THE OROFINO COAL FIELD, CLEARWATER, LEWIS, AND IDAHO COUNTIES, IDAHO.

By CHARLES T. LUPTON.

INTRODUCTION.

As reports of the presence of valuable coal in the vicinity of Orofino, Idaho, have been circulated from time to time, the writer made a hasty examination of the field in July and August, 1913. Although no samples could be procured for analysis, the examination showed the coal to be subbituminous coal of medium grade. It is believed to be similar to the coal found at Horseshoe Bend and Jerusalem Valley, Boise County, described by Bowen.[1] Considering the character of the coal and the thinness of the beds, it is believed that this locality will not be of importance as a coal field, except possibly in a small way by furnishing coal for local use in the distant future, when timber becomes scarce.

GENERAL FEATURES OF THE FIELD.

The area represented on figure 8 is situated in northwestern Idaho (see fig. 7) along Clearwater River and Orofino Creek, 30 to 55 miles east of Lewistown, and contains about 150 square miles. The area mapped includes all of T. 36 N., Rs. 2 and 3 E., and parts of T. 35 N., Rs. 1, 2, and 3 E., T. 36 N., Rs. 1 and 4 E., and T. 37 N., Rs. 1, 2, 3, and 4 E., Boise meridian. The western part of this area was formerly included in the Nez Perce Indian Reservation.

Orofino, a town of about 500 inhabitants, is the principal settlement in the field. It is at the mouth of Orofino Creek, on the north side of Clearwater River, on a branch of the Northern Pacific Railway, which crosses the field in a northwesterly direction. Ahsahka, at the junction of the two forks of Clearwater River, and Greer, on the South Fork of this stream, in T. 35 N., R. 2 E., are smaller railway towns. Russell and Fraser are but little more than post offices situated at ranches.

[1] Bowen, C. F., Coal at Horseshoe Bend and Jerusalem Valley, Boise County, Idaho: U. S. Geol. Survey Bull. 531, pp. 245–251, 1911.

