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COAL INVESTIGATIONS ON THE SOUTHERN MARGIN OF THE HOMER DISTRICT, KENAI COAL FIELD, ALASKA, IN 1947-48

By

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COAL INVESTIGATIONS ON THE SOUTHERN MARGIN OF THE HOMER DISTRICT, KENAI COAL FIELD, ALASKA, IN 1947-48

INTRODUCTION

The presence of coal in the Tertiary Kenai formation of western Kenai Peninsula has been known since 1880, chiefly as exposed along the north shore of Kachemak Bay and the adjoining east shore of Cook Inlet[1] (fig. 1). Several early attempts were made to develop a commercial mine in this area in the period 1888-1902 [2] but none progressed beyond the prospecting stage and little coal was produced. In 1915 the mining of coal was started at the Bluff Point mine, 1½ miles west of Homer. Available records indicate that this mine produced between 20,000 and 25,000 tons of coal before closing in 1924. No further attempt at mining was made until 1946, when the Homer Coal Corporation began development near the site of the old Bluff Point mine. Development work during 1946 and 1947 included construction of a truck-loading bunker, mess hall, bunkhouse, and an incline and hoist for raising coal from the tunnel in the face of the beach bluff. Only a small amount of underground work was done in 1946 and 1947, and practically none in 1948.

A preliminary step toward more extended investigation of the coal deposits of the Homer district was made by the writer, accompanied by T. R. Jolley of the U. S. Bureau of mines, in the summer of 1946. Several days were spent in examining the principal coal exposures near Homer and collecting samples to determine the desirability of more detailed investigation. [3]

Detailed examination of the coal deposits of the Homer district was started by the Geological Survey in 1947. The period July 17 to September 14 was spent by the writer, assisted by H. C. Wagner, geologist, and L. A. Hale, field assistant, in reconnaissance of isolated coal exposures in an area extending several miles north of Homer, and in measuring detailed stratigraphic sections in the bluffs just north of Homer between Coal (Bidarki) and Fritz Creeks.

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[1] Dall, W. H., Report on coal and lignite of Alaska: U. S. Geol. Survey 17th Ann. Rept., pt. 1, pp. 787-797, 821, 831-833, 1896.
Stone, R. W., Coal fields of the Kachemak Bay region: U. S. Geol. Survey Bull. 277, pp. 53-73, 1906.
Atwood, W. W., Mineral resources of southwestern Alaska: U. S. Geol. Survey Bull. 379, pp. 121-126, 1909.
Martin, G. C., Johnson, B. L., and Grant, U. S., Geology and mineral resources of Kenai Peninsula, Alaska: U. S. Geol. Survey Bull. 587, pp. 67-89, 1915.

[2] Stone, R. W., op. cit., pp. 54-56.

[3] Barnes, F. F., Preliminary report on coal deposits near Homer, Alaska, in Barnes, F. F., Wahrhaftig, Clyde, Hickcox, C. A., Freedman, Jacob, and Hopkins, D. M., Coal investigations in south-central Alaska, 1944-46: U. S. Geol. Survey Bull. 963 (in press).

Field work was resumed on June 11, 1948, and continued to September 10 under the direction of the writer, assisted by E. H. Cobb, geologist, and F. J. Markewicz and D. E. Hibbard, field assistants. The first part of the season was spent in determining the stratigraphic relations of the sections measured the previous year by tracing individual beds between sections, a task that required considerable digging with augers and shovels. The remainder of the season was spent in tracing coal beds, measuring sections, and geologic mapping from Coal Creek westward to Bluff Point and from the mouth of Fritz Creek northeastward along the shore of Kachemak Bay to Swift Creek.

GENERAL DESCRIPTION OF AREA

The Kenai coal field is here defined as the coal-bearing part of the Kenai lowland, which lies between the Kenai Mountains and Cook Inlet and extends from Turnagain Arm to Kachemak Bay (fig. 1). As the entire lowland is believed to be underlain by the coal-bearing Kenai formation, the Kenai coal field is probably coextensive with the Kenai lowland. The coal field may be conveniently divided into two parts separated by Tustumena Lake and the Kasilof River. The northern part is here defined as the Kenai district, and the southern part as the Homer district. The southern margin of the Homer district is the subject of the present report.

The Homer district, which is much lower than the rugged glacier-ridden Kenai Mountains to the east, consists in large part of rolling uplands ranging from 1,000 feet to more than 2,500 feet in altitude, culminating in the Caribou Hills near the eastern edge of the district. The Caribou Hills are separated from the mountains by a low trough, 2 to 4 miles wide, that connects the heads of Tustumena Lake and Kachemak Bay. The western part of the district, in a belt about 10 miles wide opposite Anchor Point and widening gradually northward, is low, flat, and poorly drained, characterized by numerous boggy swales traversed by winding sluggish streams separated by low sinuous ridges. This low area is separated from the higher ground to the east by a fairly steep and well-defined northeastward trending escarpment several hundred feet high.

