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SUBSURFACE EXPLORATION FOR STRIPPING COAL ON LOWER DEEP CREEK, HOMER DISTRICT, KENAI COAL FIELD, ALASKA

By

F. Farrell Francis 1905- and Daniel Sokol, 1925-

1955

This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

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For Release to PM's, MAY 23, 1955

STRIPPING COAL IN COOK INLET REGION, ALASKA

Release to open files of Geological Survey reports describing exploration for stripping coal in the Little Susitna district, Matanuska coal field and in the Homer district, Kenai coal field, Alaska was announced today by Secretary of the Interior Douglas McKay.

Previous geologic mapping by the Geological Survey in the Little Susitna district had shown that an area of at least 40 square miles was underlain by coal-bearing rocks, and that subbituminous coal of commercial thickness and quality might be present at several localities. Some interest in the area had been shown by prospectors, and a small strip mine has been operated at Houston, at the western end of the district, for several years. Exploration with a bulldozer and power auger was done at the most promising localities in 1953 and 1954. All the beds examined at the four localities tested were judged to be below minimum standards in both thickness and quality for mining under present conditions.

Field work on Lower Deep Creek in the Homer district consisted of large-scale mapping of the topography and coal exposures in two small areas. The results of the investigations, including data from auger holes, indicate that an essentially horizontal bed of lignitic coal, about 4 feet in average thickness, underlies at least 28 acres of low stream terrace beneath 10 to 25 feet of overburden. Within the area mapped the bed was estimated to contain about 200,000 tons of coal that could be mined by stripping. The bed contains additional reserves in nearby areas.

The reports entitled "Subsurface exploration in the Little Susitna district, Matanuska coal field, Alaska," and "Subsurface exploration for stripping coal on Lower Deep Creek, Homer district, Kenai coal field, Alaska" both by F. F. Barnes and Daniel Sokol have been placed on open file for public inspection in Geological Survey offices at Room 1033, General Services Administration Building, Washington, D. C.; Brooks Memorial Mines Building, College, Alaska; 117 Federal Building, Juneau, Alaska; 4 Homewood Place, Menlo Park, California; South 157 Howard Street, Spokane, Washington; 468 New Customhouse, Denver, Colorado; 807 Post Office and Courthouse, Los Angeles, California; 724 Appraisers Building, San Francisco, California; and the Territorial Department of Mines, Territorial Building, Juneau, Alaska. Copies from which reproductions of text and illustrations can be made at private expense are available at 4 Homewood Place, Menlo Park, California.

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SUBSURFACE EXPLORATION FOR STRIPPING COAL ON LOWER DEEP CREEK, HOMER DISTRICT, KENAI COAL FIELD, ALASKA

By F. F. Barnes and Daniel Sokol

INTRODUCTION

The area described in this report is on the west side of the Kenai Peninsula in south-central Alaska, near the mouth of Deep Creek, a stream of moderate size that enters Cook Inlet about 2 miles south of the village of Ninilchik (pl. 1). It is 37 miles by highway north of Homer and 51 miles south of Kenai, the two principal towns of the region (fig. 1). The localities studied are in sections 2, 3, 10, and 11, T. 2 S., R. 14 W. (Seward meridian), south and west of Deep Creek within 2 miles of its mouth, and were easily reached by cutting about a mile of tractor trail from a dirt road connecting with the Sterling Highway (pl. 1). This area was chosen for detailed study because geologic mapping had indicated the presence of at least one coal bed of minable thickness and quality that appeared to be favorably situated for strip mining and was reasonably accessible to the highway.

This report presents the results of drilling and trenching with a bulldozer and power-auger unit in areas along Deep Creek that had been mapped by Cobb (1952) and briefly examined by Barnes in 1953. The reader is referred to Cobb's report for a general description of the geology and coal resources of the Homer district, of which this area is a part. These earlier investigations showed that the coal-bearing Kenai formation, of Tertiary age, is generally covered by Quaternary glacial and stream deposits, except in steep bluffs and parts

