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CORE DRILLING FOR COAL IN THE MOOSE CREEK AREA, ALASKA

BY

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CORE DRILLING FOR COAL IN THE MOOSE CREEK AREA

By GERALD A. WARING

ABSTRACT

The Moose Creek area is in the western part of the Matanuska Valley, in south-central Alaska, about 165 miles by railroad north of the coast at Seward.

Coal deposits in the valley have been known since the early 1890's, and there have been producing mines since 1916, but the annual production is only about 40,000 tons, or less than one-third of the total amount consumed in the Territory. Early in 1931 Congress authorized the investigation of mineral resources in areas tributary to the Alaska Railroad, which is Government owned and operated, for the purpose of stimulating development and hence increasing the traffic and revenue of the railroad. The technical work of carrying on these studies was entrusted by Col. O. F. Ohlson, general manager of the railroad, to the United States Geological Survey.

One of the investigations undertaken was that of the Moose Creek area, where small coal mines are in operation. Difficulties have been encountered in these mines, owing to the faulted character of the formation, which causes unproductive work in mining and also produces a large percentage of fine coal, which is unsuitable for sale in distant markets.

Field examination indicated that more favorable mining conditions might be found somewhat farther west. Core drilling was therefore done in 1932, in order to learn if workable beds of coal were present that might be mined at less cost and produce a better product than the present mines for competitive sale in markets of the Pacific coast.

A total of 3,700 feet was drilled, in five locations. This drilling demonstrated that although the coal-bearing formation extends for some distance westward from Moose Creek, it becomes thinner in that direction. The fact that no coal seams were encountered in the five places tested shows that the coal beds are not continuous. A few thin seams were penetrated, of practically the same rank of coal as that of the developed mines; and there appears to be no hope of finding coals of higher rank in the area.

It is not unlikely that somewhere in the area there are workable coal beds at no great depth; but their discovery would require systematic drilling over a considerable area. The chance of finding a coal of good shipping quality which could successfully compete in distant markets is so slight, however, that there is at present no economic justification for further prospecting in the Moose Creek area for such coal.

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INTRODUCTION

The Moose Creek area is in the western part of the Matanuska Valley in south-central Alaska. It is accessible by the Alaska Railroad from Seward, the nearest steamer port, northward 150 miles to Matanuska station, and thence about 15 miles by branch lines up the valleys of the Matanuska River and Moose Creek. (See fig. 6.)

The coal deposits of the Matanuska Valley have been known to white men since the early 1890's, but producing mines were not opened until 1916, when the railroad, a Government owned and operated line, was extended into the valley, primarily to obtain fuel for its own needs. This line was completed in 1923 from Seward northward to Fairbanks, a distance of 470 miles, with branch lines of nearly 50 miles to the coal fields. The coal deposits are on Government land, and leases to prospect and mine coal are granted to private enterprises on the basis of small royalty payments.

The annual consumption of coal by the entire Territory is at present only about 150,000 tons. Somewhat less than one-third of this total is produced in the Matanuska Valley, chiefly from two mines, and is used principally by the railroad. About 60,000 tons is subbituminous coal from the Healy River mine, 150 miles to the north. This is used largely at Fairbanks for power development in connection with gold dredging and for the heating and lighting needs of the town. Although these two coal fields supply the local markets and are capable of producing several times the present demand, neither coal is suitable for shipment to distant markets. The Healy River coal is of low heating value and also breaks down too easily to withstand long hauling. The Matanuska Valley product is of higher rank, but it contains a large proportion of fine coal and is not suitable for shipment and sale in competition with other coals in markets of the Pacific coast. The remainder of the coal consumed in the Territory is used chiefly in the coastal towns and is supplied from Seattle and British Columbia.

In 1930 a special committee of the United States Senate, composed of Senators Howell, Kendrick, and Thomas, visited Alaska in order to study the problem of increasing the revenues of the railroad. Through their recommendations, Congress early in 1931 authorized the investigation of mineral resources in areas tributary to the railroad for the purpose of stimulating development and hence increasing the traffic and revenue of the railroad. The technical work of carrying on these studies was entrusted by Col. O. F. Ohlson, general manager of the railroad, to the United States Geological Survey.

Among the projects undertaken was the investigation of the extent of coal deposits of the Moose Creek area. One obstacle to the

development of coal mines in the area (see pl. 6) is the faulted condition of the beds. This has in some places caused the displacement of the coal seams and requires crosscutting and other dead work to find the coal again. In other places the coal seams have been pinched

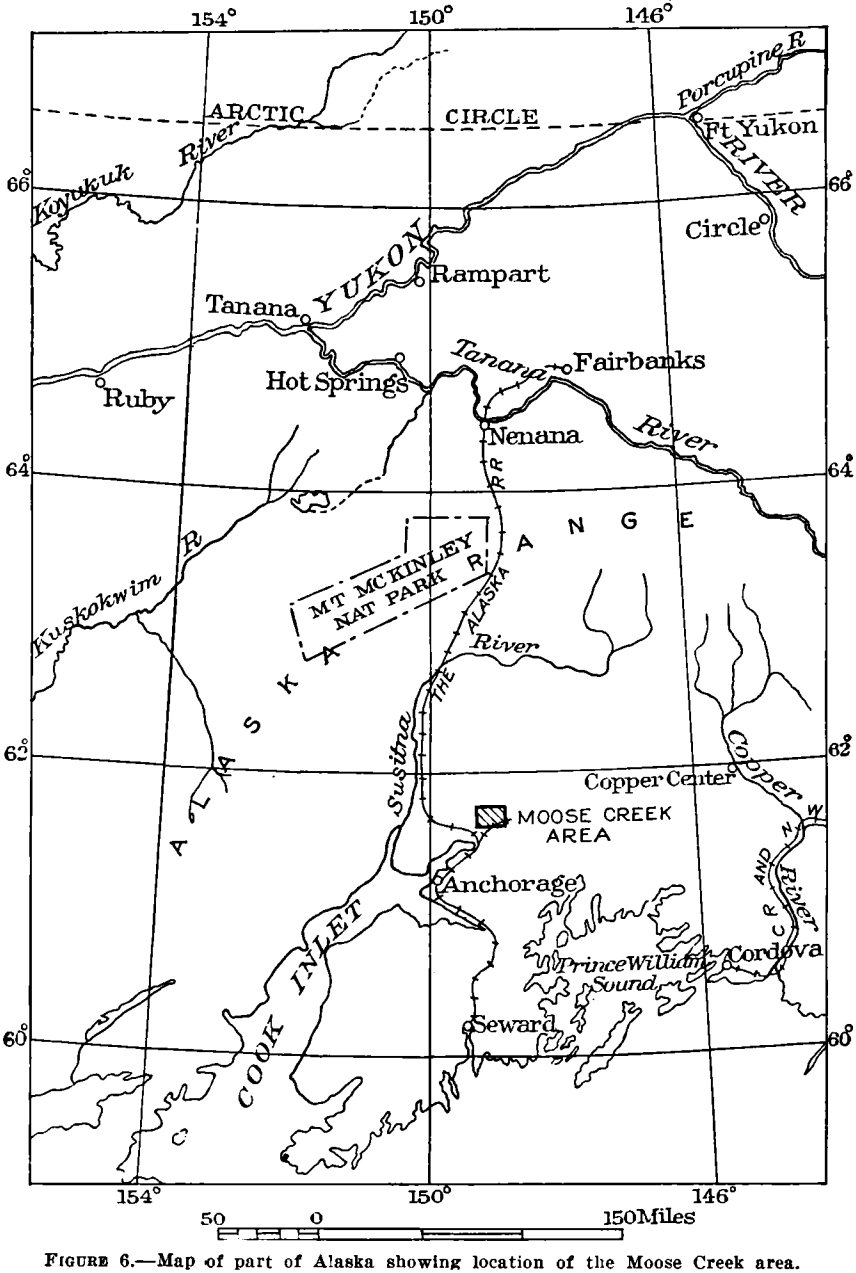


FIGURE 6.—Map of part of Alaska showing location of the Moose Creek area.

out by the faulting. The faulting and steep tilting of the beds have also caused the coal to be crushed.

