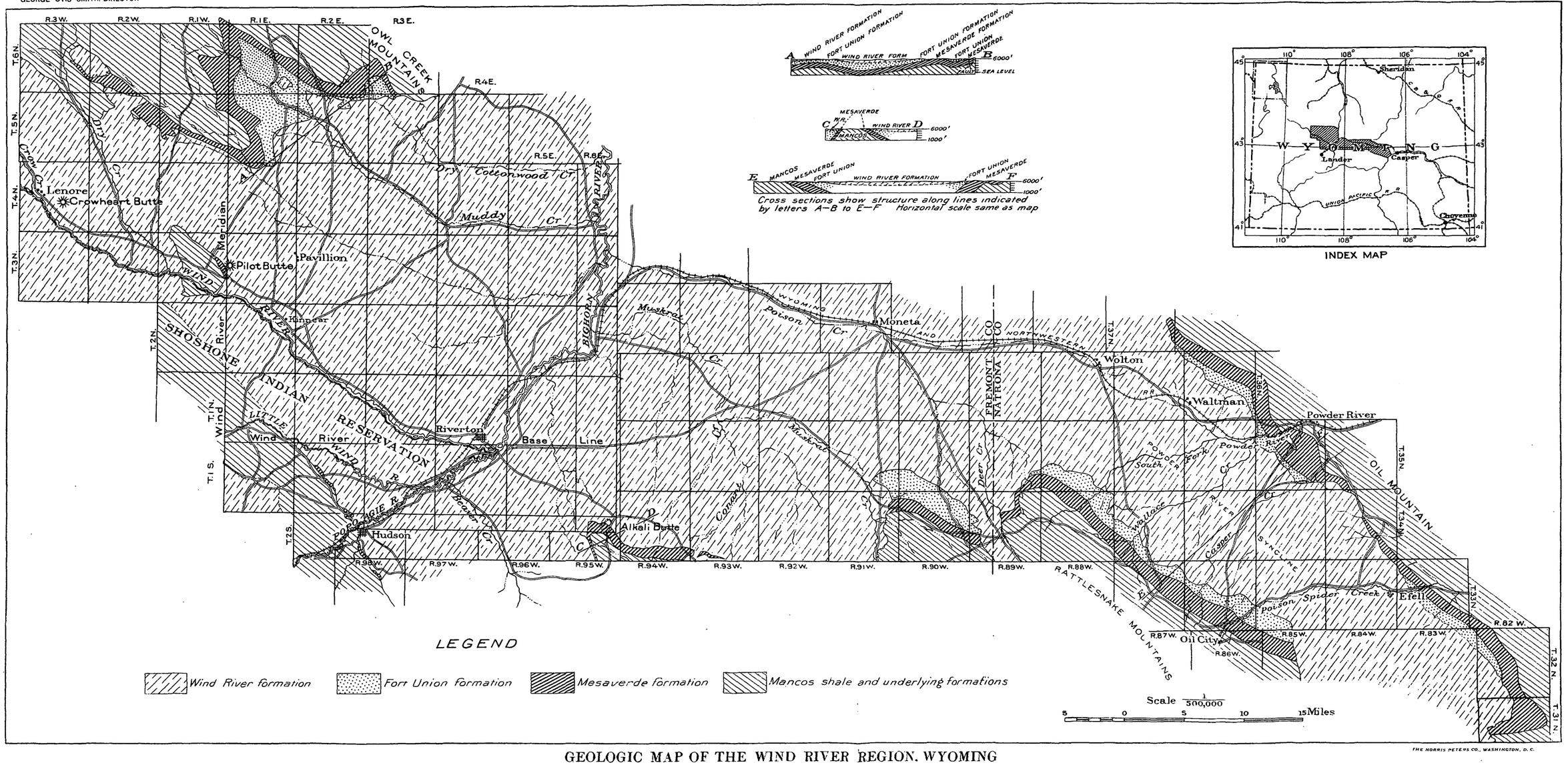
Sec. 2, T. 33 N., R. 93 W.:
- Syncyclonema sp.
- Cardium sp.
- Tellina sp.
- Cinulia sp.
- Actæon sp. related to A. attenuata M. and H.
- Baculites sp.
- Placenticeras intercalare M. and H.

Sec. 16, T. 34 N., R. 90 W.:
- Avicula sp.
- Cardium speciosum M. and H.
- Corbula sp.
- Baculites sp.

NW. ¼ sec. 25, T. 34 N., R. 88 W., Natrona County:
- Ostrea glabra M. and H.
- Anomia sp.
- Modiola regularis White ?

Stanton states that the beds from which these fossils were collected belong to the Mancos shale, the deposition of which began in Colorado

[1] Woodruff, E. G., The Lander oil field, Wyo.: Bull. U. S. Geol. Survey No. 452, 1911.
[2] Op. cit.




# GEOLOGIC MAP OF THE WIND RIVER REGION, WYOMING

By E. G. Woodruff and Dean E. Winchester

1912

time and terminated in Montana time. In this area no distinct lithologic break occurs between the Colorado and Montana, and there seems to be a gradual transition from the one to the other. In fact, there was probably continuous deposition from one epoch into the other, with a concurrent increase in the amount of sand deposited, as the Mancos is more sandy in the upper part than in the lower. Where exposed, the shale generally forms moderately even plains which are in places cut by narrow, steep-sided gorges, but locally badlands occur.

### MESAVERDE FORMATION.

The Mesaverde formation comprises a mass of sandstone and sandy shale ranging from about 1,000 to 3,000 feet thick. Thick-bedded sandstones characterize the lower portion, whereas the upper part is composed chiefly of shale. Both members contain beds of coal.

*Sandstone member.*—The sandstone member of the Mesaverde consists of thick-bedded tan-colored coarse-grained sandstone and a less amount of sandy tan-colored shale. Commonly the member is composed of two massive beds of sandstone, one at the base and the other at the top, separated by a bed of sandy shale containing lenses of coal. Locally, however, sandstone lenses are developed in addition to the more persistent beds mentioned above.

The following sections were measured at places indicated at the top of each section:

*Sections of sandstone member of the Mesaverde formation.*

**Southwest of Sheep Creek, in T. 6 N., R. 1 E., Wind River meridian.**

| | Feet. |
|---|---|
| Sandstone, buff, massive, in beds 10–40 feet thick | 145 |
| Shale, yellow, sandy, containing beds of coal (LeClair mine is working one of these beds) | 20 |
| Sandstone, buff, massive, in beds 10–40 feet thick. (This sandstone is distinguished from the one above by its more massive character and lighter color) | 120 |
| | 285 |

**East of Signor mine, south of Alkali Butte.**

| | Feet. |
|---|---|
| Sandstone, thick bedded, gray | 82 |
| Sandstone, thick bedded, tan | 49 |
| Shale, sandy, tan | 63 |
| Coal | 14 |
| Shale, carbonaceous, brown | 2 |
| Sandstone, thick bedded, tan | 96 |
| Shale, sandy, tan | 95 |
| Sandstone, thick bedded, tan | 51 |
| | 452 |

On the east side of Muskrat Creek.

| | Feet. |
|---|---|
| Shale, sandy, tan | 27 |
| Shale, containing sandy, tan-colored concretions | 3 |
| Shale, sandy, tan, with four beds of shaly, very ferruginous sandstone 2 or 3 feet apart about 25 feet above the base and two 6 feet apart about 50 feet above the base | 78 |
| Sandstone, thick bedded, tan | 17 |
| Shale, sandy, tan | 50 |
| Sandstone, hard, ferruginous | 2 |
| Shale, sandy, tan | 29 |
| Sandstone, massive, gray | 10 |
| Shale, sandy, tan and gray, with a 6-foot bed of carbonaceous shale near the middle | 24 |
| Sandstone, hard, tan, ferruginous | 1 |
| Shale, sandy, drab and also brown, carbonaceous; occasionally there are thin beds of coal in this member | 28 |
| Sandstone, thick bedded, gray | 76 |
| Sandstone, brown, ferruginous | 4 |
| Shale, sandy, tan | 4 |
| Sandstone, coarse, tan | 4 |
| Shale, sandy, yellowish tan | 35 |
| | 392 |

Along Powder River 2 miles west of Powder River station.

| | Feet. |
|---|---|
| Sandstone, gray, massive | 25 |
| Shale, tan, sandy | 640 |
| Sandstone, tan, massive | 25 |
| Shale, tan, sandy | 375 |
| Sandstone, tan, massive | 25 |
| | 1,090 |

Exposures of the member occur in a band varying from less than one-eighth to one-half mile in width between the outcrop of the Mancos shale and the interior of the basin. The areal distribution is shown on the map, Plate XLIX. A greater number of coal beds occur in this member than in any other group of rocks in the region. It contains the coal beds on Dry Creek and the beds in which the Le Clair, Kinnear, Mitchell, Hudson, and Signor mines are located.

*Shale member.*—The shale member of the Mesaverde is distinguished in the field from the sandstone member below and from the Fort Union formation above by the predominance of shale, and also by the rusty color, more subdued than that of the inclosing rocks. It consists of tan-colored sandy shale with intercalated beds of shaly sandstone which locally become thick bedded.

The following sections were measured at the places indicated at the head of each section:

*Sections of shale member of the Mesaverde formation.*

**Southwest of Sheep Creek, in T. 6 N., R. 1 E., Wind River meridian.**

| | Feet. |
|---|---|
| Shale, drab and buff, sandy, with beds of sandstone and thin coals; the coal beds are most abundant near the middle | 170 |
| Sandstone, gray | 70 |
| Sandstone, gray and ferruginous | 138 |
| Sandstone, gray, massive | 105 |
| Sandstone, ferruginous | 5 |
| Sandstone, gray, massive | 70 |
| Shale, gray and drab, sandy, with shaly sandstones. In thickness the sandstone beds range from 4 to 8 feet and are about 50 feet apart. Between the beds of sandstone are less-indurated beds of sandstones and sandy shale. A few light-buff massive sandstones occur. Several thin coal beds occur near the base of the formation | 925 |
| | 1,483 |

**South of Alkali Butte.**

| | Ft. | in. |
|---|---|---|
| Shale, sandy, tan | 13 | |
| Sandstone, shaly, ferruginous. The exposure does not clearly show the thickness, but this is estimated. This bed contains Halymenites | 2 | |
| Shale, sandy, tan | 16 | |
| Sandstone, shaly, brown, ferruginous | 2 | |
| Shale, sandy, tan | 182 | |
| Sandstone, shaly, brown. This sandstone is cut by vertical joints so that square blocks 2 feet or more across lie upon the surface | 2 | |
| Shale, sandy, tan | 86 | |
| Sandstone, hard, brown, ferruginous | | 6 |
| Shale, sandy, yellowish tan. There are silicified tree trunks in the base of this bed | 51 | 6 |
| Coal | 2 | 6 |
| Shale, sandy, tan | 14 | |
| Coal | 2 | 6 |
| Shale, brown, sandy | 27 | |
| Sandstone, massive, gray | 36 | |
| Sandstone, shaly, ferruginous | 2 | |
| Shale, sandy, tan | 6 | |
| Sandstone, shaly, ferruginous | 2 | |
| Shale, sandy, tan | 6 | |
| Sandstone, massive, tan, with hard ferruginous bed at the top | 20 | |
| Shale, sandy, thin bedded, brown, with 8 inches of coal 6 feet above the base and a 4-foot bed of ferruginous sandstone from the middle downward | 24 | |
| Sandstone, thick bedded, gray | 33 | |
| Shale, sandy, fissile, slightly carbonaceous, brown, weathering gray | 6 | |
| Sandstone, thick bedded, gray | 9 | |
| Sandstone, hard, ferruginous | 1 | |

| | Ft. | in. |
|---|---|---|
| Shale, sandy, tan | 2 | 6 |
| Sandstone, ferruginous, shaly | | 6 |
| Shale, sandy, tan | 4 | |
| Sandstone, massive, light tan | 42 | |
| Shale, sandy, slightly carbonaceous | 5 | 6 |
| Sandstone, thick bedded, tan | 20 | 6 |
| Sandstone, ferruginous, hard, brown | 1 | |
| Shale, sandy, soft, thin bedded, gray in the upper part, tan in the lower | 21 | |
| Sandstone, thick bedded, brown, weathers cavernous | 24 | |
| Shale, sandy, tan | 5 | |
| Shale, sandy, thin bedded, brown, with coal near the middle | 37 | |
| | 709 | |

**On the east side of Muskrat Creek, in T. 34 N., R. 90 W., sixth principal meridian.**

| | Feet. |
|---|---|
| Shales, sandy, tan, gray, brown, and black, fissile, carbonaceous, and thin coal beds. The carbonaceous shale varies in thickness from 2 to 20 feet. Tan shale forms about 50 per cent of the mass and gray shale about 25 per cent. These beds are of various thicknesses. It is believed that the top of this member is the top of the Mesaverde formation and therefore marks an unconformity, but there is no evidence of such an unconformity in this section | 935 |

**Along Powder River, 2 miles west of Powder River station.**

| | Ft. | in. |
|---|---|---|
| Shale, tan and drab, sandy, with some beds of rusty sandstone 1 to 5 feet thick | 562 | |
| Coal | 1 | 11 |
| Shale, tan and drab, sandy | 59 | |
| Coal | 3 | 2 |
| Shale, tan and drab, sandy, with some beds of rusty sandstone 1 to 5 feet thick | 154 | |
| Coal | 1 | 7 |
| Shale, tan and drab, sandy, with some beds of rusty sandstone 1 to 5 feet thick | 104 | |
| Coal | 2 | 3 |
| Shale, tan and drab, sandy | 51 | |
| Coal | 2 | 1 |
| Shale, tan and drab, sandy, with some beds of rusty sandstone 1 to 5 feet thick | 212 | |
| Coal | 5 | 7 |
| Shale, tan and drab, sandy | 4 | |
| Coal | 2 | 2 |
| Shale, tan and drab, sandy, with some beds of rusty sandstone 1 to 5 feet thick | 629 | |
| | 1,793 | 9 |

This member is exposed in a narrow zone beside the outcrop of the sandstone member on the side toward the interior of the basin in all the fields, except in the Pilot Butte and Hudson fields, where it is concealed by the overlying Wind River formation (Pl. XLIX). This

member also contains coal but in less quantity than the sandstone member. With one exception coal beds seem to be absent in the shale member where coal is present in the sandstone member immediately below, and vice versa. Accordingly, the shale in the western part of the region contains very few coal beds, whereas in the eastern part, where the sandstone is noncoal-bearing, are several coal beds of considerable thickness and extent. In the Alkali Butte field, which lies near the center of the region, both members contain coal beds in which mines have been opened. In the Powder River field mines have been opened on coal beds in the shale member on South Fork, near Oil City, Efell, and southwest of Powder River station, and also near the extreme southeastern end of the region in the Platte River district.

### FORT UNION FORMATION.

A group of slightly ferruginous sandstone and tan-colored sandy shale beds lying above the Mesaverde and belonging to the Fort Union formation is exposed in a small area in the Muddy Creek field in the western part of the region and in a larger area in the Powder River field. Fort Union rocks are probably present in other fields, but if so they are concealed by the Wind River formation which overlaps them. Erosion before Wind River time removed all of the Fort Union formation from part of the region, and the Wind River sediments probably entirely covered the remainder. Recent erosion has carried away the Wind River formation in part and exposed the Fort Union in small areas. In fact, it is doubtful if the total thickness of the Fort Union formation as it was deposited remains in any part of this region. Sections of this formation measured in the Muddy Creek and Powder River fields are presented below:

*Sections of Fort Union formation.*

**Southwest of Sheep Creek, in T. 6 N., R. 1 E., Wind River meridian.**

| | Feet. |
|---|---|
| Unconformity. | |
| Somber-colored sandy shale in numerous beds locally intercalated with shaly ferruginous sandstone, buff, yellow, and light-drab colors prevailing; these beds are easily eroded | 1,400 |
| Alternating beds of shale and shaly ferruginous sandstone. The ferruginous beds are hard and form ridges. At the place where this measurement was made the beds are overturned 3° from the vertical and the measurement is therefore considered not wholly reliable but certainly represents the minimum, as the beds may be slightly squeezed | 1,650 |
| | 3,050 |

Along Powder River, 2 miles west of Powder River station.

| | Feet. |
|---|---|
| Unconformity. | |
| Shale, sandy, tan, and tan sandstone with many rusty concretionary layers. The sandstones are generally massive, from 10 to 40 feet thick. This formation differs from the one below by the greater number of beds of massive sandstone. The formation is overlain unconformably by the Wind River formation | 1,546 |

The Fort Union carries several beds of coal in the Muddy Creek field, but so far as known it does not contain coal in the Powder River field. The coal occurs in the lower part of the formation as lenticular beds which seem to have slight extent, though at places they are moderately thick.