The southwest corner of the upland of the Homer district is truncated by nearly vertical beach cliffs, known as Bluff Point, which rise 800 feet above Kachemak Bay. A second prominent escarpment, 500 to 800 feet high, extends northeastward from Bluff Point, roughly parallel with, and 1 to 2 miles inland from, the shore of Kachemak Bay, as far as Fritz Creek. From the foot of the escarpment, at an altitude of about 500 feet, a slightly dissected bench, 1 to 2 miles wide, slopes gently southward to the top of bluffs that rise 50 to 200 feet above the beach. On this bench are situated the village of Homer and most of the farms of the district. Northeast of Fritz Creek the escarpment is lacking, the surface sloping gradually southward from a general altitude of 1,500 feet on the uplands to the brink of precipitous bluffs that rise 100 to 600 feet above the beach.

The principal streams of the area are the Anchor River and Deep Creek, which head on the west slopes of the Caribou Hills in the eastern part of the district. The Fox River heads in the Kenai Mountains and traverses most of the length of the low trough east of the Caribou Hills before entering the head of Kachemak Bay. Numerous smaller streams drain the peripheral areas of the district.

The climate of the Homer district is characterized by cool summers and by winters that are mild for the latitude. The hottest months are July and August, with average mean temperatures of 50° to 55° F., and the coldest months are January and December, with average mean temperatures of about 13° F. at Kenai and Kasilof and 23° at Homer. The mean annual precipitation is about 17 inches at Kasilof, 19 inches at Kenai, and 27 inches at Homer.

The vegetation of the district is varied and spotty in distribution. Fireweed, redtop, wild celery, and various other weeds and grasses are widespread. Most of the well-drained slopes and smaller stream bottoms support a dense growth of spruce, most of it too small for lumber but much of it suitable for mine timbers, and also large clumps of alder and red elderberry. Groves of cottonwood or poplar are found on the bottomlands of the larger streams. Dense thickets of wild rose are common on sunny slopes, and devil's club and nettles compete with alders, fireweed, and redtop in the damp, shaded ravines. The summits of the lower ridges are generally covered with spruce but the higher uplands are bare of all but smaller vegetation. The poorly drained swales of both the upland and lowland areas support only the low shrubs and coarse grasses typical of boggy areas.

The principal settlements of the district are at Homer, Anchor Point, and Ninilchik. Homer is by far the largest, being the center of a community of several hundred persons. A network of roads connects Homer with farms to the north and northeast, and a highway under construction in 1948 was passable as far as Anchor Point and will eventually connect with the Alaska Railroad by way of Ninilchik, Kasilof, Kenai, and Kenai Lake.

The main industries of the Homer district are farming and fishing. A large part of the population is employed full or part time by the Alaska Road Commission, and a staff of several persons is maintained by the Civil Aeronautics Authority. Homer is a regular stop for Pacific Northern Airlines and Alaska Airlines, which together afford daily plane connections with Anchorage. Power barges from Anchorage and Seldovia also stop at Homer at irregular intervals. Although there were no dock facilities for large boats in 1948, freight from occasional steamers was lightered by barges to the tip of Homer Spit, which is connected by road with the village of Homer.

STRATIGRAPHY

The only bedrock formation known to be present in the Homer district is the coal-bearing Kenai formation, of Tertiary age. The possible presence of a small igneous intrusive mass near the head of Deep Creek, about 25 miles northeast of Homer, was suggested by observations made on an air reconnaissance of the district, but the locality has not yet been visited on the ground. Quaternary deposits cover the greater part of the district, older rocks being exposed only in cliffs and stream beds. These Quaternary deposits are largely of glacial derivation and include both

till and water-laid sand and gravel. Martin 4/ suggests that these deposits may not extend over the highest part of the Caribou Hills, north of Kachemak Bay.

The Kenai formation consists of partly indurated sand, silt, and clay in generally thin and intergrading beds and lenses, interbedded with a few thin lenses of fine conglomerate and many seams of subbituminous coal. The argillaceous beds in general are bluish gray and the sandy beds light buff. Ferruginous masses are common in the massive sandstones, and ironstone concretions, both in distinct bands and in scattered nodules, are abundant throughout the formation.

The total thickness of the Kenai formation is not known, as neither the top nor the base is exposed in the area studied. The total stratigraphic thickness represented by the measured sections (pls. 2 and 3) is about 2,300 feet. The general similarity of beds throughout the exposed section, as well as at both ends of the area studied, indicates that fairly uniform conditions obtained over the entire area throughout the period of deposition, but local conditions may have been variable.