Field examination indicated that the coal-bearing formation extends for some distance west of Moose Creek and that the beds in the western area are flat-lying and presumably less broken by faults. It was therefore decided to prospect the most promising portion of this area with diamond core drill, to learn if workable beds of coal were present which might be mined at less cost and produce a better product than the present mines for competitive sale in markets of the Pacific coast. The core drilling was done during June to December 1932, a total of 3,700 feet being drilled at five locations, and the principal results are recorded in the following pages.

General supervision of the Government's interests in the core drilling was in charge of G. A. Waring, geologist, who was assisted by P. A. Davison, junior geologist, in the collection and recording of the core as drilling progressed. Much assistance during the course of the work was also rendered by J. J. Corey, mining engineer, of the Geological Survey, stationed at Anchorage. Transportation and the obtaining of supplies were facilitated by Col. O. F. Ohlson and members of his staff.

GEOLOGY

STRATIGRAPHY

The following discussion of the geology has been largely compiled from earlier publications of the Geological Survey.[1]

The Moose Creek area is bordered on the north by the Talkeetna Mountains, which are composed chiefly of granitic and gneissic rocks. From their relation to other rocks farther north and east, these crystalline rocks were assigned by Paige and Knopf to a period of intrusion during the Middle Jurassic.

Along the south side of the Matanuska River and also in bluffs on the north side both above and below the mouth of Moose Creek, dark indurated shale and sandstone are exposed. These beds in places contain fossils which show them to be of marine deposition and Upper Cretaceous age. They have for several years been known as the "Matanuska formation."

On the flank of the Talkeetna Mountains, resting directly on the granitic rocks, there is a series of highly indurated arkose, con-

[1] Paige, Sidney, and Knopf, Adolph, Geologic reconnaissance in the Matanuska and Talkeetna Basins, Alaska: U.S. Geol. Survey Bull. 327, pp. 19–52, 1907. Martin, G. C., and Katz, F. J., Geology and coal fields of the lower Matanuska Valley, Alaska: U.S. Geol. Survey Bull. 500, pp. 19–54, 67–75, 1912. Chapin, Theodore, Mining developments in the Matanuska coal field: U.S. Geol. Survey Bull. 712, pp. 131–167, 1920.

glomerate, and shale. In Arkose Ridge, north of Moose Creek, these beds are more than 1,500 feet thick, but they have not been found south of the base of the mountains. Poorly preserved plant remains found at a few places show that the beds are of Tertiary age, probably Eocene.

Much of the Moose Creek area is covered by a series of unaltered shale, sandstone, and conglomerate. This has for many years been known as the "Chickaloon formation", from prominent exposures along the Chickaloon River, farther east in the Matanuska Valley. In the western area the sandy and coarse-grained materials predominate and for the most part are poorly consolidated, though there are some beds of hard sandstone. Within the formation there are coal beds; and most of the shales are black and carbonaceous and carry veinlets of coal. The carbonaceous beds also contain plant remains which show that the deposits are of fresh-water origin and Eocene age. Additional fossil-bearing material which was collected at several horizons from the drill holes, was examined by Roland W. Brown, of the United States Geological Survey, who identified plant remains of the following genera:

32AW2. Diamond-drill core from Moose Creek area, Alaska:

Ferns.
Equisetum.
Sequoia, twigs and cones.
Populus.
Corylus.
Fagus.
Juglans.
Ulmus, seeds.
Carpites.

The different materials have been deposited irregularly, so that there is much variation in the thickness and extent of individual beds; but broad zones in the formation may be traced fairly well over considerable distances. The character of the beds is well shown by the logs of the drill holes, given in plate 7.

Although the arkose and associated beds along the flank of the mountains are in general much more indurated than the typical Chickaloon beds, they may represent the lower portion of the Chickaloon formation in the northern part of the Moose Creek area.

At Wishbone Hill, between Moose and Eska Creeks, the Chickaloon beds are overlain by a series of thick beds of coarse conglomerate, separated by minor beds of coarse sandstone and sandy shale. This formation is known as the "Eska conglomerate," and although it lies without noticeable unconformity on the Chickaloon formation, it has been considered to be a later formation, questionably of Miocene age. It contains no coal beds and very little fossil material. About 20 miles east of Eska fully 3,000 feet of the conglomerate is exposed in the cliffs of Castle Mountain. The formation is more than 1,000 feet thick in the eastern part of Wishbone Hill, but thence

westward it either thins rapidly or the upper portion has been removed by erosion. Along the valley of Moose Creek a thickness of only 200 or 300 feet of the conglomerate is exposed, and a mile farther west the core drill penetrated beds of the Chickaloon formation immediately beneath the surface layer of gravel.

Along the north side of the Matanuska River and the southern part of the valley of Moose Creek there are thick deposits of gravel containing a few boulders a foot or more in diameter. Nearly all of this gravel was probably brought down by a great glacier that formerly occupied the Matanuska Valley. On the upper lands the gravel forms areas of knolls, undrained depressions, and winding ridges, typically of glacial moraine character; but along the valley of lower Moose Creek the gravel has been reworked by water, and the surface has been smoothed into terraces which rise above the rock bluffs that border the creek. Along the north side of the Matanuska River, for about 3 miles below the mouth of Moose Creek, there are also gravel bluffs, which rise 200 to 400 feet above the river.