### WIND RIVER FORMATION.

The Wind River formation comprises a great mass of non-coal-bearing sandstone and sandy shale, filling the interior of the basin and overlapping the coal-bearing formations in many places. These rocks are mostly unconsolidated sandy shale, which erodes easily, forming badlands, but there are many intercalated beds of shaly sandstone which in a few places are massive. Locally, in the vicinity of Hudson, the base of the formation is a conglomerate composed of waterworn pebbles that range from a small fraction of an inch to several inches in diameter. The shale is prevailingly gray and tan in color, but there are intercalated beds of various shades of green, pink, red, and maroon. Consequently freshly eroded surfaces, especially the fantastic forms in the badlands, have a banded appearance. Sandstone forms the cap of both Crowheart and Pilot buttes and is exposed in a small area north of Alkali Butte; the shale forms typical badlands in the southeastern part of the Muddy Creek field, also northeast of Hudson and in the Powder River syncline. The Wind River formation rests unconformably on the beds below and in general dips slightly toward the interior of the basin. The entire thickness of the formation was not determined and, owing to the method of deposition, is probably highly variable. Osborn[1] reports the thickness to be 1,700 feet, which is probably a moderate estimate. The maximum thickness in the area studied during the present survey is in the vicinity of Crowheart Butte, where at least 1,000 feet of beds are exposed.

Carbonaceous shale is found in the formation in the Alkali Butte and Powder River fields and lenses of coal less than 14 inches thick between Muskrat and Conant creeks, but generally the formation is destitute of coal.

[1] Osborn, H. F., Cenozoic mammal horizons of western North America: Bull. U. S. Geol. Survey No. 361, 1909, p. 23.

## STRUCTURE.

Structurally the coal-bearing formations of the Wind River region are included in a steep-sided syncline, which is broad at the western end, where it forms the Wind River basin, but constricted to the east, in the Powder River syncline. The rim of the large syncline has been corrugated by a number of small parallel folds trending northwest-southeast. These have brought up coal-bearing rocks in a number of areas which constitute the coal fields of the region. The minor structure is varied and locally is complicated. A discussion of the structure as it relates to the coal beds is presented with a description of each field. The structure is shown by the dip symbols on the map, Plate XLIX, and by structure sections A–B, C–D, and E–F on the same illustration.

## THE COAL.

### OCCURRENCE.

Coal beds occur in all the formations included in this field, but beds more than 14 inches thick, which is the minimum thickness mapped, were found only in the Mesaverde and Fort Union formations. The lower part of the Mancos contains thin lenses of coal, which are believed to occur at about the horizon of the Kemmerer coal beds of Uinta County.[1] The beds at this horizon were examined at many places, but nowhere were they found to contain more than the minimum amount considered in this report. The most promising localities are near Popo Agie River in sec. 3, T. 33 N., R. 99 W., of the sixth principal meridian, where a prospect was opened several years ago, and in sec. 6, T. 32 N., R. 98 W., where Mr. Johnson, of Lander, and some associates have opened a slope 75 feet long on a bed of coal and were engaged in sinking a shaft in August, 1909, to crosscut the same bed and also another bed 69 feet lower that contains 15 inches of impure coal. The following section was measured on the upper bed:

*Section of coal bed in Johnson's prospect, sec. 6, T. 32 N., R. 98 W.*

| | Inches. |
|---|---|
| Shale, drab, sandy. | |
| Coal | 8 |
| Shale, brown, carbonaceous, soft | 1 |
| Bone | 8 |
| | 17 |

This seems to be a low-grade bituminous coal, which probably does not coke. Even if it should coke, the high percentage of pyrite associated with the coal would vitiate the product for iron smelting.

[1] Veatch, A. C., Coal and oil in southern Uinta County, Wyo.: Bull. U. S. Geol. Survey No. 285, 1906, p. 331. Schultz, A. R., Coal fields in a portion of central Uinta County, Wyo.: Bull. U. S. Geol. Survey No. 316, 1907, p. 212.

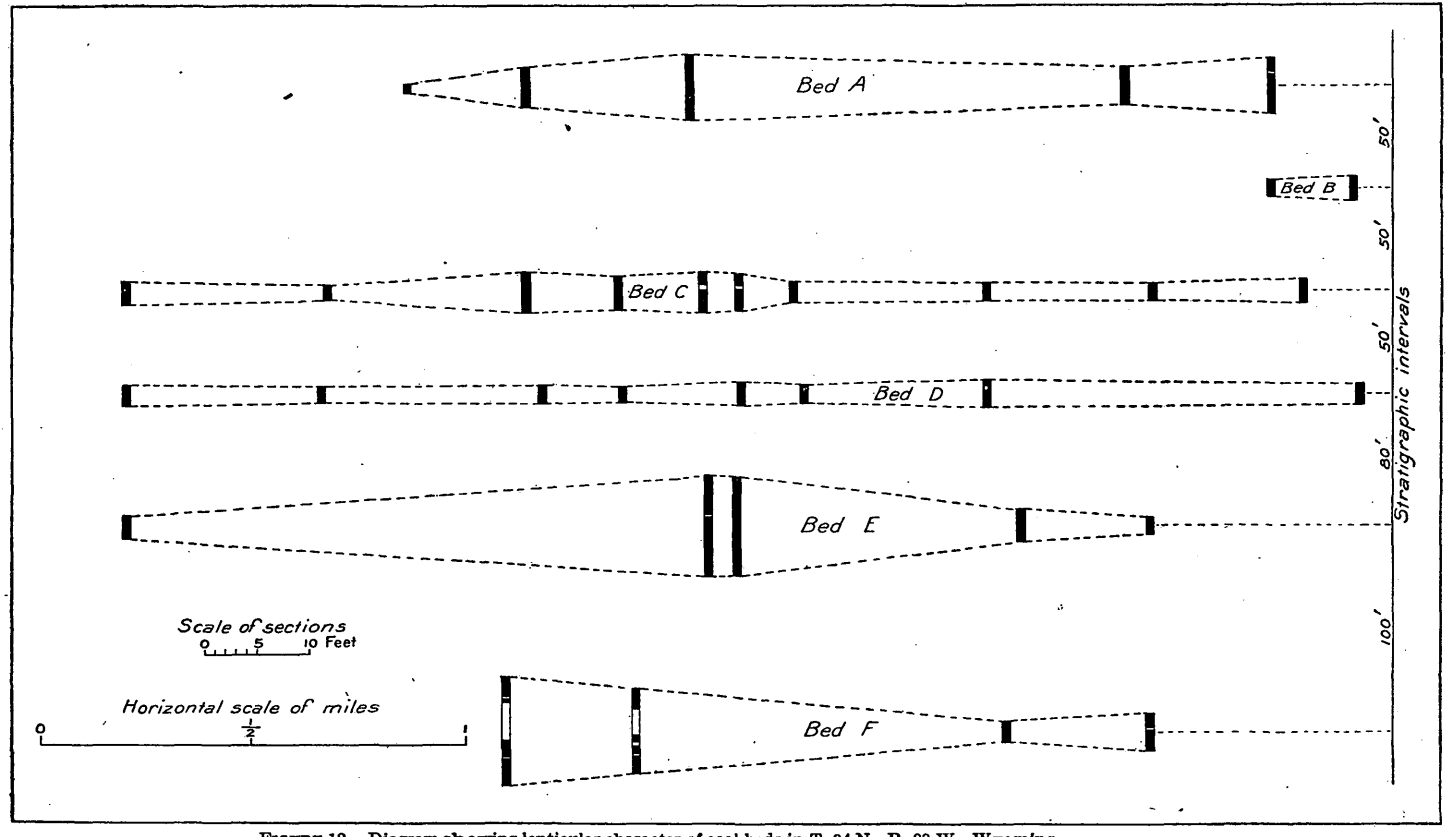



FIGURE 12.—Diagram showing lenticular character of coal beds in T. 34 N., R. 88 W. Wyoming.

With the exception of two fields in which coal beds are found in the Fort Union, all the important beds are in the Mesaverde formation. The position of the outcrops and extent of the beds are shown on the accompanying maps, and the character of the beds is shown by the several plates of sections. It will be seen from a study of the sections along any particular outcrop that the coal beds are lenticular. This characteristic is illustrated by figure 12, which is drawn to scale from measurements of beds exposed on Wallace Creek in the Powder River field. The most extensive bed in the region is in the Hudson field, where coal is mined from it by the Hudson Coal Co., the Wyoming Central Coal Co., and others. The thickest bed without partings is in the Alkali Butte field (section 170), and the greatest number of beds at one place is in the South Fork district of the Powder River field.

The map and structure sections (Pl. XLIX) indicate that the known coal-bearing areas are limited to small fields along the edges of a large syncline, and it is probable that many beds of coal lie in the interior of the basin under the cover of the Wind River formation, which is non-coal-bearing. It is reasonably certain that the coal-bearing rocks extend under the basin from side to side, and it is also most probable that they contain coal locally as they do in exposed areas, but the depth at which they lie can be determined only by drilling. The stratum may be very deep or it may be arched and lie near the surface.

## PHYSICAL PROPERTIES.

In physical appearance the Mesaverde and Fort Union coals are similar. They are black with vitreous luster, subcubical jointing, conchoidal fracture, and medium degree of hardness. When reduced to a coarse powder the coal is black, but when crushed to a very fine state it is dark brown. It burns with a short red flame, ignites readily, and produces ash not inclined to clinker. The coal does not fuse when burned in a stove and shows no tendency to coke. The mineral accessories are chiefly small nodules of amber-colored resin and some pyrite in small disks along joint planes. The pyrite has probably been introduced by percolating waters which contained the mineral in solution and deposited it as a result of the reducing action of the carbon in the coal. The total amount of pyrite is small, as shown by the amount of sulphur in the analyses given below. On the basis of its weathering, considered in relation to its chemical composition, the coal is classed as subbituminous. The first stage of rapid weathering, when a piece of freshly mined coal of this character is exposed to the air, is to produce irregularly shaped blocks. Continued exposure to the atmosphere produces smaller fragments which crumble to a very fine brown powder.

## CHEMICAL COMPOSITION.

Samples of coal were taken according to the method described on page 520 and analyzed at the laboratory at Pittsburgh, Pa. The analyses are given in the table on pages 533–534.

In the table the analyses are given in four forms, marked A, B, C, and D. Analysis A represents the composition of the sample as it comes from the mine. This form is not well suited for comparison, because the amount of moisture in the sample as it comes from the mine is largely a matter of accident, and consequently analyses of the same coal expressed in this form may vary widely. Analysis B represents the sample after it has been dried at a temperature a little above the normal until its weight becomes constant. This form of analysis is best adapted to general comparisons. Analysis C represents the theoretical condition of the coal after all the moisture has been eliminated. Analysis D represents the coal after all moisture and ash has been theoretically removed. This is supposed to represent the true coal substance, free from the most significant impurities. Forms C and D are obtained from the others by recalculation. They should not be used in comparison, for they represent theoretical conditions that never exist.

In the analytical work it is not possible to determine the proximate constituents of coal or lignite with the same degree of accuracy as the ultimate constituents. Therefore, the air-drying loss, moisture, volatile matter, fixed carbon, and ash are given to one decimal place only, whereas the ash (in the ultimate analysis), sulphur, hydrogen, carbon, nitrogen, and oxygen are given to two decimal places. The determination of the calorific value to individual units is not reliable; hence in the column headed "Calories" the values are given to the nearest five units, and in the column headed "British thermal units" they are given to the nearest tens (the value of a British thermal unit being about one-half that of a calorie).

*Analyses of coal samples from the Wind River coal region.*

[F. M. Stanton and A. C. Fieldner, chemists in charge.]

| Laboratory No. | No. on maps and sections. | District or field. | Location. | | | | Air-drying loss. | Form of analysis. | Proximate. | | | | Ultimate. | | | | | Heat value. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quarter. | Sec. | T. | R. | | | Moisture. | Volatile matter. | Fixed carbon. | Ash. | Sulphur. | Hydrogen. | Carbon. | Nitrogen. | Oxygen. | Calories. | British thermal units. |
| a9132 | 66 | Shotgun district. | NW... | 20 | 6 N. | 1 E. | 10.4 | A..... | 15.7 | 28.6 | 47.6 | 8.1 | 0.35 | ..... | ..... | ..... | ..... | 5,510 | 9,920 |
| | | | | | | | | B..... | 5.9 | 31.9 | 53.2 | 9.0 | .39 | ..... | ..... | ..... | ..... | 6,150 | 11,070 |
| | | | | | | | | C..... | ..... | 34.0 | 56.5 | 9.5 | .42 | ..... | ..... | ..... | ..... | 6,540 | 11,770 |
| | | | | | | | | D..... | ..... | 37.5 | 62.5 | ..... | .46 | ..... | ..... | ..... | ..... | 7,230 | 13,020 |
| 6706 | 87 | Sheep Creek district, Le Clair mine. | NE... | 30 | 6 N. | 2 E. | 14.2 | A..... | 21.3 | 29.0 | 37.7 | 12.0 | .32 | ..... | ..... | ..... | ..... | 4,530 | 8,150 |
| | | | | | | | | B..... | 8.3 | 33.8 | 43.9 | 14.0 | .37 | ..... | ..... | ..... | ..... | 5,280 | 9,500 |
| | | | | | | | | C..... | ..... | 36.9 | 47.9 | 15.2 | .41 | ..... | ..... | ..... | ..... | 5,760 | 10,370 |
| | | | | | | | | D..... | ..... | 43.5 | 56.5 | ..... | .48 | ..... | ..... | ..... | ..... | 6,795 | 12,230 |
| a9131 | 93 | Sheep Creek district. | NE... | 34 | 6 N. | 2 E. | 15.3 | A..... | 20.5 | 36.5 | 38.1 | 4.9 | .49 | ..... | ..... | ..... | ..... | 4,290 | 7,720 |
| | | | | | | | | B..... | 6.1 | 43.1 | 45.0 | 5.8 | .58 | ..... | ..... | ..... | ..... | 5,065 | 9,120 |
| | | | | | | | | C..... | ..... | 45.8 | 48.0 | 6.2 | .62 | ..... | ..... | ..... | ..... | 5,395 | 9,710 |
| | | | | | | | | D..... | ..... | 48.9 | 51.1 | ..... | .66 | ..... | ..... | ..... | ..... | 5,750 | 10,350 |
| a9133 | 114 | Pilot Butte field, Kinnear mine. | SW... | 13 | 3 N. | 1 W. | 10.4 | A..... | 14.8 | 34.0 | 42.6 | 8.6 | .93 | ..... | ..... | ..... | ..... | 5,665 | 10,190 |
| | | | | | | | | B..... | 5.0 | 37.9 | 47.5 | 9.6 | 1.04 | ..... | ..... | ..... | ..... | 6,320 | 11,380 |
| | | | | | | | | C..... | ..... | 39.9 | 50.0 | 10.1 | 1.09 | ..... | ..... | ..... | ..... | 6,650 | 11,970 |
| | | | | | | | | D..... | ..... | 44.4 | 55.6 | ..... | 1.21 | ..... | ..... | ..... | ..... | 7,395 | 13,310 |
| a9773 | 119A | Hudson field, Mitchell mine. | SW... | 22 | 1 S. | 2 E. | 10.6 | A..... | 20.1 | 33.8 | 37.0 | 9.1 | .87 | ..... | ..... | ..... | ..... | 5,175 | 9,320 |
| | | | | | | | | B..... | 10.6 | 37.9 | 41.3 | 10.2 | .97 | ..... | ..... | ..... | ..... | 5,790 | 10,420 |
| | | | | | | | | C..... | ..... | 42.4 | 46.2 | 11.4 | 1.09 | ..... | ..... | ..... | ..... | 6,480 | 11,660 |
| | | | | | | | | D..... | ..... | 47.8 | 52.2 | ..... | 1.23 | ..... | ..... | ..... | ..... | 7,310 | 13,160 |
| 6712 | 124 | Hudson field, Indian mine. | NE... | 2 | 2 S. | 2 E. | 11.6 | A..... | 21.3 | 30.7 | 44.9 | 3.15 | .89 | 6.13 | 55.91 | 0.75 | 33.17 | 5,435 | 9,780 |
| | | | | | | | | B..... | 10.9 | 34.7 | 50.8 | 3.56 | 1.01 | 5.48 | 63.25 | .85 | 25.85 | 6,145 | 11,060 |
| | | | | | | | | C..... | ..... | 39.0 | 57.0 | 4.00 | 1.13 | 4.79 | 71.02 | .95 | 18.11 | 6,900 | 12,420 |
| | | | | | | | | D..... | ..... | 40.6 | 59.4 | ..... | 1.18 | 4.99 | 73.98 | .99 | 18.86 | 7,190 | 12,940 |
| a13178 | 124 | Hudson field, Indian mine. | NE... | 2 | 2 S. | 2 E. | 14.0 | A..... | 20.9 | 31.9 | 39.2 | 8.0 | .51 | ..... | ..... | ..... | ..... | 5,135 | 9,240 |
| | | | | | | | | B..... | 8.0 | 37.1 | 45.5 | 9.4 | .59 | ..... | ..... | ..... | ..... | 5,970 | 10,750 |
| | | | | | | | | C..... | ..... | 40.3 | 49.5 | 10.2 | .64 | ..... | ..... | ..... | ..... | 6,490 | 11,680 |
| | | | | | | | | D..... | ..... | 44.9 | 55.1 | ..... | .71 | ..... | ..... | ..... | ..... | 7,225 | 13,010 |
| a13179 | 124 | Hudson field, Indian mine. | NE... | 2 | 2 S. | 2 E. | 11.2 | A..... | 20.4 | 33.1 | 40.7 | 5.8 | .58 | ..... | ..... | ..... | ..... | 5,305 | 9,550 |
| | | | | | | | | B..... | 10.4 | 37.2 | 45.8 | 6.6 | .65 | ..... | ..... | ..... | ..... | 5,975 | 10,760 |
| | | | | | | | | C..... | ..... | 41.5 | 51.1 | 7.4 | .73 | ..... | ..... | ..... | ..... | 6,665 | 12,000 |
| | | | | | | | | D..... | ..... | 44.8 | 55.2 | ..... | .79 | ..... | ..... | ..... | ..... | 7,195 | 12,950 |