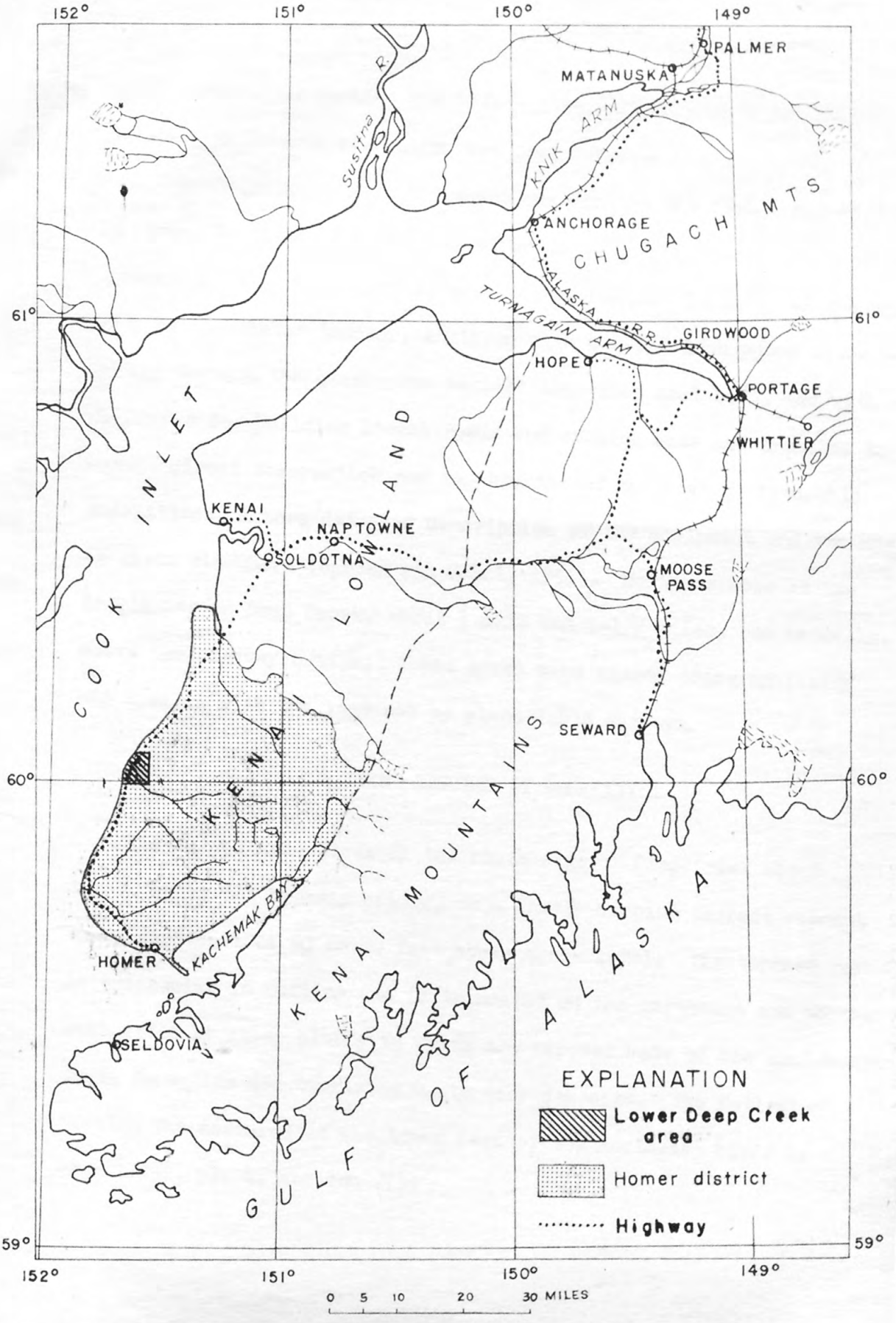

Figure 1.— Index map showing location of lower Deep Creek area, Homer district, Kenai coal field, Alaska

of the creek bed, so that subsurface data were needed to supplement the surface data in evaluating the coal reserves.

The field work for this report was done in the period August 1-30, 1954, by the writers, assisted by A. E. Burford and W. S. Hopkins, geologists, and J. W. Dawson, operator-mechanic. It involved the use of a small crawler tractor, equipped with a 4-1/2 inch power auger for boring through the overburden to test concealed coal beds, and with a bulldozer for building access roads and opening cuts and trenches to permit direct observation and measurement of the coal at favorable localities. A more detailed description of the equipment and its use is given elsewhere (Barnes and Sokol, 1955). Work was done at two localities on Deep Creek, about 1 mile and 1-1/2 miles, respectively, above the highway bridge. These areas were mapped topographically and tied in with the land net by plane-table surveys.

DRILLING RESULTS AT LOCALITY 1

Locality 1 (pl. 2) is on the south side of Deep Creek about 1 mile above the highway bridge, on a gently sloping terrace remnant whose surface lies 50 to 80 feet above creek level. The terrace remnant is triangular in outline and is truncated on the northeast and northwest sides by steep bluffs in which are exposed beds of the coal-bearing Kenai formation and overlying Quaternary deposits. The following section was measured in the lower part of the northeast bluff by Cobb (1952, pl. 4, section 27):

Section at locality 1

	Feet
Sandstone, thin-bedded	12+
Coal	4.1
Coaly claystone	.9
Siltstone and silty claystone	25.0
Coaly claystone	.5
Coal, bony at base	1.3
Coaly claystone	1.0
Bone	.2
Volcanic ash	.1
Coaly claystone, with some bone	2.3
Coal	.1
Coaly claystone, with some bone	1.0
Silty claystone	.7
Coal	.2
Siltstone and fine sandstone	5+

Strike, N.; dip, 2°-5° E.