STRUCTURE

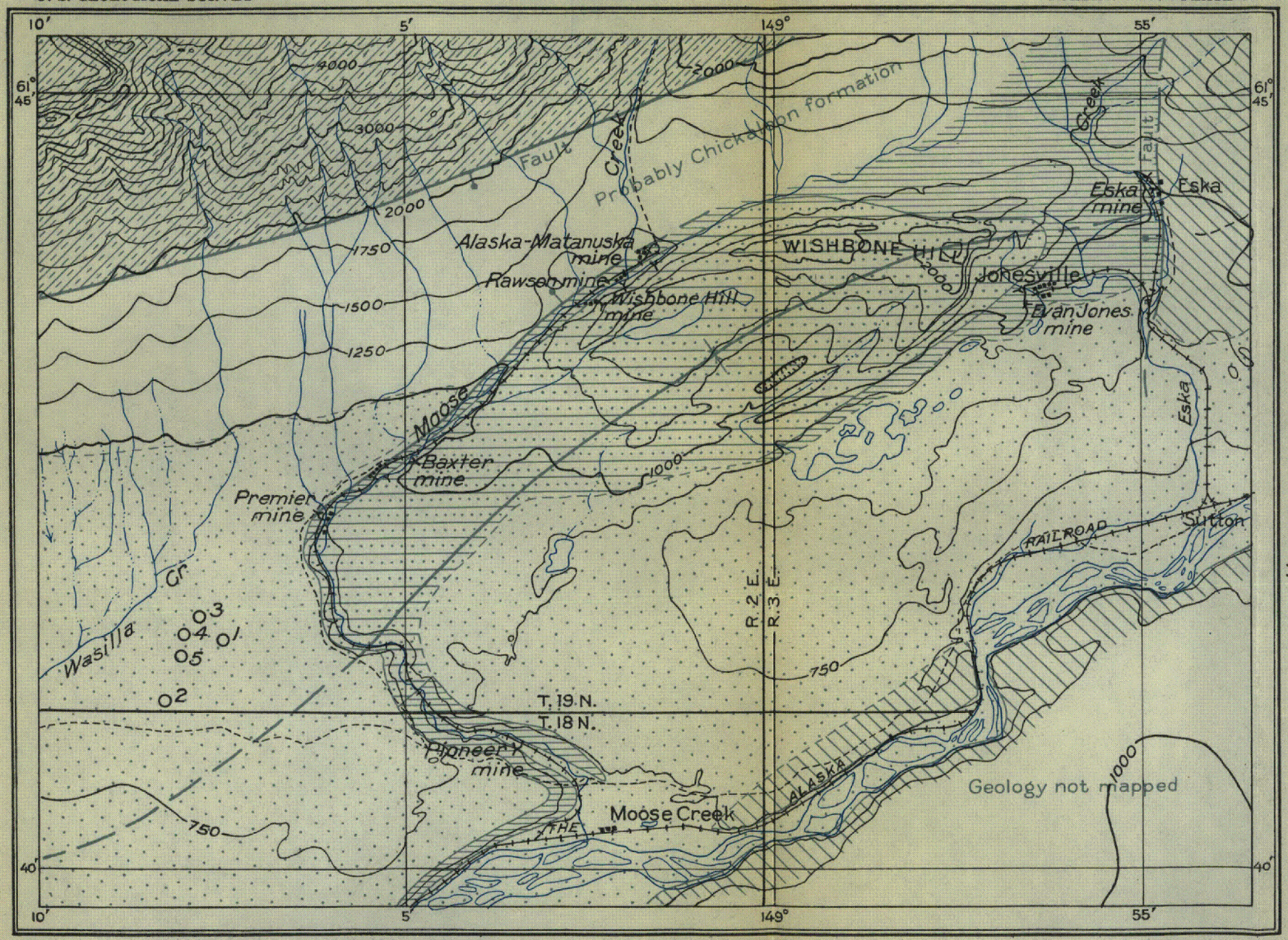
In the western part of the Matanuska Valley the rocks have been greatly folded and faulted. On the north side of the valley there is a great fault, which has been described and mapped by Martin.[2]

The dominant structure of the Moose Creek area is a broad, shallow syncline, of which Wishbone Hill is the most prominent portion. A mile east of the hill the syncline is exposed along Eska Creek, where it is broken by minor cross faults. The eastern part of Wishbone Hill seems to be unbroken by large faults; but along its northwest base the beds of the hill have been uplifted. In some places the beds there dip northward and indicate tilted fault blocks of considerable size. The axis of the syncline plunges southwestward, approximately with the slope of the hill, and the dips of its limbs flatten so that the area included between the limbs widens in that direction. Along the southern course of Moose Creek the dip flattens to only 2° or 3° near the synclinal axis, but steepens again to 20° to 40° on the south limb of the fold, near the mouth of the creek. On the south side, as well as on the north side, the syncline is broken by faults, but these have not been mapped in detail.

CORRELATION OF DRILL HOLES

The rock cores obtained from all the drill holes showed that the beds lie nearly horizontal, so no correction to obtain their true

[2] Martin, G. C., op. cit., p. 39, pl. 5.



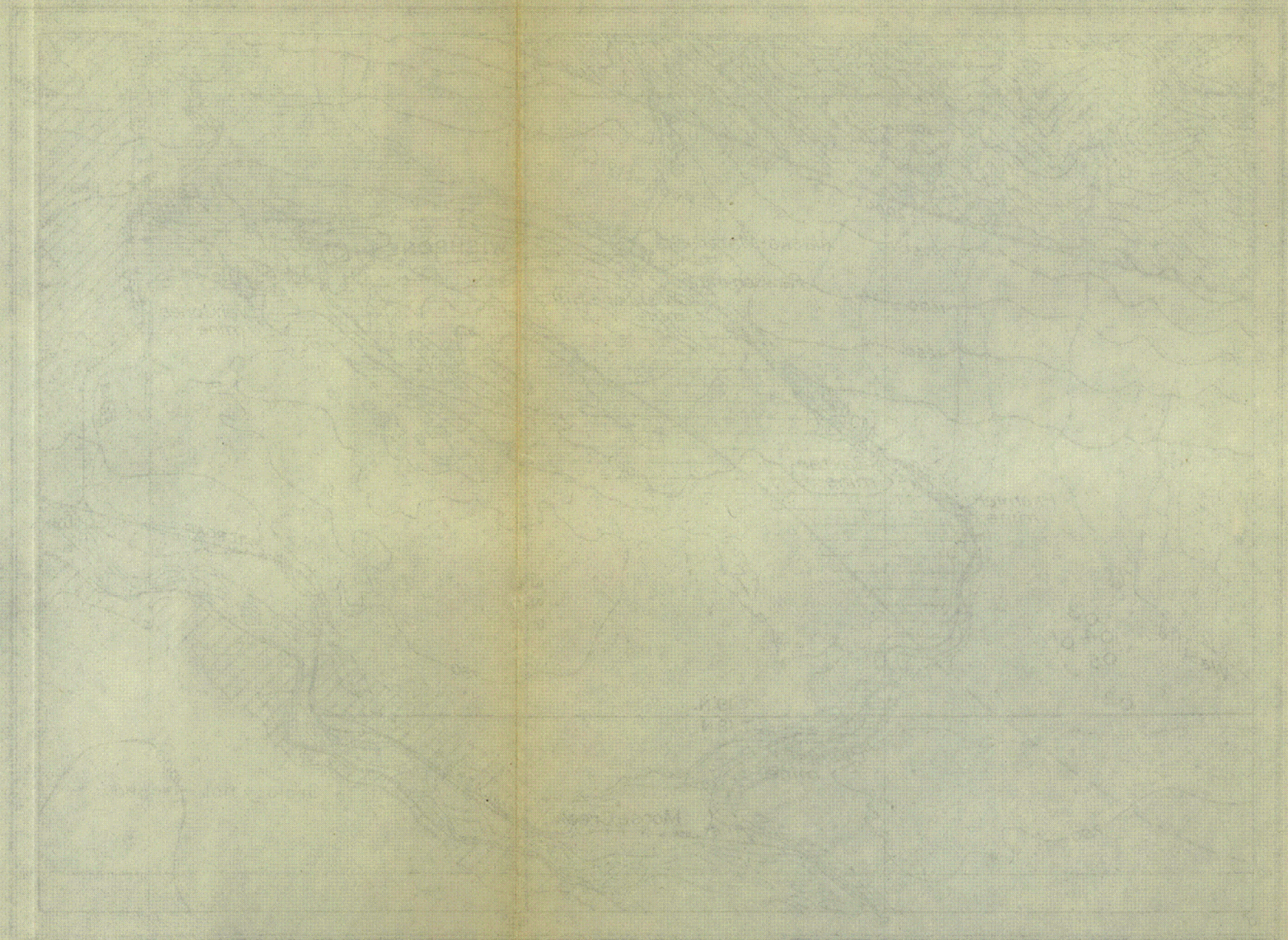
EXPLANATION

Stream and terrace gravel and glacial moraines	QUATERNARY	
Eska conglomerate	Miocene?	TERTIARY
Chickaloon formation *(Coal bearing)*	Eocene	
Arkose, shale, and conglomerate	Eocene?	
Matanuska formation	Upper Cretaceous	CRETACEOUS
Fault *Showing downthrow*		
Synclinal axis		
Mine		
Diamond-drill hole		

GEOLOGIC MAP OF THE MOOSE CREEK AREA, ALASKA

1 0 3 Miles

Geology by G. C. Martin



Log of drill hole No.1
Moose Creek area
320 ft. N. and 40 ft. W. from
E. ¼ cor. sec. 32, T. 19 N., R. 2 E.
El. 810 ft.