*Analyses of coal samples from the Wind River coal region*—Continued.

| Laboratory No. | No. on maps and sections. | District or field. | Location. | | | | Air-drying loss. | Form of analysis. | Proximate. | | | | Ultimate. | | | | | Heat value. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quarter. | Sec. | T. | R. | | | Moisture. | Volatile matter. | Fixed carbon. | Ash. | Sulphur. | Hydrogen. | Carbon. | Nitrogen. | Oxygen. | Calories. | British thermal units. |
| 6711 | 129 | Hudson field, Wyoming Central mine. | ..... | 28 | 34 N. | 98 W. | 15.4 | A..... | 23.0 | 29.7 | 42.8 | 4.50 | .48 | 6.16 | 53.84 | 1.12 | 33.90 | 5,200 | 9,360 |
| | | | | | | | | B..... | 9.0 | 35.1 | 50.6 | 5.32 | .57 | 5.26 | 63.64 | 1.32 | 23.89 | 6,150 | 11,070 |
| | | | | | | | | C..... | ..... | 38.6 | 55.6 | 5.84 | .62 | 4.69 | 69.91 | 1.45 | 17.49 | 6,755 | 12,160 |
| | | | | | | | | D..... | ..... | 41.0 | 59.0 | ..... | .66 | 4.98 | 74.24 | 1.54 | 18.58 | 7,175 | 12,910 |
| a9772 | 153 | Alkali Butte field, Shipton mine. | SE.... | 5 | 2 S. | 6 E. | 22.4 | A..... | 34.1 | 30.4 | 29.3 | 6.2 | .59 | ..... | ..... | ..... | ..... | 3,380 | 6,080 |
| | | | | | | | | B..... | 15.1 | 39.2 | 37.7 | 8.0 | .76 | ..... | ..... | ..... | ..... | 4,355 | 7,840 |
| | | | | | | | | C..... | ..... | 46.2 | 44.4 | 9.4 | .90 | ..... | ..... | ..... | ..... | 5,125 | 9,230 |
| | | | | | | | | D..... | ..... | 50.9 | 49.1 | ..... | .99 | ..... | ..... | ..... | ..... | 5,660 | 10,190 |
| 6710 | 173 | Alkali Butte field, Signor mine. | SE.... | 25 | 34 N. | 95 W. | 17.3 | A..... | 26.0 | 29.3 | 39.6 | 5.1 | .61 | ..... | ..... | ..... | ..... | 4,865 | 8,760 |
| | | | | | | | | B..... | 10.6 | 35.4 | 47.9 | 6.1 | .74 | ..... | ..... | ..... | ..... | 5,885 | 10,590 |
| | | | | | | | | C..... | ..... | 39.6 | 53.6 | 6.8 | .82 | ..... | ..... | ..... | ..... | 6,580 | 11,850 |
| | | | | | | | | D..... | ..... | 42.5 | 57.5 | ..... | .88 | ..... | ..... | ..... | ..... | 7,065 | 12,720 |
| a9145 | 257 | Oil City district, Oil City mine. | ..... | 27 | 33 N. | 86 W. | 22.2 | A..... | 28.4 | 30.3 | 34.1 | 7.2 | .43 | ..... | ..... | ..... | ..... | 4,180 | 7,530 |
| | | | | | | | | B..... | 7.9 | 39.0 | 43.9 | 9.2 | .55 | ..... | ..... | ..... | ..... | 5,375 | 9,670 |
| | | | | | | | | C..... | ..... | 42.3 | 47.7 | 10.0 | .60 | ..... | ..... | ..... | ..... | 5,835 | 10,500 |
| | | | | | | | | D..... | ..... | 47.0 | 53.0 | ..... | .67 | ..... | ..... | ..... | ..... | 6,485 | 11,670 |
| a9149 | 370 | Efell district, Efell mine. | ..... | 8 | 33 N. | 83 W. | 18.6 | A..... | 26.0 | 28.9 | 38.0 | 7.1 | .61 | ..... | ..... | ..... | ..... | 4,650 | 8,370 |
| | | | | | | | | B..... | 9.1 | 35.6 | 46.6 | 8.7 | .75 | ..... | ..... | ..... | ..... | 5,715 | 10,290 |
| | | | | | | | | C..... | ..... | 39.1 | 51.3 | 9.6 | .82 | ..... | ..... | ..... | ..... | 6,290 | 11,320 |
| | | | | | | | | D..... | ..... | 43.3 | 56.7 | ..... | .91 | ..... | ..... | ..... | ..... | 6,955 | 12,520 |
| a9183 | 345 | Powder River Station district. | ..... | 14 | 35 N. | 85 W. | 12.2 | A..... | 23.7 | 28.5 | 38.1 | 9.7 | .70 | ..... | ..... | ..... | ..... | 4,595 | 8,280 |
| | | | | | | | | B..... | 13.1 | 32.5 | 43.3 | 11.1 | .80 | ..... | ..... | ..... | ..... | 5,235 | 9,430 |
| | | | | | | | | C..... | ..... | 37.4 | 49.9 | 12.7 | .92 | ..... | ..... | ..... | ..... | 6,025 | 10,850 |
| | | | | | | | | D..... | ..... | 42.8 | 57.2 | ..... | 1.05 | ..... | ..... | ..... | ..... | 6,910 | 12,430 |
| a10671 | 473 | Platte River district, Red Ash mine. | NW... | 14 | 31 N. | 82 W. | 19.7 | A..... | 29.5 | 27.5 | 37.7 | 5.3 | .47 | ..... | ..... | ..... | ..... | 4,390 | 7,900 |
| | | | | | | | | B..... | 12.2 | 34.2 | 46.9 | 6.7 | .59 | ..... | ..... | ..... | ..... | 5,465 | 9,840 |
| | | | | | | | | C..... | ..... | 39.0 | 53.4 | 7.6 | .67 | ..... | ..... | ..... | ..... | 6,225 | 11,200 |
| | | | | | | | | D..... | ..... | 42.2 | 57.8 | ..... | .73 | ..... | ..... | ..... | ..... | 6,735 | 12,130 |

a Analyses made by the Bureau of Mines.

*No. 9132.*—This sample was taken from a small mine at location 66 (Pl. LI) on Muddy Creek, in sec. 20, T. 6 N., R. 1 E., Wind River meridian. The mine consists of a slope about 75 feet long, dipping 28° E. Probably 150 tons of coal have been removed from this opening. The region is arid and the coal was dry. This mine was not operating at the time the sample was taken. The gross weight taken was about 20 pounds.

*No. 6706.*—This sample was taken from Le Clair mine, location 87 (Pl. LI), in sec. 30, T. 6 N., R. 2 E., Wind River meridian. This mine consists of a single slope about 50 feet long, driven on the coal bed, which dips about 60° SW. The sample was taken from both benches of the bed at the end of the slope where the coal was dry. The mine was not being worked when visited. The gross sample weighed about 25 pounds.

*No. 9131.*—This sample was taken from a small prospect, location 93 (Pl. LI), in sec. 34, T. 6 N., R. 2 E., Wind River meridian. This prospect is only about 12 feet deep on a bed which dips 7°. The sample was taken at the end of the prospect where the coal was somewhat weathered. The bed is 3 feet 2 inches thick at the place where the sample was taken.

*No. 9133.*—This sample is from the Kinnear mine, location 114 (fig. 13, p. 543), in sec. 13, T. 3 N., R. 1 W., Wind River meridian. The mine consists of a slope 300 feet long, dipping 19°, from which one side entry 40 feet long has been turned near the bottom. The sample was taken in the side entry where the coal was bright. The coal bed is 2 feet 9 inches thick at the place where the sample was taken.

*No. 9773.*—This sample was taken from the Mitchell mine, recently opened, No. 119A (fig. 14), in sec. 22, T. 1 S., R. 2 E., Wind River meridian. The sample was taken at the end of an entry 40 feet long which had been turned off the main slope (dip 15° E.) about 200 feet from the mouth. The region is arid and the coal was dry, but apparently unweathered. The mine was being developed when the sample was taken.

*No. 6712.*—This sample was taken from the Indian mine of the Hudson Coal Co., location 124 (fig. 14), in sec. 2, T. 2 S., R. 2 E., Wind River meridian. The sample was taken from west entry No. 3, off the main slope, about 600 feet from the mouth, where the coal is under sufficient cover to protect it from alteration by atmospheric agencies. The coal was dry and unweathered. Weight of gross sample, about 40 pounds. The coal bed is 7 feet 2 inches thick at the place where the sample was taken.

*Nos. 13178 and 13179.*—These samples were collected in the Indian mine, Hudson, by Max A. Pishel, December 10, 1911. Sections of the coal bed in the Indian mine are as follows:

**No. 13178, in fifth back entry west, one-fourth mile southwest of mine mouth.**

| Shale. | Ft. | in. |
|---|---|---|
| Coal, with bony streaks | | 10 |
| Bone | | 4 |
| Coal [1] | 2 | |
| Shale, carbonaceous | 1 | |
| Coal [1] | | 8 |
| Bone | | 2 |
| Coal [1] | 2 | |
| Sandstone. | | |
| | 7 | |

**No. 13179, from main entry, about 9,000 feet from mine mouth.**

| Shale, roof. | Ft. | in. |
|---|---|---|
| Coal [1] | 1 | 6 |
| Bone | | 4 |
| Shale, carbonaceous | 1 | 2 |
| Coal [1] | 1 | 6 |
| Bone | | 4 |
| Shale, carbonaceous | 1 | 2 |
| Coal [1] | 4 | 6 |
| Sandstone, floor. | | |
| | 10 | 6 |

[1] Part sampled.

*No. 6711.*—This sample was taken from the Wyoming Central mine, location 129 (fig. 14), one-half mile south of Hudson, in sec. 28, T. 34 N., R. 98 W., of the sixth principal meridian. The sample was taken in south entry No. 2, about 425 feet down the slope, and the mine was then in operation. The sample was wet. The coal bed is 5 feet 3 inches thick at the place where it was sampled.

*No. 9772.*—This sample was taken from the Shipton mine, location 153 (Pl. LIII), 15 miles southeast of Riverton, in sec. 5, T. 2 S., R. 6 E., Wind River meridian. This mine had just been opened when visited in 1909. The sample was taken at the end of the entry, 45 feet long, where the coal showed no trace of weathering.

*No. 6710.*—This sample was taken at the Signor mine, location 173 (Pl. LIII), south of Alkali Butte, Fremont County. This mine is located in sec. 25, T. 34 N., R. 95 W., of the sixth principal meridian, and is worked only periodically on a small scale. The sample was taken after the mine had been idle for some months, in the first south entry, about 100 feet from the opening. The coal showed no effect of weathering, though undoubtedly it had been slightly altered.

*No. 9145.*—The mine from which this sample was taken is in Natrona County, near Oil City, sec. 27, T. 33 N., R. 86 W., of the sixth principal meridian, location 257 (Pl. LVI). A single entry has been driven about 90 feet along the strike of the bed, which dips 18°. The sample was taken at the end of the entry, where the coal was dry, but the mine had remained idle for several months and the coal was probably somewhat weathered.

*No. 9149.*—The mine from which this sample was taken is near Efell ranch, in sec. 8, T. 33 N., R. 83 W., of the sixth principal meridian, location 370 (Pl. LVI). It consists of a single entry, about 200 feet long, driven along the strike of a bed which dips 62°. The mine is worked during the winter to supply the few near-by ranchers. The coal is under insufficient cover to protect it from weathering, hence the analysis represents slightly weathered coal.

*No. 9183.*—This sample was taken from a small abandoned mine, location 345, (Pl. LVI), south of Powder River, in sec. 14, T. 35 N., R. 85 W., of the sixth principal meridian. The coal was dry and somewhat altered.

*No. 10671.*—This sample was taken from the Red Ash mine, location 473 (Pl. LVII) in sec. 14, T. 31 N., R. 82 W., of the sixth principal meridian. The mine consists of a single entry driven down the dip for about 250 feet, with two rooms, each about 25 by 80 feet. The mine is worked periodically to supply the near-by ranchers, but at the time of sampling, in July, 1910, was idle. The coal bed is 6 feet 3 inches thick at the end of room 2, where the sample was taken. The sample was dry, but slightly weathered.

## USE OF THE COAL.

Coal from the Wind River region is best adapted for a domestic fuel, but it has been employed satisfactorily under stationary boilers, in limekilns and similar places where forced draft is not required. Previous to the fall of 1910 it had not been accepted for locomotive use, though it is known that very similar coal is used successfully for locomotives in which specially designed grates and screens have been introduced. In fire boxes where the draft is not strong the coal ignites readily and burns freely without forming large clinkers or producing excessive smoke, but it does not hold a bed of fire so long as coal which does not burn so freely. Under forced draft, however, it breaks up before burning and part of the coal is blown from the grates and exhausted through the stack before it is consumed. This condition results in a loss of unburned coal, requires

the handling of fuel from which no heat is obtained, and is the cause of many fires, especially in railroad use. A considerable domestic trade along the Chicago & Northwestern Railway in Wyoming, Nebraska, and South Dakota receives its supply from the Hudson field. It is reported that this railroad has attempted to use the coal from the Hudson field in the engines running between Lander and Casper, Wyo., but the first experiments proved unsatisfactory to the railroad officials because too large a percentage of unconsumed coal was blown from the stacks.

Owing to the rapidity with which it disintegrates, the coal must be shipped in box cars and can be held in storage bins only a short time after it is mined. This results in mining only in winter, when fuel is needed for immediate use and when mining is more difficult and more expensive than in summer. Though the coal has these objectionable features, it is a good domestic fuel and will be in constant demand in markets which are easily reached.

In the following table the heat value of coal from the Hudson field is compared with that of coal from other well-known fields in the United States.

*Heat value in British thermal units of Hudson coal, compared with other well-known coals of the United States.*

| Location of mine. | Name of mine. | British thermal units. | Character of coal. | Reference. |
|---|---|---|---|---|
| Pocahontas, Va | Baby | 15,247 | Semibituminous | Bull. 362. |
| New River, W. Va | Rush Run | 14,942 | Bituminous | Prof. Paper 48. |
| Trinidad, Colo | Sopris | 13,246 | do | Bull. 381. |
| Rock Springs, Wyo | U. P. No. 10 | 12,416 | do | Bull. 332. |
| Hamilton, Iowa | No. 5 | 11,344 | do | Prof. Paper 48. |
| Kirby, Wyo | Gebo | 11,606 | Subbituminous | Bull. 381. |
| Hudson, Wyo | Indian | 11,063 | do | This work. |
| Red Lodge, Mont | No. 1 | 10.270 | do | Bull. 341. |
| Sheridan, Wyo | Dietz No. 2 | 9,843 | do | Do. |

## DETAILED DESCRIPTION OF FIELDS.

### MUDDY CREEK FIELD.

The Muddy Creek field embraces the northwestern part of the region and lies in the foothills southwest of the Owl Creek Mountains. It is drained chiefly by Muddy Creek, which gives its name to the field, but in part also by Dry Cottonwood, Sheep, and Dry creeks. Twelve townships are included in the field, namely, Tps. 5 and 6 N., Rs. 3 E. to 3 W., inclusive, Wind River meridian. The field is divided into the following districts: Dry Cottonwood, Sheep Creek, Shotgun, and Dry Creek.

#### DRY COTTONWOOD DISTRICT.

The Dry Cottonwood district (Pls. L and LI) lies at the east end of the Muddy Creek field, adjacent to the Owl Creek Mountains, and includes Tps. 5 and 6 N., R. 3 E. The surface of the district

is mostly rough and includes several small local badland areas, especially in secs. 29, 30, 31, and 32, T. 6 N., R. 3 E. To the south, however, is a large terrace which slopes gently toward the interior of the Wind River Basin. Dry Cottonwood Creek rises in the Owl Creek Range and flows southwestward to a point near the middle of the district, then turns southeast in a course almost parallel to the strike of the beds and passes beyond the boundary of the district. This creek receives the drainage of the district and its valley forms the most open course for a wagon road. A good road would be difficult to construct and maintain along this stream, however, because the valley is narrow and the floor is composed of loose soil, which is easily trenched during periodic floods by the water from the side branches. A wagon road is highly essential to the development of the district, because the area is isolated and does not contain sufficient coal to attract a railroad; therefore, it must depend wholly upon wagon transportation as a means of reaching market.