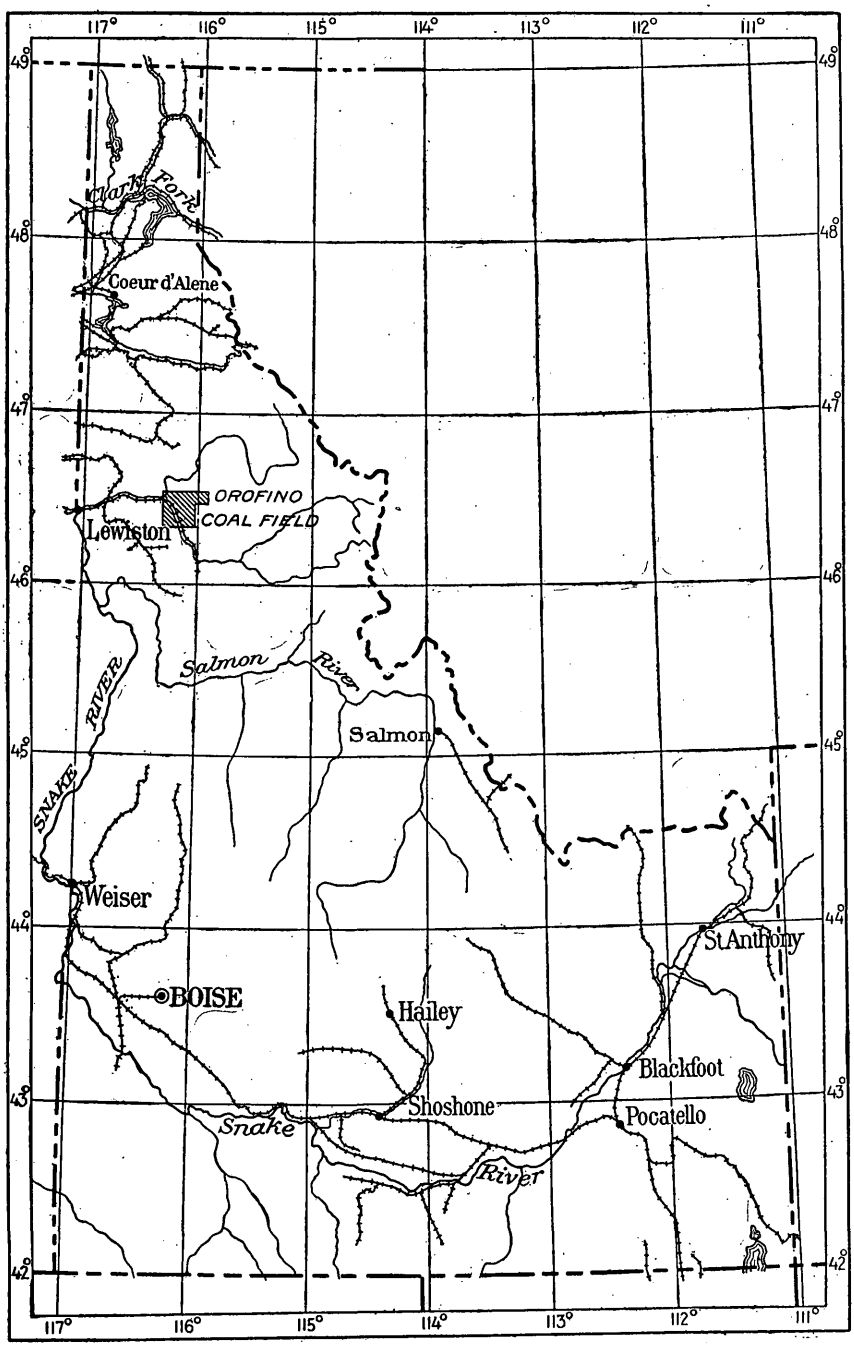

FIGURE 7.—Map of Idaho showing location of Orofino coal field.

A fairly good wagon road follows Clearwater River from the west edge of the field to Orofino. Another road leads from Orofino along the north side of Orofino Creek to the mouth of Whisky Creek, and thence to the top of the divide between Whisky and Orofino creeks, which it follows to the east. A much-used road extends up Whisky Creek and over the divide to North Fork. Other roads and trails exist in the area, but the writer knows little regarding them.

The surface of the area represented on figure 8 is hilly to mountainous, the altitude above sea level ranging from a little less than 1,000 feet, near Ahsahka, to slightly more than 2,000 feet on the uplands in the eastern part of the field. The valleys, including that of Clearwater River, are comparatively narrow and canyon-like and contain remnants of terraces. In many places the stream valleys have nearly vertical walls, due to the recent cutting of these streams into the Columbia River basalt, which constitutes the surface rock of most of this area. The uplands are comparatively flat and smooth, many parts of their surfaces representing the top of the great flows of lava that in Tertiary time spread over this region.

The original topography has been modified in many places in the valleys of the larger streams by landslides, regarding which Russell[1] makes the following statement:

> In the description of the occurrence of lignite and its associated sedimentary beds near Orofino and along the creek of the same name mention was made of the numerous displaced rock masses of that region. The borders of the canyon of Orofino Creek not only owe the minor features of their topography to landslides, but the character of the entire canyon has been modified by them. There is an outer canyon, bordered by cliffs and steep talus slopes, from 700 to 800 feet high. At the base of these rugged walls, in which the edges of horizontal sheets of lava appear, there is on each side of the creek an irregular terrace-like belt a mile or more wide, the surface of which shows the ridges, hills, and basins characteristic of landslide topography. This broken country is from 400 to 500 feet above the stream, which flows through it in a steep-sided inner canyon. At a few localities the landslides have obstructed the river and caused it to flow swiftly through narrow defiles.

GEOLOGY.

The geologic work of Lindgren and Russell was much more comprehensive and detailed than that done by the writer; hence this paper contributes little new geologic information. It contains, however, a compilation of the available data regarding the Orofino coal that may be of service to those interested in its development. Lindgren[2] reports "quartzites, sandstones, conglomerates,

[1] Russell, I. C., Geology and water resources of Nez Perce County, Idaho: U. S. Geol. Survey Water-Supply Paper 53, p. 78, 1901.

[2] Lindgren, Waldemar, A geological reconnaissance across the Bitterroot Range and Clearwater Mountains in Montana and Idaho: U. S. Geol. Survey Prof. Paper 27, p. 17, 1904.