0′
Gravel; stones up to 6" diameter
Black sh.
Medium ss.
Carbonaceous sandy sh; leaf impressions
Ss.
Sandy sh.
Fine ss.; coal veinlets
Sandy sh.
Medium to fine ss.
Sandy sh.; coal veinlets, analysis Lab. No. 4810
Medium ss.; coal veinlets
Sandy sh
Fine ss.
100′
Fine to medium ss.; carbonaceous films
Medium to coarse ss.
Fine ss.; coal veinlets
Fine to medium ss.; coal veinlets
Carbonaceous sandy sh.; coal veinlets and leaf impressions
Black sh.
Medium to fine ss.; coal veinlets
Medium to coarse ss.
Fine ss.; coal veinlets
Coarse ss.
Medium ss.; coal veinlets
Sandy sh.; coal veinlets
Medium to fine cross-bedded ss.
Sandy sh.; coal veinlets
Medium to fine ss.
Coarse ss.; calcite veins
Coarse ss.
Fine ss.; leaf impressions
Coarse ss.; coal veinlets
Sandy sh.; coal veinlets and leaf impressions
200′
Medium ss.
Conglomerate; 1" pebbles
Medium ss.
Conglomerate; 1" pebbles
Medium ss.
Conglomerate; 1" pebbles
Sandy sh.; leaf impressions
Fine ss.; coal veinlets and leaf impressions
Medium to fine ss.
Fine ss.; coal veinlets
Sandy sh.
Medium to fine ss.; coal veinlets
Fine ss.; coal veinlets and leaf impressions
Sandy sh.; coal veinlets
Medium ss.
Sandy sh.; ¼" coal
Fine ss.; coal veinlets
300′
Medium to coarse ss.
Conglomerate
Medium ss.
Conglomerate
Sandy sh.; leaf impressions
Medium ss.
Sandy sh.
Medium ss.
Black sh.
Medium ss.
Sandy sh.; coal veinlets
Carbonaceous ss.
Sandy sh.; coal veinlets
Medium ss.
Sandy sh.
Black sh.
Sandy sh.
Medium ss.
Sandy sh.; coal veinlets
400′
Coarse to fine ss.
Black sh.
Medium ss.
Coarse ss.
Sandy sh.; ¼" coal
Medium ss.
Coaly sh., with pyrite
Sandy sh.
Medium to coarse ss.
Sandy sh. Horizontal
Fine ss.
Sandy sh.; coal veinlets
Medium ss.
Sandy sh.
Fine to medium ss.
500′
Black sh.; coal veinlets
Medium ss.
Sandy sh.
Medium ss.
Carbonaceous sh.
Black sh.; coal veinlets
Medium to coarse ss.
Sandy sh.; coal veinlets
Fine to medium to fine ss.
Sandy sh.; coal veinlets
Medium to coarse to fine ss.
Sandy sh.
Medium ss.
Sandy sh.
Medium ss.
Sandy sh.; coal veinlets
Medium to coarse to fine ss.
Sandy sh.; coal veinlets
Medium ss.; coal fragments
Carbonaceous sh.; 1' dirty coal
Fine ss.
600′
Carbonaceous sh.
Black sh., slickensided
Black sh.; coal veinlets
Carbonaceous sh.
Medium ss.
Sandy sh.; coal veinlets
Carbonaceous sh.; veinlets of dirty coal
Sandy sh.
Fine ss.
Sandy sh.; calcite veins
Black sh., slickensided
Carbonaceous sh., coal veinlets
Sandy sh.
Carbonaceous sh., slickensided
Fine ss., fractured; calcite veins
Carbonaceous sh., slickensided; coal veinlets
Fine ss.
Fine ss., shattered
700′
Carbonaceous sandy sh, slickensided
Carbonaceous sh.; 3" dirty coal
Carbonaceous sh.
Carbonaceous sandy sh, shattered
Fine to medium ss., shattered
747′ Total depth

Log of drill hole No.3
Moose Creek area
1090 ft. N. and 850 ft. W. from
E. ¼ cor. sec. 32, T. 19 N., R. 2 E.
El. 820 ft.

0′
Gravel
Sh.
Conglomeratic ss.
Sandy sh.
Medium ss. Horizontal
100′
Carbonaceous sh.; coal veinlets
Fine to medium ss.
Sandy sh.
Fine ss.; coal veinlets
Sandy sh.
Fine ss.
Sandy sh.
Medium to coarse ss.
Medium to fine ss.
Medium to coarse ss.
Sandy sh. Horizontal
Fine to medium ss.
200′
Sandy sh.
Carbonaceous sandy sh.; coal veinlets and plant impressions
Carbonaceous sh.; ¾" coal
Medium ss.
Sandy sh.
Fine ss.
Carbonaceous sh.; coal veinlets
Fine carbonaceous ss.
Fine to medium ss.
Carbonaceous sandy sh.
Carbonaceous sh.
Coarse ss.
Medium to coarse ss. Horizontal
300′
Sh.; coal veinlets
Sandy sh.
Fine ss.; calcite vein
400′
Sh., slickensided
Sh., crushed
Sh., fractured
Blue-gray sh.
500′
Brown sh., crushed
Gray sh., crushed
557½′ Total depth

Log of drill hole No.4
Moose Creek area
430 ft. N. and 1500 ft. W. from
E. ¼ cor. sec. 32, T. 19 N., R. 2 E.
El. 810 ft.

0′
Gravel
Medium ss.
Sandy sh.; leaf impressions
Carbonaceous sh.
Fine to medium ss.
Sandy sh.
Sh.
Sandy sh.
Sh.
Medium to coarse ss.
Sandy sh.
Coarse to medium ss.
Sh.; coal veinlets
Fine ss.; coal veinlets
Carbonaceous sh.
Sh.
Sandy sh.
100′
Medium ss.
Carbonaceous sh.; coal veinlets Horizontal
Medium ss.; coal veinlets
Sandy sh.
Medium to coarse ss.
Sandy sh.
Medium to coarse ss.
Carbonaceous ss.
Conglomeratic ss.
Fine to medium ss.
Conglomeratic ss.
Carbonaceous sh. Horizontal
Coarse to medium ss.; coal veinlets
200′
Sandy sh.
Fine, medium, coarse ss.
Sh.
Sandy sh.
Conglomeratic ss.
Sandy sh.
Medium ss. Horizontal
Carbonaceous sh.; coal veinlets
Fine to medium ss.
Sandy sh.
Fine ss.; coal veinlets
Sandy sh.
Fine ss.
Sandy sh.
Medium to coarse ss.
Medium to fine ss.
Medium to coarse ss.
Sandy sh. Horizontal
300′
Fine to medium ss.
Sandy sh.
Carbonaceous sandy sh.; coal veinlets and plant impressions
Carbonaceous sh.; ¾" coal
Medium ss.
Sandy sh.
Fine ss.
Carbonaceous sh.; coal veinlets
Fine carbonaceous ss.
Fine to medium ss.
Carbonaceous sandy sh.
Carbonaceous sh.
Coarse ss.
Medium to coarse ss. Horizontal
400′
Sh.; coal veinlets
Sandy sh.
Sh., slickensided
Sh., crushed
Sh., fractured
Blue-gray sh.
500′
Brown sh., crushed
Gray sh., crushed
539′ Total depth

Log of drill hole No.5
Moose Creek area
460 ft. S. and 1560 ft. W. from
E. ¼ cor. sec. 32, T. 19 N., R. 2 E.
El. 810 ft.