Structurally the beds in the district are complicated. At the place where Dry Cottonwood Creek emerges from the Owl Creek Mountains and through a distance of about 1 mile southeast, the rocks are broken by a great fault along which the igneous rock of the mountains is overthrust on the Mancos shale. About a mile to the southwest the outcrops of the coal beds are displaced by a small fault which trends parallel to the large fault. Between these two faults the strata are much disturbed and locally overturned. The second fault dies out to the northwest in sec. 19, and to the east it passes beneath the unconformable cover of the Wind River formation in sec. 33. Southwest of the small fault the bed dips regularly toward the interior of the basin. The structure is shown by section A–B on Plate XLIX and also by the dip symbols on Plate LI. As the coal beds are included in the overturned strata mentioned above, the rocks which now overlie them were deposited under them. In developing mines or prospects in this area it is important to understand that on account of the overturning of the beds the dip will become steeper as depth is attained, until a point is reached where it is vertical, from which point it is believed that the dip will change gradually to the southwest until the fault is encountered, where an abrupt break will be found.

In general the outcrops of the coal beds are concealed beneath a cover of débris washed from the mountains, but in places they are exposed in ravines which cut through the surface veneer. The coal beds are lenticular and neither their character nor that of the associated rocks is sufficiently distinctive to permit definite correlation, but the most probable correlation is that shown on Plate LI.

The lowest bed that was found in this district is exposed at locations 99, 100, and 101,[1] but the bed is generally thin, and at location 101 is so impure that it is worthless. A bed a little higher is exposed only at location 102, where it is 25 inches thick. Another bed, shown at location 103, is 28 inches thick, and one at location 104 is 22 inches thick. The next higher bed than that exposed at location 104 is the most promising in the district. As shown by the sections it is 4 feet 9 inches thick at location 105 and 4 feet 6 inches at location 106. This bed can not be traced far in either direction, but the bed exposed at location 107 with a thickness of 4 feet 1 inch resembles it very strongly. At location 108 a slightly higher bed is exposed, but this can not be definitely correlated with any of the beds showing in sec. 20. Sections 109, 110, 111, and 112 were measured on a bed outcropping in secs. 29 and 32, but owing to the cover of surface material and the complexity of the structure this bed can not be correlated with any particular bed of the group exposed farther north.

The outcrops of the beds are terminated on the southeast by the fault previously mentioned, whereas to the northwest they can be traced into a terrace covered by débris, where the coal beds are known to pinch out because they are absent where the associated beds are well exposed west of Dry Cottonwood Creek.

In this district no fresh coal could be obtained for chemical analyses; therefore the character of the coal was determined only from field examination of weathered samples. Analyses of samples of similar coal from about the same geologic horizon are shown by Nos. 9132 and 6706 in the table of analyses on page 533.

Practically no development has been done in this district. A few surface prospects have been opened, but no mining has been undertaken.

### SHEEP CREEK DISTRICT.

The Sheep Creek district (Pls. L and LI) embraces the beds exposed near the Clifford ranch in T. 6 N., R. 2 E., Wind River meridian and extends westward across both forks of Sheep Creek, the bed which has been opened at the Le Clair mine, in sec. 30 of the same township, being included. The surface of this district is comparatively smooth except in the extreme eastern part and a small area in the western part near Red Butte.

Structurally the district is simple. In the eastern part the beds are exposed around the point of a low, hardly perceptible anticline, which merges westward into a monocline dipping to the southwest. They are sharply upturned along the strike of the Mesaverde and Fort Union formations west of Sheep Creek and are included in a syncline

[1] Numbers in the text refer to locations on the maps and to corresponding sections of the coal beds in the plates of sections.

between Sheep Creek and Muddy Creek. Small faults break the strata in the eastern part of the district.

Beds of coal are exposed in the eastern and western parts of the district, but if any coal underlies the broad flat between the two branches of Sheep Creek it is concealed beneath a cover of valley wash where no prospecting has been done.

The most persistent and best-exposed coal bed lies west of Sheep Creek. It is represented by sections Nos. 78 to 91, which show that it is irregular in its thickness like most of the coal beds of this region. A sample for analysis was obtained in the Le Clair mine (location 87), but the sample was somewhat weathered and the result should not be used for comparison. The analysis is given as No. 6706 in the table on page 533. In sec. 34 a coal bed is exposed for a short distance and two sections (Nos. 92 and 93) were measured. At location 93 a sample was obtained in a prospect pit for analysis, but like the one mentioned above the coal was weathered and the analysis hardly representative of the fresh coal of the district. The result is shown as analysis No. 9131 on page 533. Another bed has been prospected at locations 94 to 98, but the bed is thin and its relation to the others in this district could not be determined.

Little development work has been done in this district, probably because of the sparsely settled condition of the region and the abundance of wood available for fuel on the Owl Creek Mountains a few miles to the north. Attempts to mine the coal have been made at two places. The first is at the Le Clair mine (No. 87), which was opened several years ago and has been operated intermittently. This so-called mine consists of an irregular opening about 50 feet deep on a bed of coal which dips 56°. The total amount of coal mined is estimated to be about 100 tons. Another opening about 12 feet deep has been made recently at location 93. At this place conditions are favorable for mining, but it will probably be many years before extensive operations are undertaken because there is no available market for the coal.

### SHOTGUN DISTRICT.

The Shotgun district (Pls. L and LI) lies west of the Sheep Creek district, in T. 6 N., R. 1 E., Wind River meridian, and includes Shotgun ranch, from which it is named. The surface of the district is so rough that a railroad line can not enter it without great difficulty except along the valley of Muddy Creek, but after the area containing the outcrops of the coal beds is reached there is a strike valley about one-half mile wide along which a road can be constructed to reach the coal beds.

The strata are upturned, forming a syncline which trends northwest-southeast. This fold rises steeply and diminishes in width toward the northwest, whereas to the southeast it broadens to the line where it is

concealed by the Wind River formation, which was deposited subsequent to the folding of the coal-bearing rocks. Coal is exposed in both the shale member of the Mesaverde and in the Fort Union formation on the northwestern side of the syncline. Coal was seen in the Mesaverde formation only in the cut bank of Muddy Creek at location 60. The extent of the bed could not be determined because it is covered both to the north and to the south by valley wash. The formation is imperfectly exposed in sec. 30, but apparently it contains no coal. As coal beds in this region are usually lenticular, it is assumed that the bed pinches out between Muddy Creek and the north line of sec. 30.

Four beds of coal that seem to be lenticular are present in the Fort Union formation. The lowest bed was traced across the southern part of sec. 17 and into sec. 20 as far as Muddy Creek. It is represented by sections Nos. 61 to 65. South of location 65 it is concealed beneath alluvium, and in the upland beyond Muddy Creek it could not be found. Sections 66 to 77 indicate the character and extent of the main bed of the district. North of location 77 the outcrop turns east abruptly around the point of the syncline, but the bed contains less than 14 inches of coal and was not mapped. Nos. 52 to 59, inclusive, are exposures on beds that can not be definitely correlated but that probably correspond to the beds prospected north of Muddy Creek. South of the township line between Rs. 5 and 6 the beds are concealed beneath a gravel-covered terrace.

Development in the district is confined to two prospects at locations 60 and 66 in the valley of Muddy Creek. At location 66 a slope ranging in width from 6 to 10 feet (28° dip) has been extended to a depth of 75 feet. The zone of weathering seems to have been passed, but at the time of examination no work had been done in the prospects for several months and the coal was slightly affected by exposure to the air. A sample, however, was taken and analyzed with the results shown in analysis No. 9132 on page 533. It is estimated that the total amount of coal mined is less than 150 tons.

As stated above, the coal beds could be made accessible by wagon road or by railroad, and mining conditions are fairly simple. Development, however, will be delayed for a long time because the district is sparsely settled and is located a long distance from any market for the coal.

### DRY CREEK DISTRICT.

The Dry Creek district (Pls. L and LI) is in T. 5 N., R. 1 W., and T. 6 N., R. 2 W., Wind River meridian, and forms the southwestern part of the Muddy Creek field. The topography consists of high sharp-crested ridges trending northwest-southeast, with comparatively open valleys in areas occupied by the Mancos shale. Locally

the Wind River formation is eroded into badlands which are difficult to traverse. As the district is not easily entered from the Muddy Creek side, future development will be controlled by lines of transportation along the valley of Dry Creek which flows southeast to Wind River. The coal beds of the district are included in a narrow syncline, which trends northwest-southeast, and as indicated by the dip symbols on the map is very steep on its northeast side and only moderately steep on the opposite limb. The coal beds are exposed along the sides of this narrow trough. Small faults are not uncommon, but they neither extend far nor show a displacement of more than a few feet. Three lenticular beds of coal are exposed on the northeast side of the syncline and two on the southwest. Around the point of the syncline which lies in T. 6 N., R. 3 W., coal beds are less than 14 inches thick, and to the east, beyond location 40, they are concealed beneath the Wind River formation. In secs. 32 and 33, T. 6 N., R. 2 W., is a small anticline which deflects the line of outcrop from a northwest-southeast direction to almost east-west. This fold is small and is mainly concealed by the Wind River formation. The coal-bearing strata are exposed again in a northwest-southeast line of outcrop in sec. 5 of the township to the south, but no coal could be found in them.

On the southwest side of the syncline two beds of coal are exposed. The most persistent is shown by sections Nos. 1 to 10 and 12, 13, 16, and 18. The bed is 19 inches thick at location 2, 16 inches at location 1, and only 14 inches about 100 yards to the west. Northwest around the point of the syncline the bed, so far as it is exposed, is nowhere more than 14 inches thick. A second bed, 25 feet higher in the formation than the one mentioned above, is represented by sections Nos. 11, 14, 15, 17, and 19. It is lenticular like the bed below. Near location 10 it contains 6 inches of coal, whereas at No. 19 there is 4 feet 9 inches. The extent of the bed could not be determined because the southeastern part is concealed beneath the Wind River formation.

On the northeast side of the syncline are three coal beds. The lowest is the only one which extends throughout the exposure of the coal-bearing beds on this side of the district. It is shown by sections Nos. 20 to 24, 26, 27, 29, 31, 34, and 37. A bed 8 feet higher in the formation is represented by sections Nos. 25, 28, 30, 32, 35, and 38. The third bed, which is 25 feet higher than the second bed, is represented by sections 33, 36, and 39. South of location 40 the beds are covered. These three beds are concealed by alluvium in the northeast corner of T. 5 N., R. 2 W.

Three small beds at about the same stratigraphic position as the beds in T. 6 N., R. 2 W., are exposed in T. 5 N., R. 1 W. The thickest of the three is shown by sections Nos. 41 to 46, the next thinner by Nos. 47 to 49, and the third by Nos. 50 and 51.

## DRY CREEK DISTRICT

## SHEEP CREEK DISTRICT

## SHOTGUN DISTRICT

## DRY COTTONWOOD DISTRICT

LE CLAIR MINE

*Symbol indicates part of bed included in sample*

*A Section No 93, analysis No 9131

*B " " 87, " " " 6706

*C " " 66, " " " 9132

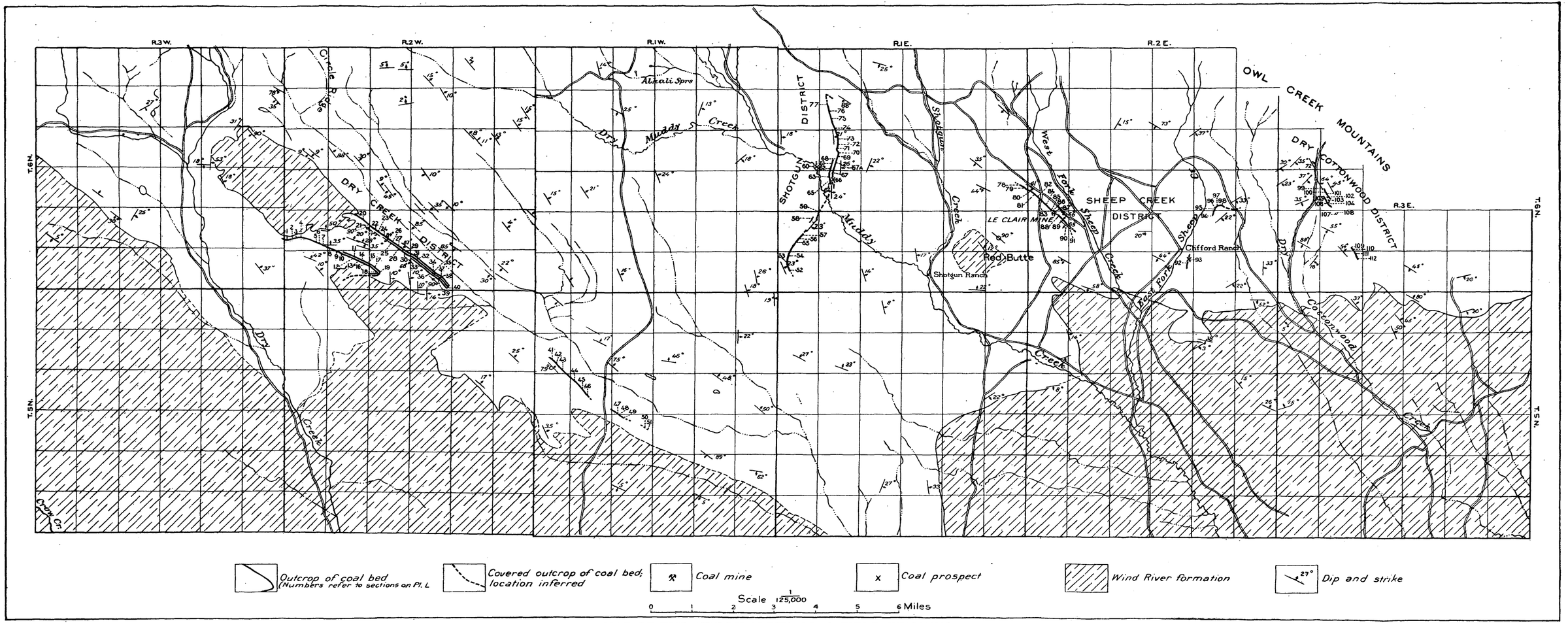
LEGEND

Coal | Bone | Carbonaceous shale | Shale | Sandy shale | Sandstone

Vertical scale 0 5 10 FEET

THE NORRIS-PEET CO WASHINGTON D C

SECTIONS OF COAL BEDS IN THE MUDDY CREEK COAL FIELD, WYOMING




# MAP OF THE MUDDY CREEK COAL FIELD, WYOMING

By W. G. Woodruff
1912

No unweathered sample of the coal could be obtained for analysis because no prospect in the district has passed below the zone of surface alteration. In fact, the only prospects consist of a few surface openings, none of which is more than 10 feet deep. This lack of development is due not to the poor quality of the coal or its inaccessibility but to the lack of demand. The region has only a few inhabitants and there is an abundance of wood suitable for fuel on the slopes of the mountains to the north and west.

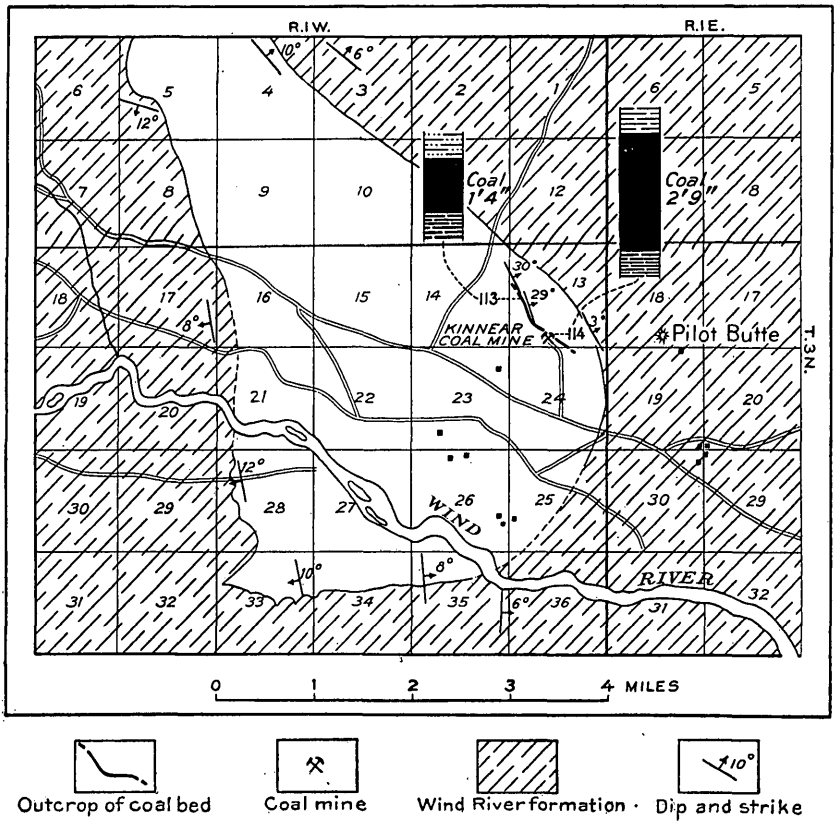



FIGURE 13.—Map of Pilot Butte coal field, Wyoming, and sections of coal bed.