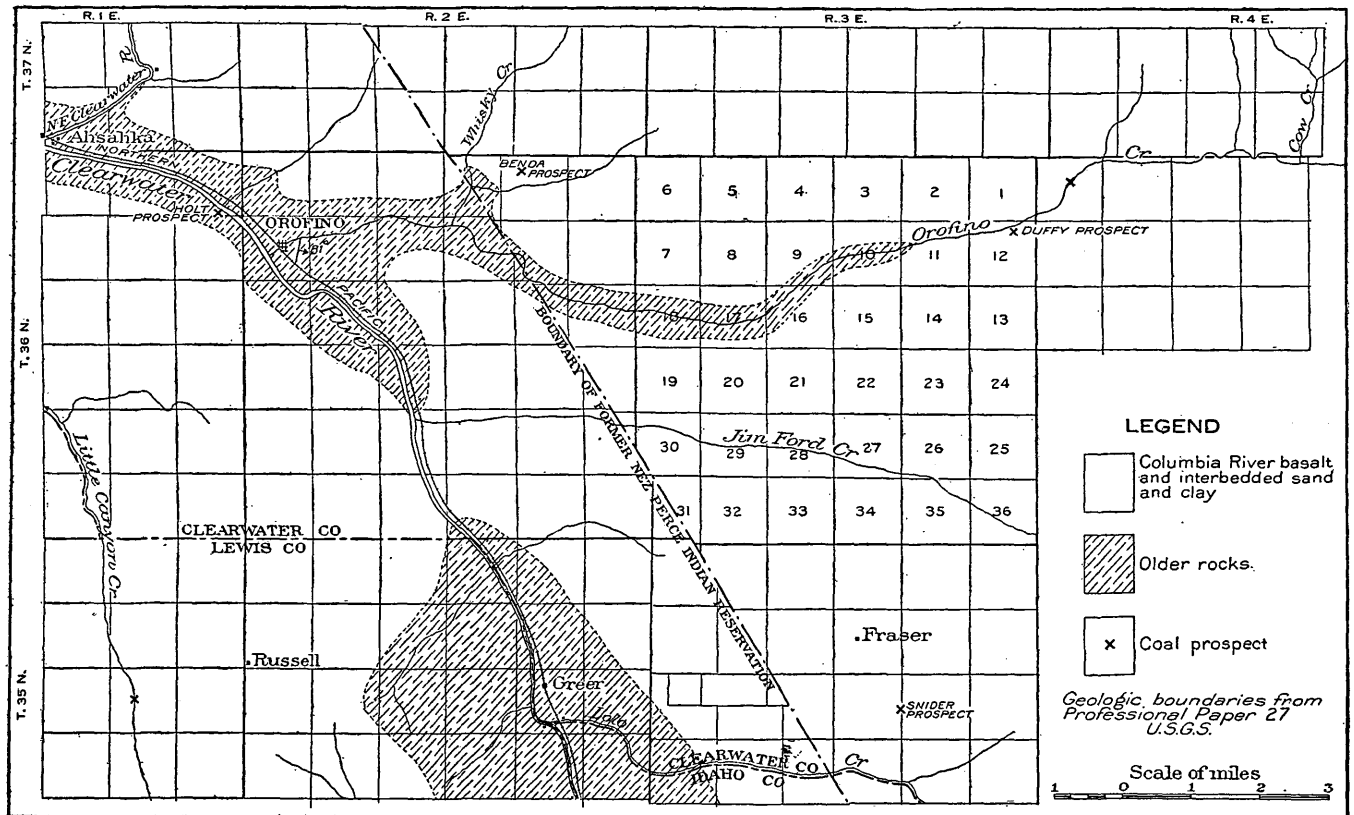

FIGURE 8.—Map showing coal prospects and geology of Orofino coal field, Idaho.

limestones, and shales, as well as large masses of associated old and partly altered and schistose lavas (greenstones)" near Ahsahka, at the mouth of the North Fork of Clearwater River. He says, "The structure of this series is little known except that the dips are generally steep and the strike has a general northerly direction. At Orofino, North Fork, and Pierce are gneisses, mica schists, and occasional crystalline limestones bordering the intrusive granite of the Clearwater Mountains. These are partly at least of sedimentary origin, but their age is unknown." The present writer observed limestone and schist dipping 70°–85° E. and in places striking slightly east of north near water level along Clearwater River from a point a few miles west of Peck (a town about 5 miles west of Ahsahka) to the vicinity of Greer. At Orofino crystalline limestone is well exposed on the north side of the river and is quarried for the manufacture of cement. The beds in the quarry dip 81° E. and strike about N. 10° E. and are somewhat broken by minor faults, as shown in part by slickensided surfaces. These rocks have been referred to by Russell[1] as the "older group, of both igneous and sedimentary origin." He says also, "The younger group consists principally of basalt but includes layers of clay, sand, gravel, volcanic dust, and lapilli interbedded with it." It "contains lignite which may prove of value and on decomposing furnishes a deep, rich, dark soil of marvelous fertility." This series of lava flows is known as the Columbia River basalt, which, according to Russell,[2] "was outpoured at successive intervals embracing a long period of time, as is shown by the occurrence, at several horizons, of layers of sedimentary material, principally clays and sand, between the lava sheets." The coal described below is found in the interbedded sand and clay.