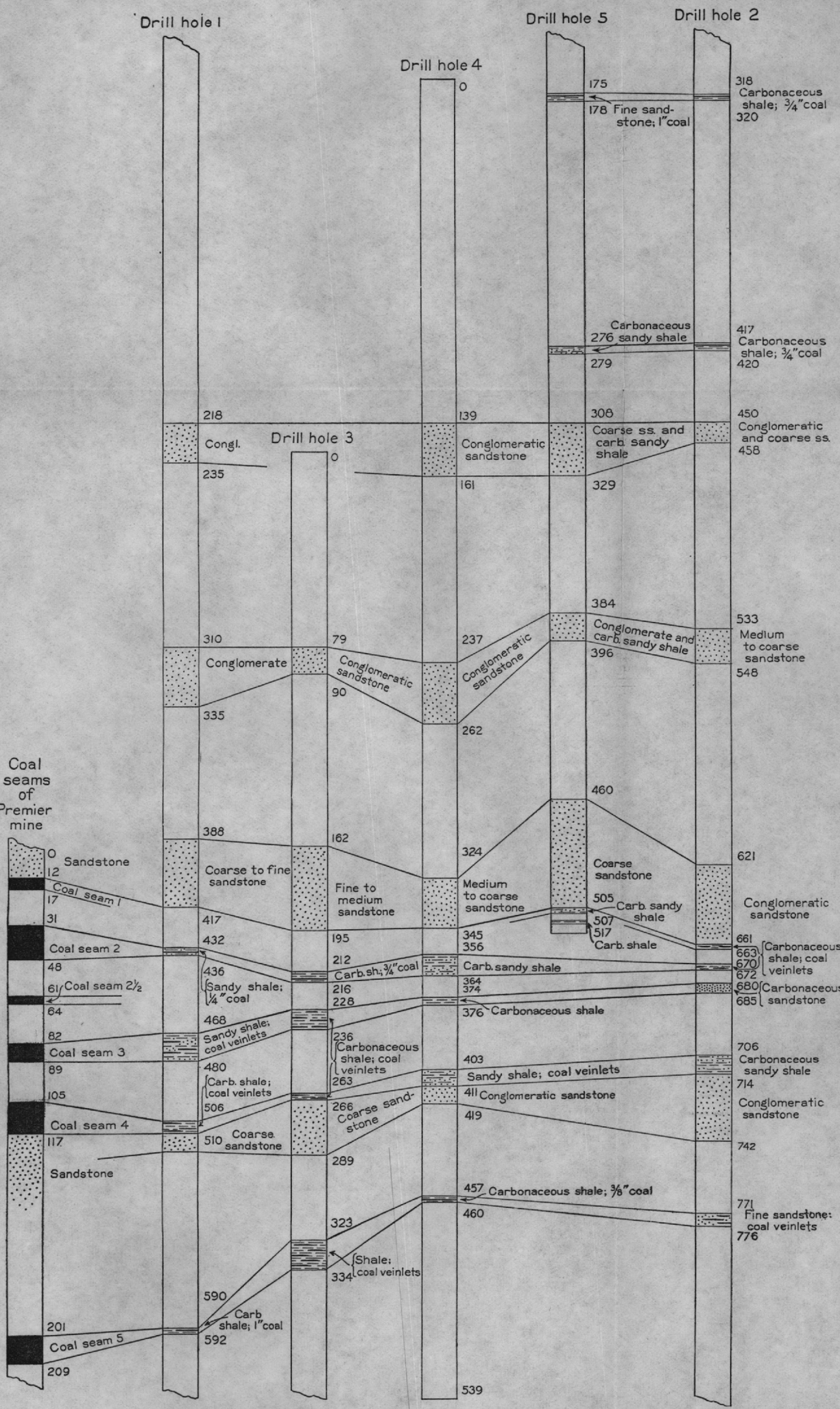
0′
Gravel
Medium to fine ss.
Sandy sh.
100′
Medium cross-bedded ss. Dip 5° to 20°
Sandy sh.
Fine to medium ss.
Dip 5° to 10°
Coarse ss.
Carbonaceous sandy sh.
Coarse ss.
Fine ss.
Coarse ss.
Fine ss.; coal veinlets Dip 3°
Medium to coarse ss.
Carbonaceous sandy sh.; 2" coal
Fine to coarse to fine ss.
Carbonaceous ss.; 2" coal
Medium to coarse ss.; coal fragments
300′
Fine ss.; 3" coal
Carbonaceous ss.; coal veinlets Dip 5° to 10°
Fine ss.; 1" coal
Fine to coarse to medium ss.
Carbonaceous ss.
Medium to coarse to medium ss.
Sandy sh.
200′
Carbonaceous sandy sh. Dip 5°
Medium to coarse ss.
Carbonaceous sh.
Fine ss. Dip 5°
Medium to fine to medium ss.
Carbonaceous sandy sh.
Medium ss.
Carbonaceous sandy sh.
Medium ss.
Fine ss.
Coarse ss.
Sandy sh.
Fine ss.
Carbonaceous sandy sh.
Medium to coarse carbonaceous ss.
Carbonaceous sandy sh.
Medium carbonaceous ss.
Carbonaceous sh.
300′
Fine carbonaceous sh.
Carbonaceous sandy sh.
Medium to coarse to fine ss.
Coarse ss.
Carbonaceous sandy sh.
Coarse ss.
Fine to medium ss. Dip 2° to 5°
Carbonaceous sandy sh.
Medium to coarse ss.
Fine ss. Dip 5°
Coarse to medium ss.
Carbonaceous sandy sh; coal veinlets
Fine to medium ss.
Sandy sh.
Fine laminated ss. Horizontal
Medium ss.
Coarse ss.
Conglomeratic ss., pebbles ½" diameter
Coarse ss.; coal fragments
Coarse ss.
Carbonaceous sandy sh.
400′
Fine ss.
Carbonaceous sandy sh.
Coarse ss.
Fine carbonaceous ss
Coarse ss., with medium ss. bands
Carbonaceous sandy sh.
Coarse to medium ss.
Carbonaceous sandy sh.
Fine carbonaceous ss.
Carbonaceous sandy sh.; Medium ss.
Crumbly coarse ss.
Coarse ss.
500′
Carbonaceous sandy sh.
Coarse ss.
Carbonaceous sandy sh.
517′ Medium to fine carbonaceous ss. Total depth

Log of drill hole No.2
Moose Creek area
490 ft. N. and 210 ft. E. from
S. ¼ cor. sec. 32, T. 19 N., R. 2 E.
El. 840 ft.