## PILOT BUTTE FIELD.

The Pilot Butte field (fig. 13) is a small isolated coal-bearing area in T. 3 N., R. 1 W., Wind River meridian, lying a little more than a mile west of the prominent butte from which the field takes its name. A coal bed belonging to the sandstone member of the Mesaverde is exposed at locations 113 and 114 in a small area about 2 miles long and one-half mile in maximum width. The coal bed dips 19° to 30° NE. and beyond the outcrop in sec. 13 passes beneath a cover of

detritus. A short distance beyond the mapped limits the bed is concealed by the Wind River formation, which overlies it unconformably.

The surface southwest of the exposure of the coal bed is an even plain and only moderately rough in other directions. Consequently the field is accessible and the coal bed easily reached.

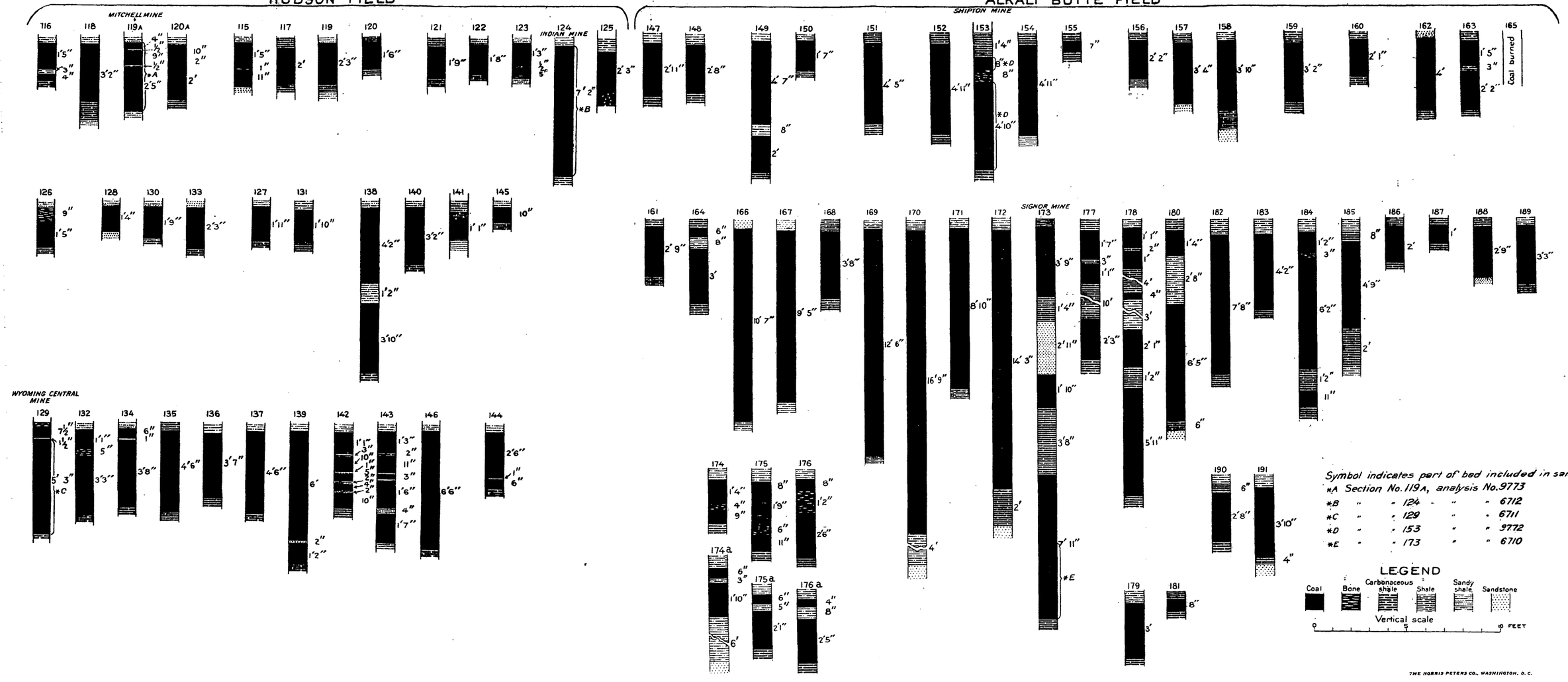
Only one bed of coal is exposed. The position and extent of the outcrop are shown on the map, figure 13, and the character of the bed is shown by the sections. A sample of coal was taken below the zone of weathering in the Kinnear mine, in the SE. ¼ SW. ¼ sec. 13, and analyzed with the result shown by analysis No. 9133 in the table on page 533. This mine consists of a slope (19°) 300 feet long, with an entry 40 feet long starting 20 feet from the bottom. The character of the bed at the end of this entry is shown by section No. 114. The equipment of the mine consists of a horsepower drum, a short cable, and one pit car. It is estimated that about 300 tons of coal have been mined and sold to settlers in the river valley to the south. The mine was dry and there was no evidence of gas.

### HUDSON FIELD.

The Hudson coal field (Pl. LII and fig. 14) is in the southeastern part of the Shoshone Indian Reservation and in the adjacent area to the southeast on the east side of Little Popo Agie River. The field embraces 21 square miles of land underlain by beds of coal less than 2,000 feet deep. Popo Agie River crosses the field and bisects it into a northwest and a southeast district. The surface of the district northwest of the river is only moderately rolling, whereas the district to the southeast is rough. The distinctive topographic feature in the southeastern district is a high ridge capped by Mesaverde sandstone with an escarpment toward Little Popo Agie River and a moderate slope which merges into the badlands of the Wind River formation on the opposite side. Beds of coal outcrop at some places on the northeast side of the crest of the ridge and at others on the escarpment face.

Between the two districts there is a small flood plain occupied by the valleys of Popo Agie and Little Popo Agie rivers, which form a junction near the town of Hudson. Wagon roads lead to outcrops of the coal beds at many places and a railroad spur extends to the Indian mine of the Hudson Coal Co., in sec. 2, T. 2 S., R. 2 E., Wind River meridian.[1]

[1] Since the preparation of this manuscript Max A. Pishel, of the United States Geological Survey, who has reexamined the Indian mine, reports that the railroad track has been removed and that the mine is practically abandoned. This action of the company is reported to have been taken because the bed splits and contains a greater percentage of impurities in the deeper workings than it does near the surface.




Symbol indicates part of bed included in sample

SECTIONS OF COAL BEDS IN THE HUDSON AND ALKALI BUTTE COAL FIELDS, WYOMING

Other mines are not reached by railroad, probably because there is insufficient market to pay for the expense. Tracks can be extended to almost any point along the outcrop of the coal beds in the Indian reservation and can be built near enough to the outcrop in the southeastern district of the field to receive coal direct from mines without first hauling it an excessive distance in tram cars.

The coal occurs between two thick beds of sandstone in the lower member of the Mesaverde formation. There are three beds of coal, only one of which appears to be continuous for any considerable distance. The other beds are lenticular and even the persistent bed varies in thickness from place to place. Two beds are exposed at locations 115 to 120 in secs. 21 and 22, T. 1 S., R. 2 E., Wind River base and meridian. It is probable that the beds extend farther in both directions, but they are concealed beneath the Wind River formation. Erosion of the Wind River has exposed coal beds at the same horizon at locations 121 to 124. At location 125 a shaft reached a coal bed at a depth of 30 feet.

Southeast of the river the outcrops are more continuous, but generally they are concealed beneath the overlapping formation. Location 128 is at the edge of the alluvium and location 146 at the southeasternmost point at which these beds are exposed. Between these two locations outcrops are not continuous. Location 126 is on a small bed in the Mancos shale. Near the northern end of the district three beds are exposed between locations 127 and 134, near the middle two, and near the southern end only one. This condition is not due necessarily to the absence of coal beds, but to the unequal overlap of the Wind River formation, which locally conceals the beds. Where the three beds are exposed the second bed is 26 feet above the lowest and the third 16 feet above the middle bed. In the greater part of this field there is a conglomerate, which is believed by some operators to lie immediately above the main coal bed. This view is erroneous, because the conglomerate is at the base of the Wind River formation, which unconformably overlies the coal-bearing strata and consequently at some places is in contact with the coal beds and at others rests upon the beds above or below the coal, depending upon the extent of erosion which had occurred previous to the deposition of the conglomerate.

The beds dip gently to the northeast, except in the northeast corner of T. 2 S., R. 2 E., Wind River meridian, where they are folded in a small syncline and corresponding anticline with axes oblique to the general strike of the beds. The crest of the anticline which pitches to the northeast has been eroded, producing a deflection in the line of outcrop to the east in the vicinity of the Indian mine, which lies on the east side of this small anticline and extends down the dip at an angle of 14° into the syncline. At the time of examination the

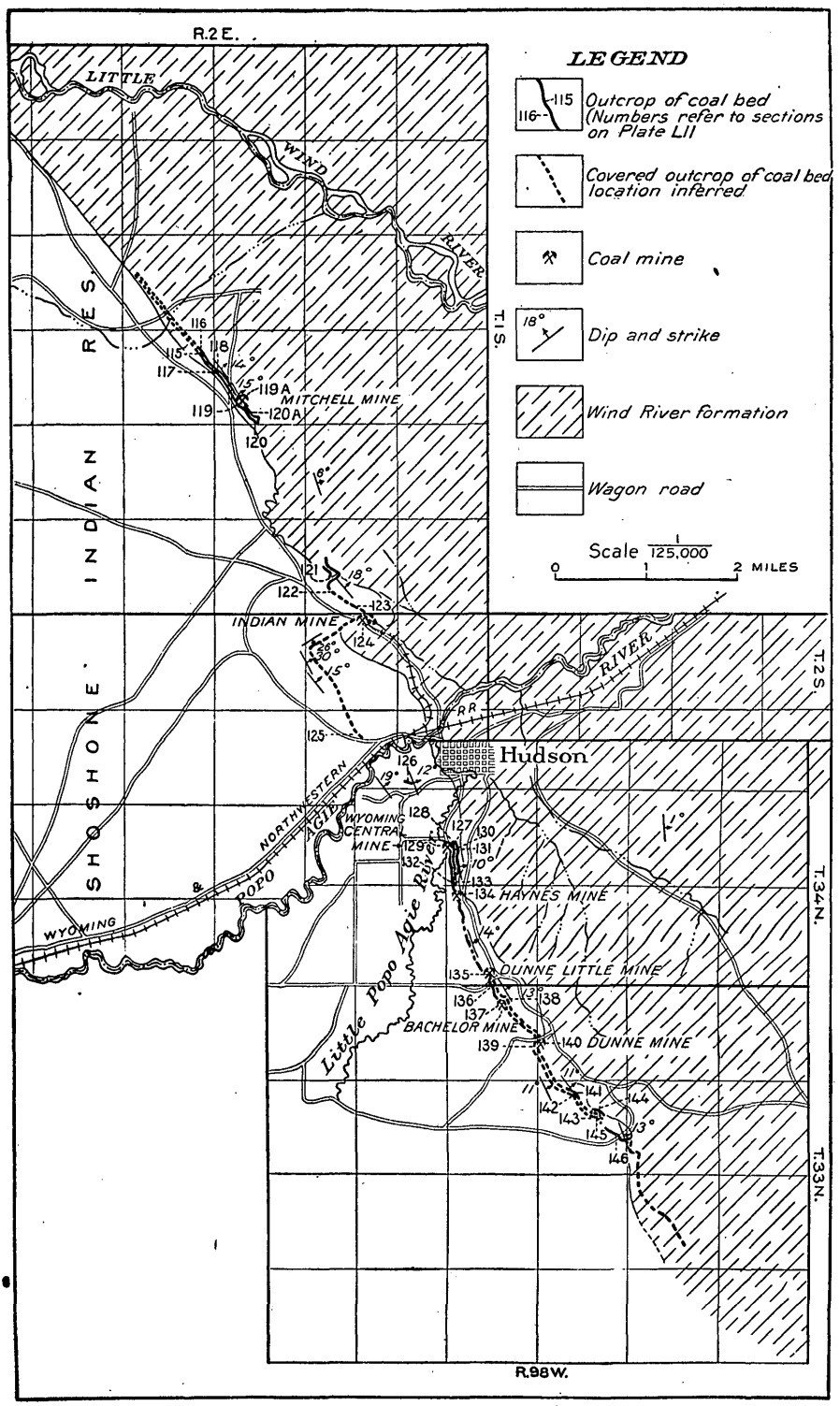



FIGURE 14.—Map of Hudson coal field, Wyoming.

deepest workings had not reached the bottom of the trough. No faults were observed in the field.

Samples for chemical tests were taken in three mines, with the results shown by analyses Nos. 6711, 6712, 9773, 13178, and 13179 on pages 533–534. The conditions under which the samples were taken are described on pages 535–536.

Development in the Hudson field has extended over a considerable time, but actual mining on a commercial scale has been carried on only since the construction of the railroad. Previous to that event the work was limited because the only demand for coal was to supply the small city of Lander and the few inhabitants in the sparsely settled region. This market was very small because there was an abundant growth of wood on Wind River Mountains which could be obtained for fuel without great difficulty.

In that part of the field southeast of Popo Agie River nearly all of the important development of the coal has been on one bed, along which sections 129, 132, 134 to 137, 139, 142, 143, and 146 were measured, but other beds have been prospected at locations 138, 140, and 144. Sections 141 and 145 are of unimportant beds exposed in sec. 10, T. 33 N., R. 98 W.

In 1870 the first mine in the field was opened at location 129. This mine was operated periodically until the property was secured by the Wyoming Central Coal Co., and a new mine opened. The Bachelor mine, location 137, was opened in 1884, but was subsequently closed and remained idle until 1908, when operations were renewed on a small scale and continued each winter to the present time. It is impossible to give the total output or the average selling price. Coal is now sold for $2 per ton at the mine.

In 1886 there was considerable local interest in coal mining and about 600 tons were produced. In that year one mine, which was later set on fire accidentally and abandoned, was opened across the gulch to the north from the Dunne mine. Two years previous to this time (in 1889) the Dunne Little mine, location 135, was opened and has been operated periodically since. No statistics are at hand to show the total production and there are no mine maps to indicate the area mined out. It is believed, however, that less than 1,500 tons have been taken from this mine.

In 1890 a mine was opened at location 139, and was operated for two years, when it was "robbed out" and abandoned. Then the Dunne Big mine (No. 140) was opened and operated until the winter of 1907-8, when the railroad was built into the field and larger commercial mines opened.

The Haynes mine, location 134, was the only mine in the field equipped with machinery previous to 1907. At that time a haulage engine was installed, an entry driven 300 feet, and several rooms were

opened, but the attempt proved unsuccessful and the mine was abandoned.

At the time of this examination the only commercial mine in the Wind River region from which coal is regularly shipped is the Indian mine, operated by the Hudson Coal Co., on the Shoshone Indian Reservation. This mine was first opened in 1904 by an Indian under a treaty with the tribes which provided for mining on a royalty basis. Three years later the rights were acquired by members of the present company, and practically the entire development of the property has taken place under direction of these operators. They have constructed 2 miles of railroad, connecting the mine with the main line of the Wyoming & Northwestern Railway, erected a tipple, and installed a steam hoist, a ventilating fan, and necessary accessory machinery. The underground workings have been systematically laid out and a regular plan of operation followed.

In the fall of 1908 the Wyoming Central Coal Co. began the modification and extension of a mine previously opened at location 129. A main slope was driven 680 feet on a dip of 13° and two entries opened on each side. Hauling and pumping machinery were installed and a small tipple constructed. Difficulty was experienced in securing railroad connections to the mine; consequently the coal was hauled by wagon 1½ miles to sidetracks at Hudson and there loaded on cars. The mine requires constant pumping to keep it free from water. A small quantity of gas is developed in the mine, but not enough to endanger the miners or require safety lights. Most of the coal is sold at the mine for the local country trade at $2.25 per ton for run of mine, and $3 for lump. There are no available statistics to show the total production.

The Mitchell mine, which is the most recently opened, is in the northwestern part of the field at location 119A. It consists of a slope (15°) 200 feet long with an entry turned near the bottom and extending 30 feet to the right. This mine is reported to have been opened chiefly for the purpose of exploring the coal bed with the intention of beginning extensive operations if conditions proved favorable.