Russell considered the sandstone, shale, and coal beds in the Orofino field to range from 200 to 300 feet in thickness and to occur from about 700 to 1,000 feet below the tops of the uplands. He says:[3]

> Throughout the length of Orofino Creek, from its mouth to near Pierce City, there is an almost continuous series of heavy landslides on each side of the creek, which indicates the presence of incoherent beds at least 200 to 300 feet in thickness, beginning at a depth of about 750 feet below the surface. These strata are probably a continuation of those which have so greatly influenced the topography of the wall of Clearwater Canyon near Kamiah and elsewhere. Their character is shown by outcrops of sandstone and shale-carrying lignite, which are exposed in the bed of the creek at several localities.

Similar beds of sandstone, shale, and coal are believed to be present along Little Canyon Creek 8 to 12 miles south and southwest of Orofino, just outside of the area shown on figure 8.

[1] Op. cit., p. 15. [2] Idem, p. 29. [3] Idem, p. 39.

The Columbia River basalt and associated coal-bearing rocks are nearly horizontal, except in localities where there has been slumping, as, for example, along Clearwater River and Orofino Creek. Where landslides have occurred the slumped masses are found near the bottom of the valleys, and usually with the beds dipping toward the uplands, from which they have slipped.

THE COAL.

GENERAL CHARACTER.

The coal in the Orofino field, called lignite by Lindgren and Russell, should more properly, to judge from specimens collected by the writer, be designated subbituminous. A hand specimen that had been exposed to weathering at the Duffy prospect on Orofino Creek for 8 or 10 years was probably nearly as firm as when it came from the prospect. This fact suggests that the coal has good "stocking" qualities. The coal at this prospect is probably of higher rank than the greater part of the "lignite" referred to by Lindgren and Russell. Russell[1] suggests this in the following statement:

> Small specimens of lignite "float," said to have been found in the canyon of the North Fork of Clearwater River in the vicinity of Elk Creek, and other similar fragments from Orofino Creek, are jet-black in color and evidently are of much better quality than any of the material thus far obtained at the localities described.

Very little prospecting has been done in this field recently, and the prospects opened several years ago have caved so that it was impossible to enter them. At only one place (Benda's prospect) was it possible to see the carbonaceous material in place, and here it is of no economic importance. For this reason the greater part of the information collected by the writer was obtained from settlers and others who knew something of the old prospecting.

The sample collected from the Duffy prospect is jet black, mostly dull, but having a few bright lustrous layers. Woody structure is evident in parts of the sample, and as a whole it is laminated, showing thin plates ranging from films to bands a quarter of an inch in thickness. The fracture is irregular, and the jointing is somewhat columnar. Considerable resin in globules as much as one-third of an inch in diameter occurs along the bedding planes of the coal. The coal is hard, and when pulverized is a black powder, with a slightly brownish tint.

No samples of the coal for analysis were collected by the writer, because it was impossible to find prospects or outcrops where the coal was unweathered.

[1] U. S. Geol. Survey Water-Supply Paper 54, p. 127, 1901.

Russell[1] gives the following analyses of samples collected by E. W. Barnes, of Portland, Oreg., from the same formation on Grande Ronde River, Wash. These analyses do not give the heat units, and furnish only an approximate idea of the composition of the coal.

Analyses of lignite from Grande Ronde River, Wash.

[Analyst, J. T. Gove.]

	1	2
	Per cent.	*Per cent.*
Moisture	20.50	6.50
Volatile matter	40.75	38.50
Fixed carbon	31.25	42.00
Ash	7.50	13.00
	100.00	100.00

It is believed that the poorer grade of coal (lignite) in the Orofino field is similar in chemical composition to that represented by these analyses. The better coal, like that at the Duffy prospect, on Orofino Creek, is probably similar to the coal near Horseshoe Bend, Idaho,[2] the analysis of which is given below.