0′
Gravel
Coarse ss
Conglomeratic ss.
Medium ss.
Conglomeratic ss.
Medium ss.
100′
Conglomeratic ss.
Coarse ss.
Sh. Horizontal
Medium ss.
Fine to medium ss.
Medium ss.
Conglomerate
Medium to coarse ss.
200′
Medium ss., coal veinlets
Medium ss.
Carbonaceous ss.
Conglomerate
Fine to coarse ss.
Fine ss.
Medium ss.
Carbonaceous sh.
Fine to medium ss.
300′
Carbonaceous sandy sh.
Carbonaceous sh.; ¾" coal
Sandy sh.; leaf impressions
Medium ss.
Carbonaceous sh.
Fine ss.
Medium ss.
400′
Sh.; coal veinlets
Sandy sh.; coal veinlets
Medium ss.
Carbonaceous sh.; 1" coal
Sandy sh.; leaf impressions
Carbonaceous sh.
Sandy sh.
Medium ss.
Fine ss.; 4" coal
Medium ss.
Sandy sh.
500′
Sh.
Sandy sh.
Medium ss.
Carbonaceous ss.
Carbonaceous sandy sh.
Coarse ss.
Fine ss.
Carbonaceous sandy sh.
Fine ss.
Sandy sh.; leaf impressions
Medium ss.
Carbonaceous sh.; coal veinlets
Fine ss.; coal fragments
600′
Carbonaceous sh.; coal veinlets
Fine ss.
Coarse ss.; coal fragments
Carbonaceous sandy sh.
Fine ss.
Conglomeratic ss.
Carbonaceous sh.; coal veinlets
Fine carbonaceous ss.; leaf impressions
Carbonaceous sh.; coal veinlets
Fine carbonaceous ss.
Carbonaceous sandy sh.; coal veinlets
Medium carbonaceous ss.
Fine ss.
700′
Sandy sh.
Sh.
Carbonaceous sandy sh.
Conglomeratic ss.
Sandy sh.
Fine ss.
Carbonaceous sandy sh.
Fine ss.
Carbonaceous sandy sh.
Carbonaceous sh.
Coarse ss.
Fine ss.; coal veinlets
Sandy sh.
Fine ss.
Sh.
Fine ss.
Sh.
Medium ss.
800′
Sandy sh.
Fine ss.
Medium ss.
Conglomeratic ss.
Fine ss.; coal veinlets
Sandy sh.
Medium to coarse ss.
Fine ss.
Medium ss.
Coarse ss.
Carbonaceous sh.
Carbonaceous sandy sh.
Medium ss.
Carbonaceous sh.
Medium to coarse ss.
Carbonaceous sandy sh.
Fine ss.; coal veinlets
Carbonaceous sandy sh.
Fine ss.
Sandy sh.
900′
Conglomeratic ss.
Carbonaceous sandy sh.
Medium to coarse ss.
Carbonaceous sandy sh.
Coarse ss.
Sandy sh.
Sh., crushed
Carbonaceous ss.
Carbonaceous sh.
Sandy sh.; ½" coal
Fine carbonaceous ss.
Carbonaceous sandy sh.
Fine carbonaceous ss.
Sandy sh., slickensided
Sh.
Fine ss., cross-bedded
Carbonaceous sandy sh.
1000′
Sh., coal veinlets, crushed
Fine ss.
1027′ Total depth

EXPLANATION
Ss., sandstone
Sh., shale

LOGS OF DIAMOND-DRILL HOLES IN THE MOOSE CREEK AREA.

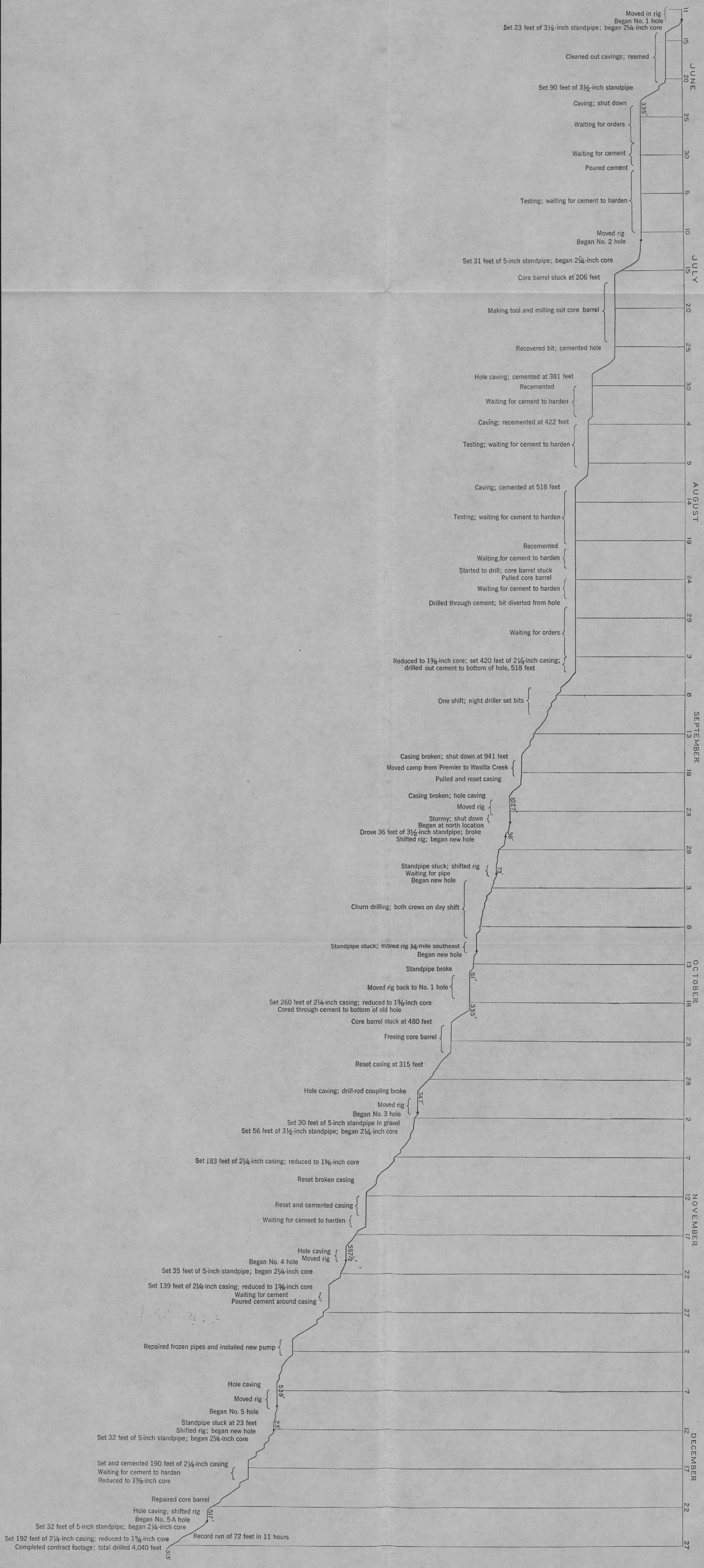


LOGS OF DIAMOND-DRILL HOLES IN THE MOOSE CREEK AREA.