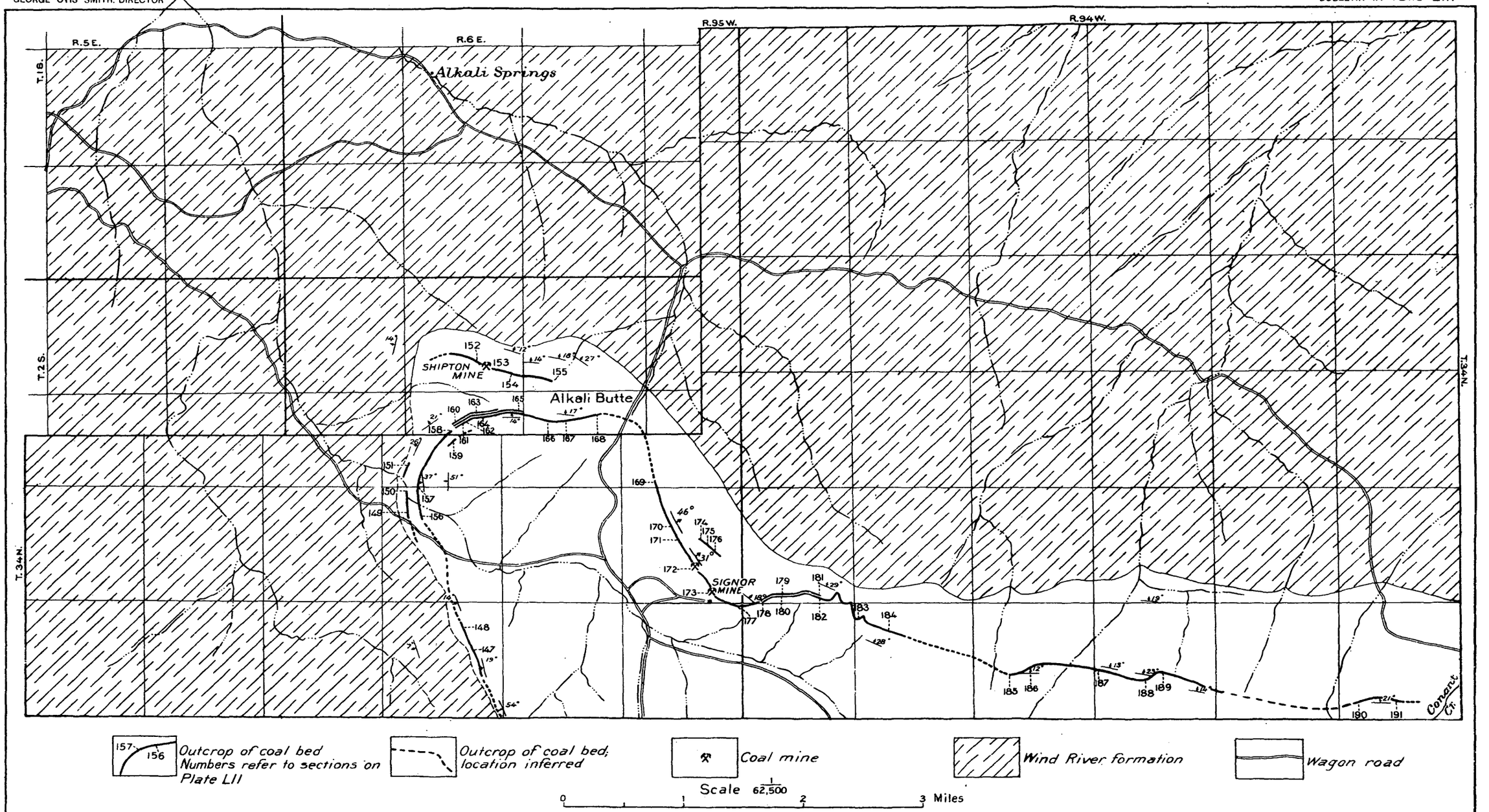
It is important for the prospective investor to know that a portion of the field is within the Shoshone Indian Reservation and controlled by the Office of Indian Affairs, which requires that mining be conducted in a systematic way to avoid waste. Title to the property can not be acquired, but mining is done on a royalty paid quarterly on the output of the mine.

### ALKALI BUTTE FIELD.

The Alkali Butte field (Pls. LII and LIII) lies in T. 2 S., R. 6 E., Wind River meridian, and in T. 34 N., Rs. 94 and 95 W. of the sixth principal meridian. It is some distance from the railroad, the near-

U. S. GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR






# MAP OF ALKALI BUTTE COAL FIELD, WIND RIVER REGION, WYOMING

By E. G. Woodruff
1912

est places being Riverton, 12 miles to the northwest, and Hudson, 20 miles to the west. That part of the field east of location 168 is moderately broken and covered with grass, whereas to the west it is rough and dominated by a high, broken ridge culminating in Alkali Butte, which forms a prominent landmark in the region. To the north of the field the surface is undulating.

The field is situated on a small anticline, whose major axis trends southeast and northwest. The geologic history of the field has been in part as follows: Subsequent to the uplift of the coal-bearing beds erosion removed the crest of the anticline; then the whole field was covered unconformably by the Wind River formation, which at present has been partly removed. The coal beds are exposed around the western end and on the north flank of the anticline, whereas the strata on the south flank and to the east are still covered and their contents unknown. There is one rather persistent bed in this field which extends from location 147 to location 181 and is represented on Plate LII by sections 147, 148, 156 to 158, 161, 164, 166 to 173, 177, 179, and 181, and another bed almost as extensive represented by sections 178, 180, and 182 to 191. These beds are irregular in thickness and locally their outcrops are concealed, but they are believed to be continuous between the points mentioned. Besides these are everal lenticular beds, the largest of which is shown by sections 152 to 155. Other lenses were measured at locations 149, 150, 151, 159, 160, 162, 163, and 165. In the NE. ¼ sec. 25, T. 34 N., R. 95 W., a single line of outcrop represents two beds of coal. The upper bed, represented by sections 174, 175, and 176, is 12 feet above the bed along which sections 174a, 175a, and 176a were measured. Samples for chemical analysis were taken in the Signor (No. 173) and Shipton (No. 153) mines, with the result shown by analyses Nos. 6710 and 9772 on page 534.

Development has been undertaken at several places in the field, but the prospectors were soon forced to abandon the undertakings because of the absence of drinkable water and also because of the distance to market. In addition to these difficulties, the market which might be supplied by this field is also reached by the railroad which carries coal from the commercial mines at Hudson. These conditions produce competition unfavorable to the Alkali Butte field and have prevented extensive operations.

Notwithstanding these unfavorable circumstances, some coal has been produced and new mines are occasionally opened. The most extensive work has been in the Signor mine, at location 173. At that place a slope (11°) has been opened 175 feet down the dip of the coal bed and an entry about 40 feet long driven from the foot of the slope and widened into a room at the end. A back entry for use as an air course extends in a slightly diverging direction from the bottom of

the main slope to the surface. This mine has passed through the zone of weathering and extends into unaltered coal. The mine is dry, as a result no doubt of its location in an arid region. Equipment consists of a pit car operated on a wooden track by cable. The mine is worked only periodically during the winter to supply the local trade at Riverton, 14 miles away, to which place the coal is hauled by wagon.

The Signor prospect, at location 172, is a slope (31°) about 50 feet long in the lower part of a bed of coal 14 feet thick.

The Shipton mine, at location 153, consists of a nearly horizontal entry 45 feet long, which was being extended at the time the field was examined (fall of 1909). The end of the entry had not passed beyond the zone of weathering but had evidently almost reached that point. It was planned to haul coal from this mine to Riverton, 12 miles distant.

In addition to the mining operations described above, there are several prospects where mining has been attempted only to be abandoned after a small amount of work had been done.

Extensive operations are favored by the structure of the strata and the extent of the beds and by the character of the coal, but profitable mining is prevented at present by the absence of water suitable for human use and mine operations. When coal is in sufficient demand to pay for the construction of a railroad into the field, water can be brought from Wind River in tank cars or through a pipe line and large mining operations made possible. At present the field is uninhabited.

### POWDER RIVER FIELD.

The Powder River field embraces the coal districts near the head of Powder River. Rattlesnake Mountain stands on the south side and Oil Mountain on the northeast. The field is drained by Muskrat Creek, a tributary of Wind River, by South Fork, Wallace, and Casper creeks, all of which belong to the Powder River drainage basin, and by North Platte River and its tributaries, Poison Spider and Poison Spring creeks. These streams, with the exception of North Platte River, contain running water only in the spring and early summer. At other times they have dry courses containing here and there seepages or pools of alkaline water.

There is great diversity in the topography of the field; that of the western part is a broadly undulating plain, whereas to the east badlands predominate.

Structurally the field is a northwest-southeast trending syncline, with a minor anticline and syncline on its northeastern limb. The principal fold, which is here termed the Powder River syncline, is 15 to 18 miles broad. The coal-bearing strata are exposed around the

edges of the syncline except where concealed beneath the overlapping Wind River formation. The Muskrat, South Fork, Wallace Creek, and Oil City districts, on the southwestern limb of the Powder River syncline, and the Waltman, Powder River Station, Efell, and Platte River districts on the northeast, are separated by barren areas or areas in which the coal-bearing rocks are concealed beneath more recent formations.

The coal is subbituminous and its chemical properties are shown by several analyses on page 534. These were made from weathered samples because no fresh coal could be obtained, and therefore the results are only approximately representative. The place at which each sample was taken and the conditions prevailing at the time are shown by notes on page 536.

### MUSKRAT CREEK DISTRICT.

The Muskrat Creek district (Pls. LIV and LVI) lies mostly in the valley of Muskrat Creek, in T. 34 N., Rs. 89 and 90 W., and T. 35 N., Rs. 90 and 91 W. of the sixth principal meridian. In general the surface is an undulating plain, though locally there are rough areas. The drainage of the district is through Muskrat Creek, which flows in a moderately broad open valley along the west side of the district and through Canyon Creek, which crosses the eastern part. The district is traversed by several wagon roads, which either cross the outcrops of the coal beds or terminate near them. Wagon roads can be constructed without much difficulty to almost any place along the outcrops of the coal beds. Water is scarce; therefore the region is practically uninhabited and at present there is no market for the coal.

In the western part of the district the Fort Union formation contains beds of coal thick enough to be mined, but the Mesaverde formation contains only thin beds less than 14 inches thick, whereas in the eastern part of the district the Fort Union apparently contains no coal and the Mesaverde carries thick beds.

The bed exposed at location 192 is a small unimportant lens in an isolated area of Fort Union rock. The following section is exposed:

*Section of coal bed at location 192, in sec. 22, T. 34 N., R. 91 W.*

| | Inches. |
|---|---|
| Sandstone. | |
| Coal | 11 |
| Bone | 8 |
| Coal | 3 |
| Bone. | |
| | 22 |

A coal bed is also exposed at locations 193, 194, and 195, but it diminishes in thickness in both directions and is doubtless only a small lens. A more persistent bed is exposed in sec. 31, T. 35 N., R. 90 W., and secs. 5 and 4, T. 34 N., R. 90 W. Throughout this

distance it holds a fairly regular thickness of about 3 feet, as shown by sections Nos. 196 to 202. The bed exposed at locations 203 and 204, and also the one at locations 205 and 206, are in the Mesaverde formation. The former was determined to be a small lens, but the extent of the latter could not be ascertained because the eastern limit is covered by the Wind River formation.

The strata in this district are folded into a small southwestward-plunging anticline, from the crest of which the coal-bearing formations have been removed by erosion. On the southwest limb the coal beds are concealed by the Wind River formation, but on the northeast limb enough of the covering has been removed to expose the beds, which dip gently to the northeast, toward the interior of the basin. The strata are broken in sec. 31, T. 35 N., R. 90 W., by faulting. Very little development has taken place in this district because the demand for fuel for the only ranch in the district is small. At location 202 there is a prospect 10 feet deep, extending horizontally from the west side of the gulch, and on the east side, about 50 yards distant, there is another larger opening, which is now apparently abandoned. It is estimated that less than 100 tons of coal has been taken from these openings.

#### SOUTH FORK DISTRICT.

Outcrops of the coal beds in the South Fork district (Pls. LIV and LVI) are confined to T. 34 N., R. 88 W., but it is possible that the beds extend into the township to the east, where débris conceals the coal-bearing strata. Nothing is known concerning the coal beds in the western part of the district. Sufficient data were obtained to determine that the outcrop of the coal-bearing rocks extends in a slightly curved line from location 207 to a point one-half mile north of the township corner, then slightly southwest one-half mile. Along this zone the coal beds are concealed beneath a gently undulating plain covered with grass and sagebrush. In the eastern half of T. 34 N., R. 89 W., the strata are concealed beneath débris, which covers a terrace extending northwestward from the Rattlesnake Mountains. The coal beds are also covered by débris along the line of outcrop in the southwestern part of T. 34 N., R. 87 W., beyond location 241.

The surface of the district is rough. It is occupied mainly by badlands which are crossed by two small streams. There are high, rugged ridges, separated by narrow valleys, in the zone which contains the outcrops of the coal beds. The whole region is trenched by many steep-sided valleys. It is impossible to traverse the field by wagon except along the strike valleys and larger stream courses.

The coal beds occur in the shale of the Mesaverde. The beds outcrop along the northeast flank of the Rattlesnake Mountains and

dip into the Powder River syncline at angles generally ranging from 20° to 30°, but in places even at greater angles. A dip of 38° was measured in the NE. ¼ sec. 27, T. 34 N., R. 88 W. Dips observed in the Wind River formation do not show the structure of the coal beds below, because that formation is unconformable upon the coal-bearing strata.

There are nine beds of coal exposed in this township in a stratigraphic distance of 550 feet. Their positions are as follows:

*General section of coal beds in South Fork district.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 214, 224, 227, 235, 239. | |
| Sandy shale and sandstone | 50 |
| Coal: Sections Nos. 222, 240. | |
| Sandstone, thick bedded, and sandy shale | 50 |
| Coal: Sections Nos. 210, 213, 225, 228, 230, 231, 233, 237, 241. | |
| Sandstone, thick bedded, and sandy shale | 55 |
| Coal: Sections Nos. 211, 213*a*, 215*a*, 223, 226, 229, 232, 234. | |
| Sandstone, thick bedded, and sandy shale | 87 |
| Coal: Sections Nos. 212, 217, 218, 236, 238. | |
| Shale, sandy | 48 |
| Coal: Sections Nos. 215, 216, 221, 221*a*. | |
| Shale, sandy | 130 |
| Coal: Sections Nos. 207–209, 219. | |
| Shale, sandy | 18 |
| Coal: Section No. 220. | |

One of the higher beds contains 30 inches of coal at location 210 but only carbonaceous shale opposite location 208. At location 213 it contains 20 inches of coal.

The highly lenticular character of the coal beds in the district is shown graphically in figure 12, page 531.

Owing chiefly to the lack of settlement in the field and consequent lack of market, very little development has been undertaken. There are several places where the coal beds have been removed to a depth of a few feet, and two places, locations 217 and 218, at which deeper openings have been made. At the latter place an entry has been driven in the side of the gulch about 100 feet along the strike and widened out irregularly to a maximum of 25 feet. At the former place a slope on a coal bed, dipping 31°, has been opened to a depth of 25 feet. Both of these prospects are abandoned. The total amount of coal mined in the field does not exceed 300 tons.

### WALLACE CREEK DISTRICT.

The Wallace Creek district (Pls. LIV and LVI) comprises a few square miles on both sides of Wallace Creek in T. 33 N., R. 87 W. It is separated from the South Fork district on the west and the Efell district on the east by grass-covered plains, which conceal the outcrops of the coal beds. The surface of the district is uneven.

The outcrops of the coal beds are near the base of a rugged ridge broken in places by valleys cut by branches of the main creek. The exposures of the coal beds can generally be reached over wagon roads which extend along the valley and in some places along strike valleys near the outcrop of the coal beds.

In this field the beds dip to the northeast at angles varying between 20° and 30° and are steepest in the northwestern part. Three beds of coal occur in the shale member of the Mesaverde as shown by the following general section:

*General section of the coal beds in the Wallace Creek district.*

| | Feet. |
|---|---|
| Coal: Section No. 245. | |
| Sandstone and sandy shale | 370 |
| Coal: Sections Nos. 246*a*, 248. | |
| Shale, sandy | 28 |
| Coal: Sections Nos. 242–244, 246, 247, 249. | |

Practically no mining is being carried on in this district. Small openings have been made at locations 243 and 244. At location 243 there is a prospect which is caved, but it appears to have been less than 25 feet deep when work ceased. The prospect at location 244 is on a much thicker portion of the bed and was about 50 feet deep when work was abandoned. Lack of interest in prospecting is probably due to the absence of market, a condition which arises from the sparsely settled state of the country and from the abundant supply of wood on the mountains only a few miles away.