Analysis of coal sample from the Henry mine, Horseshoe Bend, Idaho.

[Bureau of Mines laboratory, A. C. Fieldner, chemist in charge. Laboratory No. 12703. Air-drying loss, 5.4 per cent.]

	As received.	Air-dried.
	Per cent.	*Per cent.*
Moisture	10.1	5.0
Volatile matter	38.2	40.4
Fixed carbon	36.1	38.1
Ash	15.6	16.5
Sulphur	.51	.54
British thermal units	10,440	11,030

PROSPECTS.

Duffy prospect.—The Duffy prospect, on the south side of Orofino Creek, in the NE. ¼ sec. 12, T. 36 N., R. 3 E., 10 or 12 miles from Orofino, was visited by the writer. As the shaft was nearly full of water, it was impossible to see the coal in place. This prospect, it is reported, was opened by Tom Duffy and three other prospectors about 1903. The shaft, whose mouth is only a few feet above the creek, is said to be 30 or 40 feet deep. From the bottom of the shaft an entry was driven about 70 feet. Coal in this entry is reported to range from 30 to 36 inches in thickness and to occur in three benches, none of which is more than 12 inches thick. The bed is believed to be nearly horizontal, with possibly a slight dip away from the stream.

[1] Op. cit., p. 126.

[2] Bowen, C. F., Coal at Horseshoe Bend and Jerusalem Valley, Boise County, Idaho: U. S. Geol. Survey Bull. 531, p. 251, 1911.

No exposures of the sedimentary strata were observed at this place, as the basalt extends down almost to the level of the stream. Apparently the shaft and outfit, consisting of a small cabin, a windlass, diamond drill, and water wheel for pumping water from the shaft, have long been abandoned. Fragments of coal found near the shaft mouth indicate that this coal is of higher grade than lignite. Those who have used it report that it burns like poor pine wood and yields considerable ash.

Other prospects on Orofino Creek.—Another old prospect is reported about a mile east of the Duffy prospect, approximately in sec. 6, T. 36 N., R. 4 E. This prospect is said to consist of a shaft 30 to 50 feet deep, in the bottom of which a diamond drill was sunk in search of lower coal beds. The coal encountered in the shaft is reported to be not so thick as the bed at the Duffy prospect. No coal was sold from either of these prospects, the opening of which, it is estimated, cost from $15,000 to $20,000 in labor and machinery, all material having been brought in by means of a pack train from Orofino over a very poor trail which crosses the divide between Orofino and Whisky creeks. This divide is at least 1,500 feet high.

Russell[1] reports a prospect farther east on Orofino Creek, which he visited in 1899, as occurring in sec. 12, T. 36 N., R. 4 E. It is believed, however, that the location may be near the Duffy prospect in T. 36 N., R. 3 E. Regarding the coal or "lignite" in this locality he makes the following statement:

> Lignite is reported to occur at several localities on Orofino Creek (all of it probably belonging to approximately the same bed), within a distance of several miles in the middle portion of its course. The only one of these outcrops that was examined by the writer is situated on the immediate banks and in the bed of the creek about 15 miles above its mouth (sec. 12, T. 36, R. 4) but is not in place. * * * On the left bank of the creek, at the locality referred to, and partially submerged, the following section is exposed, the dip being south at an angle of 30° and the strike about east-west, or with the course of the stream.

Section on Orofino Creek about 15 miles above mouth.

	Inches.
Sandstone, gray, with fossil leaves	12.0
Lignite	20.0
Clay parting	2.5
Sandstone, base not exposed	6.0

These outcrops can be followed along the bank of the creek and in its bottom for a distance of 60 to 70 feet. Near the upstream end of this natural exposure, on the north side of the creek and at the water's edge during low-water stages, a prospect shaft about 15 feet deep has been opened. In this shaft the strata where first met, beneath a foot or two of surface débris, are nearly vertical, but below they dip northward and soon flatten, until the inclination is about 50°. The lignite is 27 inches thick and has fine micaceous clay on its southern side and a coarse sandstone on its northern side. The lignite-bearing formation on

[1] Op. cit., p. 123.

the two sides of the creek is a portion of a sharp upward fold or anticline, which is broken along its crest, where the creek flows. This fold is obviously due to the weight of the landslides on each side, and is not a structural feature of the beds in place. The true position of the lignite in the canyon walls is not known but should be looked for at an elevation of between 400 and 600 feet above the creek.