Correlated on conglomerate beds and with the coal seams of the Premier mine as measured by J. J. Corey.

LOGS OF DIAMOND-DRILL HOLES IN THE MOOSE CREEK AREA.

Correlated on conglomerate beds and with the coal seams of the Premier mine as measured by J. J. Carey.



PROGRESS OF CORE DRILLING IN THE MOOSE CREEK AREA.

thickness was necessary in the measurements recorded during the drilling. A few dips of 5° or 10° were noted, but these dips persisted for only a few feet in depth and evidently represented cross-bedding within narrow zones.

In the several drill-hole logs four principal zones of conglomerate and coarse sandstone can be traced. The logs have been correlated in plate 8, with the top of the highest conglomerate bed as a datum. This is apparently at about the surface at drill hole 3, in which the first conglomerate that was penetrated seems to be the second conglomerate of the other drill holes. When so correlated, four thin zones of carbonaceous beds can also be traced through the lower portion of drill holes 1, 2, 3, and 4. Drill hole 5 reached only the uppermost of these zones. This correlation of the logs is in accord with the structure of the beds exposed along Moose Creek 1 mile to the east and shows that all the drill holes are on the gentle north limb of the syncline that extends southwestward from Wishbone Hill. There is a fairly uniform dip of about 440 feet from drill hole 3 southward to drill hole 2. The correlation of the logs also indicates that the strike of the beds is south of west, as beds encountered in drill hole 1 are found at shallower depths in hole 4 and greater depths in hole 5.

The projection southwestward of the structure observed at the Premier mine, with due allowance for the flattening of dip toward the synclinal axis, indicates that the horizons of the coal seams of the Premier mine should be at depths between about 400 and 600 feet in drill hole 1. Between these depths there are carbonaceous beds in the drill hole, and these beds therefore appear to be equivalent to the coal seams. In plate 8 the top of the sandstone beneath coal seam 4 of the Premier mine has been correlated with the top of the lowest zone of coarse sandstone in drill hole 1, and the approximate correlation of the several coal seams is indicated in all the drill-hole logs. The distance between the highest and lowest carbonaceous beds in the drill holes is somewhat less than the distance between the highest and lowest coal seams at Premier. This condition shows that there is some westward thinning of the coal-bearing zone.

The logs show that four of the drill holes penetrated some distance below the coal zones of the Premier mine and found only carbonaceous shale with veinlets and stringers of coal an inch or less in thickness. The core drilling is therefore believed to have demonstrated that, in the area tested, the coal beds have pinched out and there are no commercial coals within the depths penetrated. Drill holes 2, 3, and 4 in their lowest portions penetrated crushed shales, which indicate that there is some faulting in this area of flat-lying beds.

COAL

DEVELOPMENTS

Along the valley of Moose Creek and also in some places farther east coal beds are exposed interbedded with the sandy materials of the Chickaloon formation. In 1916–17 the railroad was extended to and beyond Moose Creek, primarily in order to reach these coal fields as a source of fuel for the railroad, and the opening of mines was stimulated. The Doherty or Pioneer mine (see pl. 6) was opened on the west side of Moose Creek, three-quarters of a mile above its mouth, on a 3-foot bed, and the coal was hauled by tramway to bunkers beside a spur of the railroad. The coal was used chiefly by the railroad, some also being sold in Anchorage, but it was dirty, and the mine was shut down after a few months' operation. Early in 1917 the Eska Creek Coal Co. began development work, and in June of that year its property was purchased by the Alaska Engineering Commission and operated as a Government mine, in order to assure a fuel supply for the railroad. It was closed late in 1921, after the Evan Jones mine, 1¼ miles to the southwest, had been opened by private enterprise; but it has since been kept in condition to produce on short notice, in case of failure of the coal supply from the privately operated mines. The Baxter mine, 4½ miles above the mouth of Moose Creek, produced coal during the winter of 1917–18, from an 11-foot bed exposed on the east bank of the creek. Later development work showed the coal to be faulted, and lack of capital caused the mine to be closed for a time. It was reopened in 1921 and produced small amounts of coal during the next few years, but its operation ceased in 1925. Coal showings at several other places along Moose Creek were prospected during 1917–20, but successful development was hindered by the faulted condition of the beds. At the Rawson mine, 2 miles above the Baxter mine, and at the mine of the Alaska-Matanuska Coal Co., a quarter of a mile farther upstream, tunnels were driven and considerable other development work was done. Some coal was produced from the Rawson mine until late in 1926 and from the other property until late in 1929. In 1925 the Premier mine of the Alaska-Matanuska Coal Co. (later the Alaska Premier Coal Corporation) was opened 4 miles above the mouth of Moose Creek, and this mine has been the chief producer in the Moose Creek area. In the summer of 1932 the Wishbone Hill Coal Co. started operations on the old Rawson property and produced some coal.

The production of all the mines in the area has been relatively small, as 40,000 or 50,000 tons annually has supplied the needs of the railroad and the several towns in which the coal has been marketed.

QUALITY

All the coal of the Moose Creek area and also of the Evan Jones and Eska mines, farther east, is of bituminous rank. The following analyses show the chemical character of the coal from the two principal mines and of three samples obtained from the diamond-drill holes.

Analyses of coal from Jonesville and Moose Creek areas

[By Maurice L. Sharp, chemist, U.S. Bureau of Mines]

Laboratory no.	Source	Air-drying loss	Form of analysis [a]	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	Heating value: Calories	Heating value: British thermal units	Fuel ratio
4570	Premier mine	3.8	A	5.5	38.2	46.7	9.6	0.2	6,686	12,035	1.22
			B	1.8	39.7	48.5	10.0	.2	6,950	12,510	-----
			C	-----	40.4	49.4	10.2	.2	7,074	12,735	-----
			D	-----	45.0	55.0	------	.2	7,876	14,175	-----
4571	Evan Jones mine	5.0	A	7.0	36.8	45.8	10.4	.2	6,517	11,730	1.24
			B	2.1	38.7	48.2	11.0	.2	6,860	12,350	-----
			C	-----	39.6	49.2	11.2	.2	7,006	12,610	-----
			D	-----	44.5	55.5	------	.2	7,892	14,205	-----
4810	Drill hole 1 (depth 57 feet; veinlets of coal).	-----	A	3.2	33.0	48.3	15.5	.3	6,373	11,470	1.46
			C	-----	34.1	49.9	16.0	.3	6,583	11,850	-----
			D	-----	40.6	59.4	------	.4	7,839	14,110	-----
4811	Drill hole 2 (depth 320 feet; ¾ inch of coal).	-----	A	3.1	33.7	57.7	5.5	.2	7,160	12,890	1.71
			C	-----	35.8	58.5	5.7	.2	7,381	13,285	-----
			D	-----	36.9	63.1	------	.2	7,833	14,100	-----
4812	Drill hole 2 (depth 1,010 feet; 1 inch of coal).	-----	A	1.7	38.0	43.3	17.0	.4	6,641	11,955	1.14
			C	-----	38.7	44.0	17.3	.4	6,754	12,160	-----
			D	-----	46.6	53.4	------	.5	8,202	14,765	-----

[a] A, as received; B, air-dried; C, moisture free; D, moisture and ash free.

The samples from the Premier and Evan Jones mines were monthly composites of shipments of coal to the Alaska Railroad during November 1931.