### OIL CITY DISTRICT.

The Oil City district (Pls. LIV and LVI) is in T. 33 N., R. 86 W., and includes the most southeastern exposures of coal beds on the southwest limb of the Powder River syncline. The district lies northeast of Oil City post office. It is considered as a separate district for the reason that in the vicinity of Casper Creek the coal-bearing rocks are concealed by grass and detritus, and the coal beds, if present, will be found at some depth below the surface. The coal-bearing rocks doubtless extend farther to the southeast, but near Poison Spider Creek they are concealed by surface material and still farther southeast by the great overlap of the Wind River formation. The surface of the district is rough and consequently the outcrops of the coal beds are not easily reached by wagon road. A branch of Casper Creek crosses the western part of the district, and Poison Spider, a tributary of North Platte River, the eastern part. Between these two streams there is a moderately rough divide which culminates in a high point in sec. 27. Coal beds occur in the shale member of the Mesaverde formation; they extend along the side of

Rattlesnake Mountain and dip into the Powder River syncline at angles generally ranging between 20° and 30°; but in the southeastern part of the district the angle is not over 12°.

There are six beds of coal exposed in the district. Their stratigraphic positions are shown by the following section:

*General section showing stratigraphic positions of coal beds exposed in the Oil City district.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 252, 253, 254, 256. | |
| Sandstone and sandy shale | 148 |
| Coal: Sections Nos. 255, 258, 259. | |
| Sandstone and sandy shale | 84 |
| Coal: Section No. 257*a*. | |
| Sandstone and sandy shale | 48 |
| Coal: Sections Nos. 251, 257. | |
| Sandstone and sandy shale | 37 |
| Coal: Section No. 250. | |

Very little development has occurred in this district; in fact the only attempt at mining was made at location 257. At this place an entry has been driven in the side of a small canyon and extended 90 feet along the strike of the beds. It is estimated that 300 tons of coal have been mined. The mine had been abandoned previous to the examination and there seemed very little probability of its reopening in the near future. The lack of interest in developing the coal is due probably to the absence of demand for the coal. The district is uninhabited, and there are only a few ranches in the adjacent areas to be supplied and these can secure wood for fuel on the adjacent mountain slopes.

### WALTMAN DISTRICT.

The Waltman district (Pls. LIV and LVI) includes a narrow zone of outcrop which extends northwest from the place where the Mesaverde formation is covered north of Powder River to sec. 24, T. 37 N., R. 87 W. The northwestern limit of the field is determined by grass-covered alluvial plains and the uncomformable overlap of the Wind River formation. In the coal-bearing area the surface is rough and the outcrop of the coal beds is difficult to approach with a wagon except in a few favorable localities. Gravel-covered terraces conceal the coal-bearing rocks between locations 302*b* and 303*c* and between 303*a* and 303 in the adjoining district.

The coal beds occur in the shale member of the Mesaverde formation, which is sharply upturned in this district, forming the northeast limb of the Powder River syncline. Near Powder River the angle of dip varies between 50° and 60°, but to the northwest the dip increases until the beds are vertical or slightly overturned. Nine beds of coal are exposed in the district, with the stratigraphic positions shown in the following sections:

*General section showing stratigraphic positions of coal beds in T. 36 N., R. 86 W., in the Waltman district.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 274, 278, 279, 282. | |
| Interval (estimated) | 160 |
| Coal: Sections Nos. 273, 275, 277, 280, 281, 283. | |
| Interval (estimated) | 25 |
| Coal: Section No. 276. | |
| Interval (estimated) | 300 |
| Coal: Section No. 275*a*. | |

*General section showing stratigraphic positions of coal beds in T. 36 N., R. 85 W., in the Waltman district.*

| | Feet. |
|---|---|
| Coal: Section No. 292. | |
| Interval | 150 |
| Coal: Sections Nos. 293, 289. | |
| Interval | 100 |
| Coal: Sections Nos. 284, 288, 290, 302. | |
| Interval | 150 |
| Coal: Sections Nos. 287, 291, 302*a*. | |
| Interval | 200 |
| Coal: Sections Nos. 286, 298, 299, 302*b*. | |
| Interval | 200 |
| Coal: Sections Nos. 294, 297, 300, 302*c*. | |
| Interval | 35 |
| Coal: Sections Nos. 285, 295, 296, 301, 302*d*. | |

Owing to the imperfect exposures near the township line it is impossible to correlate coal beds from one part of the district to the other.

In the northwestern part of the district, at locations 260 to 272, are outcrops of coal beds that can not be correlated with the main beds of the district, for the reason that the spaces between the outcrops are badly covered by surface materials, and neither the characteristics of the coal beds nor the associated rocks are sufficient to afford a clue as to their correct stratigraphic positions.

In sec. 31, T. 36 N., R. 85 W., at location 303a, a bed of coal 28 inches thick is exposed; at location 303b a bed 41 inches thick; and at location 303c the following section:

*Section of coal bed at location 303c, sec. 31, T. 36 N., R. 85 W.*

| | Ft. | in. |
|---|---|---|
| Shale, sandy. | | |
| Coal | 3 | 11 |
| Shale, sandy | 20 | |
| Coal | 3 | 3 |
| Shale, sandy, drab | | 4 |
| Coal | 2 | 6 |
| Shale, sandy, drab | 1 | 2 |
| Coal | 2 | 7 |
| Shale, sandy, drab. | | |

These beds are exposed in a small gully and could not be correlated with other beds of the field.

Practically no development work has been done in the district. Surface prospects have been opened at several places, but only a few tons of weathered coal have been taken from the largest. Very little interest has been taken in mining, because the district is uninhabited and uninhabitable, except by roving sheep herders, for whom water is hauled into the field. The nearly vertical attitude of the beds is also discouraging to coal miners, because uncommon and expensive methods of mining must be used.

#### POWDER RIVER STATION DISTRICT.

Southwest of Powder River railroad station there is a coal district (Pls. LV and LVI), which extends from the valley of Powder River, where it is crossed by the Mesaverde formation, southeast to the east side of Casper Creek, in sec. 5, T. 34 N., R. 84 W. Outcrops of coal beds occur at many places throughout this district and encircle a small isolated syncline in the northeastern part of T. 35 N., R. 85 W. At the southeast end of the field the coal beds pass under the Wind River formation. It is believed that the beds extend both to the northwest and southeast beyond the limits shown by the line of outcrop, but positive information concerning the coal could not be obtained because the beds are concealed beneath a débris-covered terrace to the northwest of Powder River and by the Wind River formation to the southeast.

The surface of the district is rough. In fact, the outcrops of the coal beds in the main part of the district lie along a high, rugged ridge that is intersected by Powder River and Casper Creek, both of which occupy narrow valleys. Practically all of the district except the creek valleys and the coal-bearing syncline can be approached by wagon only with difficulty. The small syncline in secs. 11, 13, 14, 23, and 24 has a moderately uneven surface, but it is surrounded by a fairly even plain over which roads can be constructed without difficulty.

The coal beds occur in the shale member of the Mesaverde formation, which in the greater part of the area dips steeply toward the southwest into the Powder River syncline, but east of Casper Creek the beds are slightly overturned, dipping to the east. The same strata are also involved in the small fold described above.

The lowest coal bed involved in the small syncline is exposed at locations 341, 346, and 347 and higher beds at locations 342 to 345. The lower bed is variable in thickness and in places badly broken by partings but contains considerable coal. It is estimated that 700 acres are underlain by it and that the depth of the trough is such that it can be all mined out. Besides the sections shown on Plate LV

measurements of beds were made as follows: At location 330, 32 inches of coal; 331, 36 inches of coal; 334, 26 inches of coal.

The stratigraphic positions of the coal beds in the main part of the district are shown by the following columnar section:

*General section of coal beds in Powder River Station district.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 309, 316, 330, 335*a*, 338–340, 348, 351, 354, 358, 359. | |
| Interval | 59 |
| Coal: Sections Nos. 310, 315, 349, 353. | |
| Interval | 154 |
| Coal: Sections Nos. 311, 314, 323, 326, 329, 333, 335, 337. | |
| Interval | 104 |
| Coal: Sections Nos. 304, 312, 320, 322, 325, 328, 332. | |
| Interval | 51 |
| Coal: Sections Nos. 303, 313, 319, 321, 324, 327, 331, 334, 336. | |
| Interval | 212 |
| Coal: Sections Nos. 305, 306, 308, 318. | |
| Interval | 4 |
| Coal: Sections Nos. 307, 317. | |

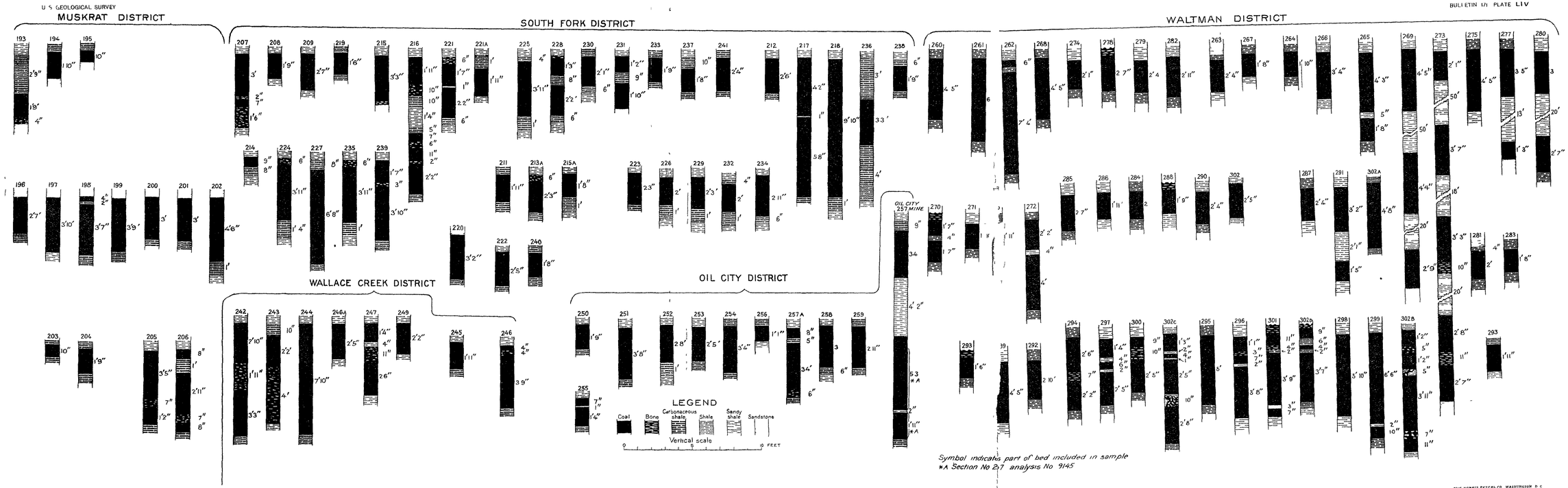
Nos. 350, 352, and 355 to 357 are on small lenticular beds in the southeastern part of the district.

Development in this district consists of a few surface openings, a shaft 50 feet deep at location 306, and a mine at location 345. The mine consists of a slope 350 feet long, extending down to the bottom of the syncline and 40 feet up the rise on the opposite side. There is a lateral entry at right angles to the slope and joining it at the bottom of the syncline. Some rooms have been turned near the junction of these two entries. When the mine was first opened it was planned to extend the work over a large area, but exploration showed that the coal beds occupy only a few acres and the undertaking was abandoned. In parts of the district the beds dip steeply, involving unusual and expensive methods of mining, and therefore it is impossible to open large mines which can compete successfully with those that have more favorable natural conditions.

### EFELL DISTRICT.

The Efell district (Pls. LV, LVI, and LVII) comprises an area between Poison Spring Creek in T. 32 N., R. 82 W., and the divide north of Poison Spider Creek. That portion in T. 33 N., R. 83 W., was examined in 1909 and is shown on Plate LVI, whereas the remainder, which lies to the southeast, was mapped in 1910 and is shown on Plate LVII.

Along the zone of coal outcrop are numerous parallel strike ridges and valleys resulting from the unequal erosion of the steeply inclined resistant and nonresistant members of the Mesaverde and Fort Union




SECTIONS OF COAL BEDS IN MUSKRAT CREEK, SOUTH FORK, WALLACE CREEK, OIL CITY, AND WALTMAN DISTRICTS OF THE POWDER RIVER COAL FIELD, WYOMING

formations. Erosion of the Mancos shale produces a wide valley, whereas the Wind River formation gives rise to badland forms.

The coal-bearing Mesaverde formation dips steeply to the southwest and strikes about S. 45° E., except near Poison Spring Creek where the strike changes to nearly north-south for a short distance, then continues southeastward again. In the area along either side of Poison Spider Creek in T. 33 N., R. 83 W., are a number of coal beds whose outcrops are exposed for a considerable distance, as shown on the maps. The correlation of sections and stratigraphic relation of the beds are shown by the following table:

*Section showing stratigraphic relation of coal beds in the Efell district north of Poison Spider Creek.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 361, 364, 368a, 371, 375. | |
| Interval | 330 |
| Coal: Sections Nos. 368, 369, 373, 377. | |
| Interval | 110 |
| Coal: Sections Nos. 360, 365, 370, 372, 374, 376. | |
| Interval | 1,500 |
| Coal: Sections Nos. 362, 367. | |
| Interval | 175 |
| Coal: Sections Nos. 363, 366. | |

As indicated by sections Nos. 360 to 377, these beds vary greatly in thickness. The highest bed exhibits thicknesses of 2 feet 9 inches at 368*a*, whereas only a few yards away (371) there is only 2 feet of coal at the same horizon. The thickest bed and the one which was traced for the greatest distance is the one which is worked at the Efell mine (370) in sec. 8, T. 33 N., R. 83 W. In 1909 the mine consisted of one entry driven from the side of a small coulee along the strike of the steeply dipping bed for about 200 feet. It is estimated that 200 tons of coal have been mined. This mine has been operated periodically during the winter months to supply the Efell ranch, which is the only place in the district permanently inhabited. Sample No. 9149 was taken from the end of this drift where the coal was only slightly weathered, and the analysis is given in the table on page 534. There seems to be little interest in the development of the coal resources of the district, probably because there is no market for the coal and also because the beds dip so steeply that unusual and expensive methods of mining must be employed. Other development within this part of the Efell district consists of a few small surface prospects, none of which exceed 20 feet in depth.

South of Poison Spider Creek and extending to Poison Spring Creek is an area in which from 1 to 4 coal beds are exposed and which is separated from the area just discussed by a grass-covered ridge in secs. 20 and 21, T. 33 N., R. 83 W. The stratigraphic relation of the various beds is shown in the following section:

*Section showing stratigraphic relation of coal beds in the Efell district south of Poison Spider Creek.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 379, 386, 390, 393, 396, 401, 404. | |
| Interval | 96 |
| Coal: Sections Nos. 378, 380–384, 387, 392, 395, 400, 402, 405. | |
| Interval | 65 |
| Coal: Sections Nos. 385, 388, 391, 397, 399. | |
| Interval | 715 |
| Coal: Sections Nos. 389, 394. | |
| Interval | 600± |
| Coal: Section No. 398. | |

Coal beds in this portion of the district are almost vertical at nearly every point and prospecting has been done at only one location (384) where a small drift was opened.

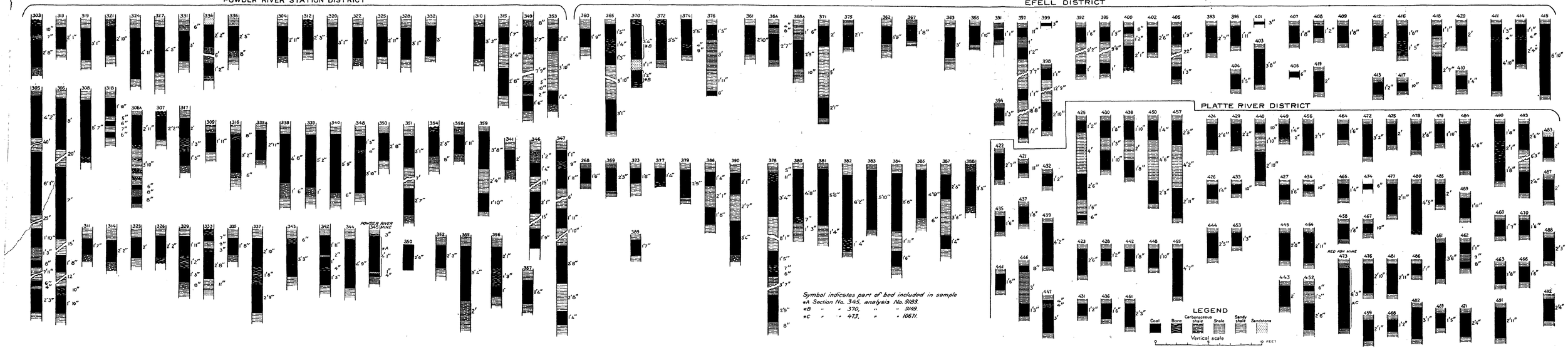
Other sections of coal beds range in thickness from 3 inches (401) to 6 feet 2 inches (382). To the southward the beds become generally unimportant, though at location 403 is a bed 42 inches thick. At location 406, in sec. 5, T. 32 N., R. 82 W., no bed of coal more than 6 inches in thickness was to be found at the horizons of beds exposed farther to the north, though exposures were good. In sec. 8, however, beds are exposed at locations 407 to 417, ranging in thickness from 10 inches at location 417 to 6 feet 10 inches at location 415.