Benda prospect.—A little prospecting was done in 1909 and 1910 in the NW. ¼ sec. 2, T. 36 N., R. 2 E., on Frank Benda's homestead, which is about 4½ miles northeast of Orofino. The prospect is about 500 feet above the bed of Deer Creek and at about the horizon suggested by Russell as the stratigraphic position of the lignite beds at the easternmost prospect on Orofino Creek. The material discovered at this place by Mr. Benda is not coal, however, but a form of basalt containing some carbonaceous material that will burn slightly when ignited. It is of no known economic importance.

Holt prospect.—A prospect for coal was opened about 1901 on the James Holt homestead, on the south side of Clearwater River, in the S. ½ sec. 1, T. 36 N., R. 1 E., about three-fourths of a mile west of Orofino station. One of the men who helped to open this prospect (now caved) stated that in a 10-foot drift a 3-inch bed of brownish-black shaly coal or lignite was discovered. This material would burn when mixed with good coal, but contained so much ash that it retained its shape after burning.

This prospect is undoubtedly near the one referred to by Russell[1] in the following statement:

> On the southern side of Clearwater River, a half mile below Orofino, openings have been made in the side of the canyon, on the farm of F. M. Holt, at an elevation of about 200 feet above the river, which reveal the following section:

Section on Clearwater River one-half mile below Orofino.

	Ft.	in.
Talus from slopes above.		
Sandstone, coarse	2	0
Slate, fine, sandy		10
Lignite, with branches of trees		4
Sandstone	2	6
Lignite		3½
Sandstone	5	0
Lignite	1	8½
Sandstone, bottom not seen	1	0
Talus to the river bank.		

The beds are well exposed in the openings that have been made, one of them being a tunnel about 40 feet in length, but the material is part of a series of landslides, and the true position of the lignite should be sought about 500 feet higher than where it is now to be seen.

Other exposures on Clearwater River.—The general statement that some coal or lignite is exposed along Clearwater River between Orofino and Peck (about 12 miles west of Orofino) was made by men who

[1] Op. cit., p. 122.

had done some prospecting in this locality but was not verified by the writer.

Snider prospect.—About 1909 a prospect was opened a short distance southeast of Fraser post office, in sec. 14 or 15, T. 35 N., R. 3 E., by Henry Snider. A son of Mr. Snider, who helped to open the prospect (now inaccessible on account of caving), stated to the writer that the coal is very similar to that of the Duffy prospect, that it burns readily and leaves a white ash, and that he saw no evidence of sulphur or resin in it. The coal crops out in the bed of a creek, but was not noted at any other locality. The coal bed is about 2 feet thick and dips slightly to the east. Extensive prospecting showed that the coal bed does not increase in thickness and quality under cover, so the project of opening a mine here was abandoned.

Other exposures.—Coal is reported at several places in Little Canyon 10 to 12 miles south of Orofino. Russell[1] makes the following statement regarding one of these exposures:

> One of these outcrops, near Russell [T. 35 N., R. 1 E.], which was examined by the writer, is at the bottom of the canyon, which there is 800 feet deep and has precipitous walls composed of horizontally bedded lava sheets. * * * The following section was exposed by a recent excavation:

Section in Little Canyon, near Russell, Idaho.

	Ft.	in.
Talus, fallen from above	6	3
Carbonaceous shale, apparently altered by heat	3	5
Parting of white laminated shale composed in part of volcanic dust		1
Black carbonaceous shale		2½
White "shale"		1½
Black carbonaceous shale		6
White laminated shale		10
Coarse sandstone with fragments of shale; base not exposed	3	0

In this place the strata are well exposed, and the absence of coal indicates that little or none may be expected in this general locality.

CONCLUSIONS.

The inferior quality of the coal and the fact that extensive prospecting in this region has failed to reveal coal in commercial quantities suggest that the field will be of no importance as a producer of coal or lignite except in a very local way. It is questionable if any additional information regarding the coal or lignite possibilities of the general region of sufficient promise to justify further prospecting will be found, and the writer does not advise anyone to expend time and money in such work.

[1] Op. cit., p. 124.