The mined coals are noncoking, burn freely, are moderately low in ash, and have fairly high heating value. They are good coals for steam making. In a few places along upper Moose Creek the coals have at some time naturally burned, which is an indication of their rather high content of volatile matter.

The small samples from the drill holes show that the rank of the thin stringers of coal encountered is about the same as that of the Premier coal, two of the samples having a little higher fuel ratio and the other a little lower fuel ratio than the Premier coal. The low content of ash in sample 4811 is not significant in such selected sample. None of the analyses indicate that the coal differs appreciably from the beds exposed along Moose Creek.

CORE DRILLING

As considerable difficulty was experienced in the core drilling, chiefly because of the poorly consolidated character of the materials penetrated, a short account of the work is given here as being of interest in connection with the project.

The contract for the core drilling was awarded on May 19, 1932, to the Pennsylvania Drilling Co., of Pittsburgh, Pa. The terms were $5.50 a foot for core drilling in bed rock, with $1.50 additional for each foot of core recovered. For drilling through the overburden of gravel, $5 a foot was paid. All expenses of moving in equipment and setting up the drill at the first four locations were borne by the contractor. Additional set-ups were paid for at $350 each.

The equipment consisted of a Sullivan type CN drill with hydraulic feed and 20-horsepower steam engine and a vertical 20-horsepower boiler. Coal from the Premier mine was used for fuel. Pumps capable of delivering water to the bit at a pressure of 250 pounds to the square inch were used, and double-tube core barrels were employed to protect the core from erosion by the wash water. An A-shaped derrick was employed, the 30-foot timbers for its construction being obtained from local spruce trees. The drill rods were handled in 20-foot sections (two rods at a time). During most of the time two shifts were employed, each consisting of a driller and a helper, who also served as fireman.

On June 6 the drilling machinery and camp equipment were unloaded from the train at Premier, under the supervision of J. A. Christopherson, drill foreman. Camp was established at Premier, and during the next few days a road was built to the first location, beside a marsh 1½ miles southwest of Premier. The progress of the work is shown graphically on plate 9, which also gives notations on the principal features of the drilling, which began on June 13. Only 17 feet of gravel was encountered, and after setting standpipe 6 feet deeper, in soft black shale, core drilling began with a 3-inch diamond bit, cutting 2¼-inch core. Poorly consolidated sandstone, which caved badly, was soon encountered, and it was necessary to ream the hole and set 90 feet of 3½-inch casing. The hole was continued to 335 feet, where caving became so bad that an attempt was made to hold back the loose material by cementing. A quick-setting portland cement was tried but failed to set hard; and after experimenting with this for several days, the drill was moved about three-quarters of a mile, to the south location, to see if the materials were better consolidated there.

Water for drilling hole 2 was obtained from a pond 2,000 feet to the north, where a steam pump was installed, a 1-inch pipe line being laid to the drill. The bottom of the gravel was reached at

31 feet, where the standpipe was set and core drilling commenced. The formation was sandy, and drilling proceeded rapidly until at 206 feet the core barrel became stuck, owing to caving of the hole. On attempting to free the tools by pulling, the inner tube of the core barrel was pulled out, leaving the bit and outer tube in the hole. It was necessary to mill this down within a few inches of the bit before the bit could be recovered by means of a tapered tap. The hole was cemented, but the cement was only partly successful in holding back the cavings, and at 381 feet caving again became serious. The hole was recemented, using warm water in the mixing and hot water to warm the hole before pouring in the cement; but it did not harden much better than before. At 422 feet caving again required cementing; and drilling was continued to 518 feet, where caving again endangered the tools. This time calcium chloride was mixed with the cement, but the mixture did not harden much better than the cement alone; so it was drilled out, the hole recemented, and several days allowed for the mixture to harden. On attempting to drill through this, the core barrel became stuck and required a day's work to recover. On redrilling, the bit became diverted from the hole about 100 feet off bottom, and the new hole began to cave badly. After a few days' delay it was decided to try drilling with a smaller bit; so casing was run and drilling resumed with a 2-inch bit, cutting 1⅝-inch core. This drilled with less caving, though core recovery was not so good as with the larger bit; and the vibrating rods broke the casing some distance above its bottom. At 1,027 feet the hole began to cave badly, the casing was broken again, and as no favorable showings of coal had been found, the hole was abandoned.

For the next test the rig was moved a mile, to the north location. This was close to the north quarter corner of sec. 32, T. 19 N., R. 2 E., beside Wasilla Creek, to which camp had for convenience been moved from Premier. Three attempts were made to set standpipe through the gravel, the last hole being carried to 157 feet without reaching bedrock. The rig was then moved a quarter of a mile southeast, and another attempt was made to penetrate the thick layer of glacial gravel and boulders but was abandoned at 51 feet. The rig was then moved back to drill hole 1 for an attempt at deepening it with smaller bit, as this method had been successful in drill hole 2. The cement, which was still soft, was drilled out to 260 feet, where casing was set and drilling proceeded with a 2-inch bit. This worked fairly well, although the core barrel once became stuck and the casing was once broken by the vibrating drill rods and had to be pulled and reset. At 747 feet a drill-rod coupling broke, and after recovering the rods the hole was found to be caving so badly that it was abandoned. Only thin stringers and veinlets of coal had been penetrated.

The drill was moved about a quarter of a mile northwest, for drill hole 3, and standpipe was landed on bedrock at 56 feet. Core drilling proceeded easily to 183 feet, where the sandy material caved badly; so casing was set and the size of the hole reduced. The vibration of the drill rods soon broke the casing, and on the second recurrence of this trouble the casing was set and strengthened by cement poured between it and the wall of the hole. At about 400 feet crushed shale was encountered which caved badly, and after penetrating this material to 557½ feet the hole was abandoned. No coal other than veinlets and small stringers had been penetrated. Drill hole 4 was located about 900 feet to the southwest, where water was available for drilling. Much the same conditions were encountered as in the third hole, a depth of 539 feet being reached before caving shale caused the hole to be abandoned.

The next move was about 900 feet south, where on the second attempt standpipe for drill hole 5 was set on bedrock at 32 feet. The materials here penetrated were chiefly sandy; and caving necessitated the setting of casing at 190 feet and reduction to 1⅜-inch core. Serious caving caused the hole to be abandoned at 517 feet. Drill hole 5A was started 4 feet south of hole 5 but was carried to only 313 feet, where caving caused the cessation of drilling. As no favorable showings of coal had been penetrated in either hole at this location, and as the footage contracted for had been drilled, the work was discontinued.

CONCLUSIONS

The core drilling demonstrated that although the coal-bearing formation extends for some distance westward from Moose Creek, it becomes thinner in that direction; and the fact that no coal seams of workable thickness were encountered in the five localities tested shows that the coals are intermittent in character. The thin seams penetrated were of practically the same rank of coal as that of the Premier and the Evan Jones mines, and there appears to be no hope of finding coals of higher rank in the western part of the area. The crushed character of the materials in three of the drill holes indicates that the area is faulted.

It is not unlikely that somewhere in the area there are coal seams of workable thickness at no great depth below the surface, but their discovery would doubtless require systematic drilling over a considerable area. The chance of finding a coal of good shipping quality which could be sold competitively in Pacific coast markets is so slight, however, that there is at present no economic justification for further prospecting for such coal in the Moose Creek area.

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UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary
GEOLOGICAL SURVEY
W. C. Mendenhall, Director

Bulletin 857

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REPORT ON PROGRESS OF INVESTIGATIONS IN 1932

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