The beds of the upper part of the bluff are largely concealed by slump but were penetrated by borehole 1 (pl. 3), which showed them to consist mainly of sandstone overlain by about 15 feet of sand and clay of Quaternary age. The following analysis of a sample of the 4-foot coal bed, taken from the south end of the outcrop in the northeast bluff by Barnes in 1954, shows it to be lignite in rank, according to current standards of classification.

Analysis of lignitic coal from Deep Creek locality 1

(Analysis by C. R. Cupp, U. S. Bureau of Mines, Anchorage, Alaska)

Condition	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Heating value, B.t.u.
As received	30.4	41.3	24.5	3.8	0.2	7,536
Moisture free	--	59.3	35.2	5.5	.2	10,828

From the preliminary examination it was inferred that the 4-foot coal bed would underlie the terrace at a depth ranging from 20 to 50 feet (pl. 2). To check this inference it was planned to drill several holes on the terrace to outline the area of surface-minable coal and determine the average thickness of overburden. Borehole 1 was drilled near the edge of the northeast bluff, so that the log of the borehole could be checked by comparison with the exposed section. Coal cuttings first appeared when the drill head was down 57.5 feet, and continued to appear for an additional 2 feet of advance. As the difference in elevation between the collar of the borehole and the top of the coal bed in the nearby bluff is about 48 feet, a discrepancy of nearly 10 feet in the true and apparent depths to the coal bed is evident. This represents the lag-interval, or distance the drill advances while the cuttings from a given bed are moving to the surface, which must be taken into account in determining the depth of a bed with a spiral auger. In most holes this interval must be estimated, taking into account such factors as the depth of the hole and the rate and constancy of the rise of cuttings from the hole. A more accurate check of the true depth is obtained when a bed can be detected by the "feel" of the auger. A second discrepancy appears in the thickness of the

coal bed, which examination of drill cuttings indicated was only half of its true thickness of 4 feet. These discrepancies indicate that the accuracy of depth and thickness determinations with a spiral auger decreases rapidly with depth, and that reasonably accurate results can be expected only at comparatively shallow depths, generally less than 30 feet. In plotting graphic logs of the boreholes (pl. 3), the depths to the coal beds were adjusted by applying the estimated lag-interval, but as the interval through which coal cuttings appear is generally the only indication of the thickness of a coal bed, this interval was used throughout in plotting bed thicknesses. For uniformity this was done in borehole 1, even though the logged thickness is believed to be too small, probably because of incomplete recovery of the cuttings from the relatively deep hole, possibly resulting from enlargement of the hole when the auger was forced past boulders in the overburden.

Borehole 2 was started about 300 feet northwest of borehole 1 and, after several attempts in which the auger was stopped by boulders and cobbles, reached a depth of 28 feet, of which 15 feet was in terrace deposits and 13 feet was in sandstone and conglomerate (pl. 3). The hole was abandoned without reaching coal, because of excessive boulders. Several other holes on the terrace were stopped by cobbles and boulders without reaching bedrock, and operations were then shifted to another locality, as the relatively small amount of theoretically possible coal, estimated at about 35,000 tons beneath a maximum cover of 50 feet, did not warrant more intensive exploration in this area.

DRILLING AND TRENCHING RESULTS AT LOCALITY 2

Locality 2 is about a quarter of a mile southeast of locality 1, on the flood plain and adjoining low terrace west of Deep Creek (pls. 1 and 4). Coal is exposed at several places in the creek bed and forms ledges and rapids. As the bedding is essentially horizontal, it appeared that the outcrops were all on a single bed underlying the adjoining low ground at shallow depth, and thus favorably situated for strip mining. Subsurface work was therefore started on the adjoining flood plain to determine the extent and thickness of the coal and the depth of overburden.