A small drift opening had been driven along the strike of the coal bed at location 411. The coal bed at this point dips about 55° SE. A second prospect at location 415 exposed a bed 6 feet 10 inches thick at the same horizon. Only a few wagonloads of coal have been removed from either of these openings. Southward beyond sec. 8 the outcrops of coal beds are grass covered for about a mile. Near the south line of sec. 16, however, two beds are exposed, one of which has been prospected at location 418, but at neither location 419 nor 420 is there more than 2 feet of coal.

### PLATTE RIVER DISTRICT.

The Platte River district (Pls. LV and LVII) forms the eastern extremity of the Wind River coal region and is about 25 miles from Casper, the nearest railroad town. It extends southeastward from the Efell district, described above, and the area is drained by North Platte River. The topography of the area underlain by coal-bearing rocks is rough and hilly, whereas the area in which the Mancos shale outcrops is more level and open.

The district occupies the southeast end of the Powder River syncline as shown on Plate XLIX. The coal-bearing Mesaverde formation dips steeply toward the interior of the basin and is overlain conformably by the Fort Union formation. The outcrop of the




SECTIONS OF COAL BEDS IN THE POWDER RIVER STATION, EFELL, AND PLATTE RIVER DISTRICTS OF THE POWDER RIVER COAL FIELD, WYOMING

Mesaverde formation trends southeastward from the northwestern limit of the district to a point within a few hundred yards of Platte River, where they turn sharply to the west and continue until covered by the Wind River formation in sec. 18, T. 31 N., R. 82 W. In addition to the main synclinal structure there is in sec. 3, T. 31 N., R. 82 W., a sharp flexure and a fault, as shown on Plate LVII. The fault has a maximum offset of about 30 feet and does not affect the rocks except for a very short distance. The Wind River formation lies unconformably on the Fort Union in the northwest part of the district, but gradually encroaches on the older beds until in the southwest corner of the district it lies unconformably on the Mancos shale. Between Poison Spring Creek and location 422, in sec. 34, T. 32 N., R. 82 W., the coal-bearing rocks are grass covered and there is no evidence of coal beds. In sec. 34, however, the surface is rough and several beds of coal are exposed. In sec. 3, T. 31 N., R. 82 W., the number of beds increases to nine, most of which do not exceed 24 inches in thickness at any point; one, however, attains a maximum thickness of 4 feet 7 inches at location 455. Coal beds are not continuous; in fact for half a mile south beyond the valley in which sections Nos. 455 to 457 were measured there is no bed more than 6 inches thick, although there are numerous good exposures. Sections Nos. 421 to 457 were measured within a distance of a little over a mile along the outcrop of the coal-bearing zone and are shown on Plate LV.

The following section shows the stratigraphic relation of the sections measured in this part of the district:

*Section showing stratigraphic relation of coal beds in Platte River district.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 427, 434. | |
| Interval | 35 |
| Coal: Sections Nos. 426, 433. | |
| Interval | 50 |
| Coal: Sections Nos. 432, 435. | |
| Interval | 150 |
| Coal: Section No. 436. | |
| Interval | 75 |
| Coal: Sections Nos. 431, 437, 451. | |
| Interval | 75 |
| Coal: Sections Nos. 425, 430, 438, 450, 457. | |
| Interval | 20 |
| Coal: Section No. 439. | |
| Interval | 50 |
| Coal: Sections Nos. 424, 429, 440, 449, 456. | |
| Interval | 5 |
| Coal: Section No. 441. | |
| Interval | 10 |

| | Feet. |
|---|---|
| Coal: Sections Nos. 423, 428, 442, 448, 455. | |
| Interval | 20 |
| Coal: Section No. 447. | |
| Interval | 50 |
| Coal: Section No. 446. | |
| Interval | 25 |
| Coal: Sections Nos. 445, 454. | |
| Interval | 25 |
| Coal: Sections Nos. 444, 453. | |
| Interval | 30 |
| Coal: Sections Nos. 443, 452. | |

South of the barren area in the NW. ¼ sec. 11 coal beds occur, as shown on the map. Eight beds are exposed within a stratigraphic distance of about 200 feet and at several locations (458 to 486) important thicknesses are exhibited. Only a few of the beds could be traced for distances of more than half a mile, as may be seen by referring to the map.

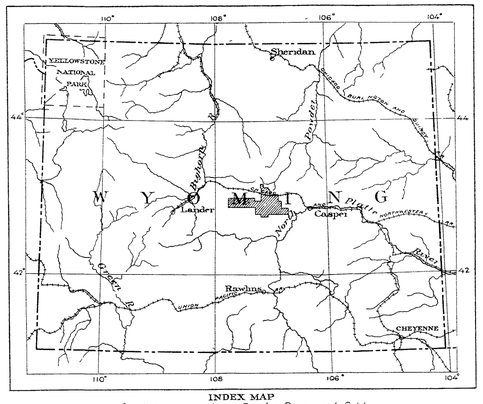
*Section showing stratigraphic relation of coal beds exposed near Red Ash mine.*

| | Feet. |
|---|---|
| Coal: Sections Nos. 461, 462. | |
| Interval | 20 |
| Coal: Sections Nos. 460, 470. | |
| Interval | 20 |
| Coal: Sections Nos. 469, 471. | |
| Interval | 10 |
| Coal: Sections Nos. 459, 468. | |
| Interval | 6 |
| Coal: Sections Nos. 458, 467. | |
| Interval | 20 |
| Coal: Sections Nos. 463, 466. | |
| Interval | 60 |
| Coal: Sections Nos. 464, 472, 475, 478, 479, 484. | |
| Interval | 30 |
| Coal: Sections Nos. 465, 474, 477, 480, 485. | |
| Interval | 30 |
| Coal: Sections Nos. 473, 476, 481, 486. | |

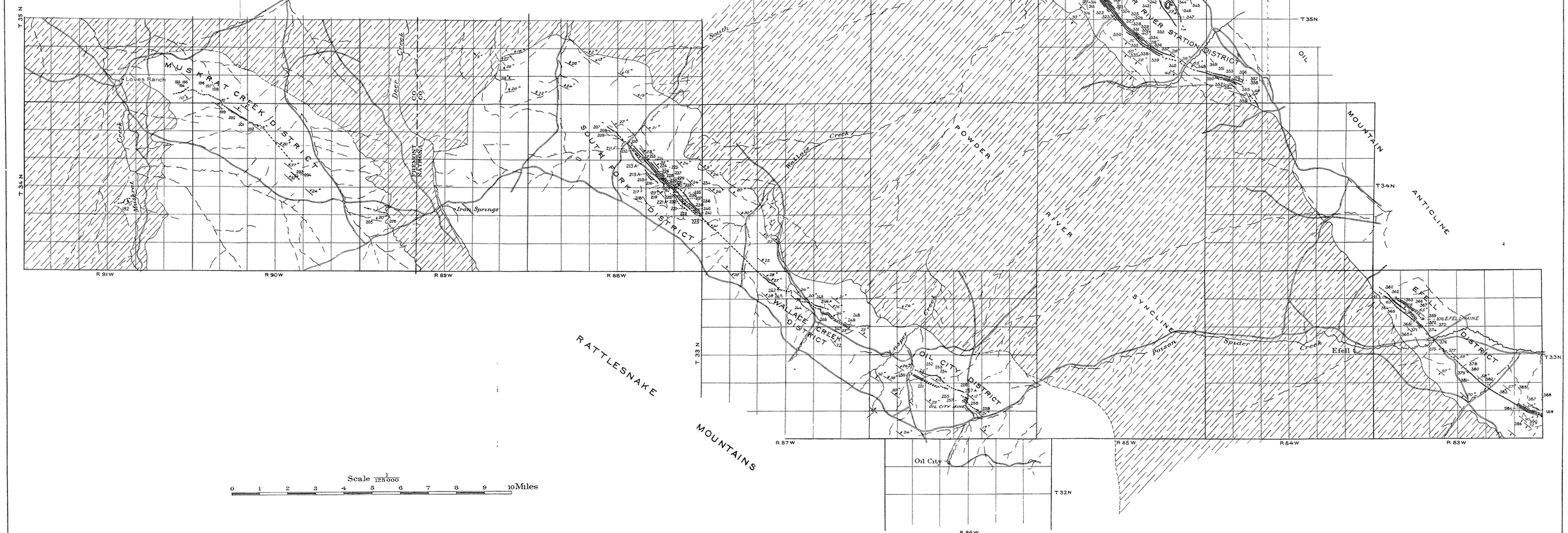
Sections Nos. 464, 472, 475, 478, 479, and 484 were measured along one bed exposed in secs. 14 and 15, T. 31 N., R. 82 W., and show a range in thickness from 1 foot 6 inches at location 464 to 4 feet 6 inches at location 484. A second bed about 30 feet below was measured at locations 465, 474, 477, 480, and 485, where the thickness varied from 6 inches (location 474) to 4 feet 5 inches (location 480). The lowest bed exposed in the district occurs about 30 feet below the one just mentioned, and sections Nos. 473, 476, 481, and 486 were measured along its outcrop showing a thickness ranging from 1 foot 1 inch (location 486) to a maximum of 6 feet 3 inches at the Red Ash mine (location 473) in sec. 14. The Red Ash mine is located at

LEGEND

- 203 / 204 — Outcrop of coal bed (Numbers refer to sections on Plate LIV)
- Outcrop of coal bed covered location inferred
- Coal mine
- Coal prospect
- 20° — Strike and dip
- Wind River formation
- Wagon road



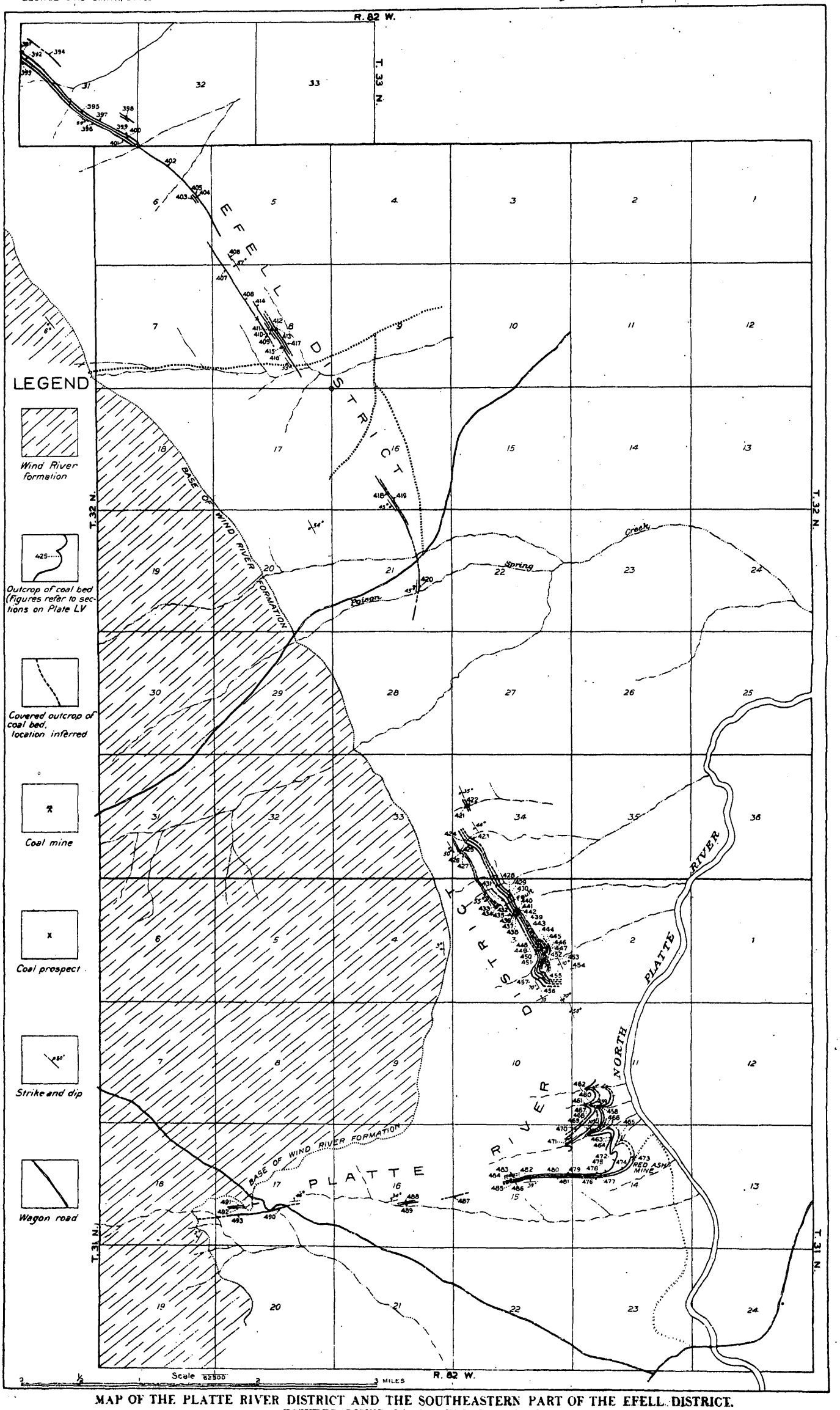

INDEX MAP
Shaded portion shows Powder River coal field




# MAP OF POWDER RIVER COAL FIELD, WIND RIVER REGION, WYOMING

By E G Woodruff
1912

"THE HOOPES PETERS CO WASHINGTON D C"




MAP OF THE PLATTE RIVER DISTRICT AND THE SOUTHEASTERN PART OF THE EFELL DISTRICT, POWDER RIVER COAL FIELD, WYOMING

By Dean E. Winchester

1912

the point of the syncline in sec. 14, T. 21 N., R. 82 W., where the coal beds dip 8° NW. The mine consists of a slope 10 feet wide by 250 feet long driven down the dip of the beds, with two rooms 60 feet and 100 feet by 25 feet opened near the lower end. During the winter of 1909–10 a second slope was driven parallel to the main slope for about 100 feet, and during this time the mine is reported to have produced about 275 tons of coal, which was sold to near-by ranchers at $2.50 a ton at the mine. The coal is hard and homogeneous when fresh, but on exposure to the atmosphere it disintegrates rapidly. On account of this characteristic it is impossible to stock the coal, consequently the mine is idle during the summer, when there is little or no demand for fuel.

A sample was taken in this mine at the end of the entry, where the coal was almost free from weathering. Analysis No. 10671 (p. 534), made from this sample, shows a heat value of 9,840 British thermal units for the air-dried sample.

Coal beds dipping 35° to 46° N. are exposed in secs. 16 and 17, T. 31 N., R. 82 W., and were measured at locations Nos. 487 to 493 but could not be correlated with other beds exposed in the district.

No other mines or prospects had been opened within the district, although numerous good exposures of fairly thick beds exist.

## MARKET.

Market for coal in the Wind River region is limited to a few towns along the railroad and to widely separated ranches in the area. Consequently the product of the large mines must be shipped to places reached by railroad outside of the region. These towns are mostly in eastern Wyoming, northern Nebraska, and southwestern South Dakota, though some of the coal from the Hudson field has found sale as far east as western Iowa. In these markets, however, the Hudson coal is brought into competition with that from other fields in Wyoming and in Iowa, where mining conditions are generally more favorable or where a better grade of coal is obtained. The Chicago & Northwestern Railway is at present the only continuous line of transportation from the mines to the outside markets. A branch of the Burlington system is under construction through Bighorn Canyon to Shoshone, with traffic arrangements eastward to Orin Junction, where it will join the Colorado & Southern. This new road does not enter any of the coal fields of the Wind River region. It will probably not extend the territory supplied by the mines of this region, but may somewhat decrease the demand for their product, because it can bring coal directly from the Bighorn Basin, where mining conditions are equally favorable, if not more advantageous, to the towns now supplied by the Hudson field. It is

believed, however, that this readjustment will be neither extensive nor highly disadvantageous to the market conditions in the Wind River region. The price at which the coal sells is shown by the following table:

*Price of coal f. o. b. at the mines in the Wind River region.*

| | Price per ton of 2,000 pounds. |
|---|---|
| Run of mine | $2.25–$2.50 |
| Lump | 2.25– 3.00 |
| Range | 2.25– 3.00 |
| Nut | 2.00– 2.50 |
| Slack | .50– .75 |

Wood is the chief competitor of coal as fuel in this region. Timber is abundant on the slopes of the adjacent mountains, where it can be obtained without great expense. There is also in certain localities an abundance of water power, which can be used to generate power and heat, but no attempt has been made to utilize it. Coal is used only in the towns and at a few ranches where it is easily obtained and is considered a more desirable fuel than wood.