Borehole 3 was drilled on the creek bank adjacent to the easternmost coal exposure (pl. 4). About 3 feet of coal was penetrated under 1.2 feet of surficial material. As the top of the coal bed had been removed by stream erosion its original thickness at this point is not known. The hole was continued to a total depth of 62.9 feet and encountered a 3-foot bed of coal at 35 feet and a 1-foot bed at 55 feet, neither of which is considered minable. (See pl. 3.) West and southwest of borehole 3 two trenches were cut through about 4 feet of stream gravel before being stopped by inflowing water. As the bottoms of these trenches were several feet below the projected position of the coal exposed in the creek bank a short distance to the north, it appeared that the coal at these points had been cut away by the stream in a former channel. This was later confirmed by borehole 4, in which bedrock was reached at a depth of nearly 20 feet, or 13 feet below the top of the coal in borehole 3. Because of the general swampy nature of the low ground in the eastern part of the area, and

the probability that the upper coal bed had been largely removed by stream erosion, operations were then shifted to the higher ground to the west, on the terrace above the 90-foot contour (pl. 4). As the western part of the terrace is also swampy, work was restricted to the eastern and northern edges. Two deep trenches in the terrace front near the southern boundary of the area mapped failed to reach bedrock before being stopped by excessive water.

Borehole 5, at the extreme northeast corner of the higher terrace, penetrated nearly 4 feet of coal under 7 feet of silt and gravel, and was continued to a depth of 63 feet, encountering two thin coal beds between depths of 50 and 60 feet (pl. 3). Coal beds about 4 feet in thickness were also found in boreholes 6, 9, 10, 11, and 12, under 10 to 15 feet of overburden. At boreholes 6, 9, and 11 it was necessary to remove the bouldery terrace deposits by trenching before the drill could reach the coal. As the coal in all these holes is at essentially the same altitude as the 4-foot bed in borehole 5, there is little doubt that a single nearly horizontal bed is represented. Borehole 13, in the northwest corner of the terrace, penetrated 3 feet of coal immediately beneath terrace gravel at an altitude about 7 feet below the coal to the east. This is believed to be the same bed, probably reduced in thickness by erosion and in altitude by a slight dip to the northwest. Similarly, the top coal in borehole 3, which is also exposed in ledges in the creek bed (pl. 4) is probably an eastward extension of the 4-foot bed, reduced about 10 feet in altitude by a slight dip to the east. The relations of the 4-foot coal bed to the surface of the terrace and flood plain at locality 2 are shown in section B - B' (pl. 4).

The approximate boundary of the area underlain by the 4-foot coal bed under a maximum cover of 25 feet is shown on plate 4. The southern boundary was chosen more or less arbitrarily, on the assumption that the coal bed extended southward without appreciable change in altitude. The tract so outlined is about 28 acres in area and, assuming an average thickness of 4 feet and a weight of 1,750 tons per acre-foot, is underlain by 196,000 tons of coal. Although subsurface work farther south on the terrace was prevented by swampy conditions, the topography suggests that the coal may lie within stripping depth for some distance south of the area mapped. No sample was obtained from the coal at locality 2, but it is judged to be similar in rank to the lignite at locality 1; in fact, its similarity in thickness and altitude suggests that it may be the same bed.

A coal outcrop farther up Deep Creek, about 1-1/2 miles southeast of locality 2 in the NE 1/4 sec. 14, T. 2 S., R. 14 W. (pl. 1, locality 3), contains at least 6 feet of coal in two benches separated by a 6-inch parting (Cobb, 1952, pl. 4, section 28). No subsurface work was done on this bed, but its position suggests that it may underlie at relatively shallow depth the upstream continuation of the terrace at locality 2. The relation of this bed to the one at locality 2 is not known.

SUMMARY

Subsurface exploration with a bulldozer and power-auger unit was completed at two localities on lower Deep Creek in August 1954. At locality 1 a 4-foot bed of lignite is exposed in the creek bluff and

probably underlies a small terrace remnant at a depth ranging from 20 to 50 feet. Systematic exploration of the bed with the power auger was prevented by excessive boulders in the overburden.

At locality 2, exposures of horizontal coal at creek level suggested that a coal bed several feet thick might underlie the flood plain and low terrace south and west of the creek at shallow depth. The results of drilling and trenching indicate that the coal probably has been removed by stream erosion from most of the flood plain but is present in the terrace to the west, where it has an average thickness of about 4 feet and is covered by 10 to 25 feet of largely unconsolidated overburden. The advantages of a relatively thin cover are offset to some extent by the swampy condition of much of the terrace surface, which would introduce a drainage problem in strip mining. The terrace is underlain by an estimated 196,000 tons of stripping coal in the area mapped, and possibly by several times that amount farther south.

REFERENCES CITED

Barnes, F. F., and Sokol, Daniel, 1955. Subsurface exploration in the Little Susitna district, Matanuska coal field, Alaska, in 1953 and 1954: U. S. Geol. Survey open-file report.

Cobb, E. H., 1952. Coal investigations in the Homer district, Kenai coal field, Alaska, in 1950 and 1951: U. S. Geol. Survey open-file report.

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