The age of the Kenai formation has been determined from fossil plants to be Tertiary, probably Eocene. 5/

STRUCTURE

The structure of the bedrock of the Homer district has been studied in detail mainly in a narrow coastal belt between Bluff Point and the head of Kachemak Bay, wherein the bedrock is well exposed in numerous gullies and canyons incised in the escarpment that passes just north of Homer, and in wave-cut cliffs along much of the bay shore. A few isolated exposures of Kenai rocks were found on the upland north of Homer and along the middle course of the Anchor River in Tps. 4 and 5 S., R. 13 W.

In the area studied the structure is characterized by broad, gentle folds, in which the dips are generally less than 5°. In many outcrops the beds are horizontal. The regional dip is to the north, at angles generally less than 5°. The strike is approximately east between Bluff Point and Bear Canyon (pl. 1) but appears to swing to about N. 60°E. farther east.

Accurate measurement of the strike is difficult, owing partly to the low dip and partly to the scarcity of outcrops undisturbed by slumping. Bedrock exposures are too restricted to a narrow coastal belt to permit the determination of the general trend of folds, which are revealed only by reversals in the direction of apparent dip as beds are traced along

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4/ Martin, G. C., The western part of Kenai Peninsula, in Martin, G. C., Johnson, B. L., and Grant, U. S., Geology and mineral resources of Kenai Peninsula, Alaska: U. S. Geol. Survey Bull. 587, p. 89, 1915.

5/ Smith, P. S., Areal geology of Alaska: U. S. Geol. Survey Prof. paper 192, p. 61, 1939.

~~along~~ the beach cliffs. Folds detected in this manner include three synclines, one at the mouth of Coal Creek, one just west of Cottonwood Creek, and one west of Swift Creek; and two anticlines, one about a mile east of the mouth of Fritz Creek and the other at the mouth of Cottonwood Creek. All these folds except the syncline at Coal Creek are shown on plate 3. In preparing plate 3 the sections were plotted in their proper relation to a common datum plane, that is, the beach, so that the structure, including both folds and faults, is reflected by the correlation lines that connect corresponding beds identified in more than one section.

At least 20 faults, with vertical displacements ranging from 3 feet to nearly 80 feet, cut the Kenai formation where it is well exposed in the beach cliffs between Fritz Creek and Swift Creek. Only three faults were mapped between Bluff Point and Fritz Creek, but the lack of continuous exposures in this interval leaves the possibility that more faults are present in concealed areas. All the faults mapped are of the normal, high-angle type, with dips ranging from 50° to vertical. Although a reliable strike reading could not be obtained on many of the faults, particularly those exposed in nearly vertical bluffs, the prevailing strike appears to be northwest, with individual strikes ranging from due north to due west (pl. 1). Another feature of the Homer district is the predominance of faults in which the southwest side was downthrown as compared to those in which the northeast side was downthrown. This predominance is evident both in the number of faults and in the total displacement: 16 faults, with a total vertical displacement of about 460 feet were downthrown on the southwest, and 7 with a total vertical displacement of about 150 feet were downthrown on the northeast. The net result is that the beds exposed near the head of Kachemak Bay are about 300 feet higher than they would have been without the faulting.

The relative direction and amount of vertical displacement of all the faults mapped east of Fritz Creek are shown on plate 3. West of Fritz Creek, the faults mapped near sections 7 and 11 (pl. 1) were downthrown on the southwest 50 and 40 feet, respectively. The fault at section 10, near Miller's landing, is exposed only on the nearly flat beach so that the direction and amount of displacement could not be determined with certainty, but it is believed that the southwest side was downthrown not more than 10 feet.

At many points, especially in the deeper canyons in the escarpment north of Homer, displacements resembling faults were found on close examination to be the result of slumping of large masses of the soft Kenai sedimentary rocks on oversteepened slopes. Between Bluff Point and Coal Creek the escarpment is separated from the bay shore by an area about 2 miles long and half a mile in maximum width that is characterized by irregular knobs, ridges, and lake-filled depressions. In the adjoining beach cliffs and in the beach itself numerous bedrock exposures show the strata to be highly deformed. The complex and irregular structure, in which several coal beds were tightly folded, tilted, overturned, and abruptly terminated by numerous faults, is probably the result of deformation in the toe of a large landslide mass that came from the escarpment to the north. This structure is in sharp contrast to that of beds exposed in the escarpment itself, along which a single prominent coal bed was traced with nearly uniform strike and dip from the east end of the landslide area to Bluff Point.

COAL

Character and distribution of coal beds

The coal of the southern part of the Homer district occurs in a large number of lenticular beds distributed more or less uniformly throughout the 2,300 feet of known strata of the Kenai formation. It is difficult to find a 100-foot section of the formation that does not contain at least one coal bed. The Kenai formation differs in this respect from the Tertiary coal-bearing Chickaloon formation of the lower Matanuska Valley, in which the coal beds lie in several generally well-defined groups separated by thick sections of barren strata. 6/

In the western part of the area described in this report few of the coal beds could be traced more than a short distance, as most of the exposures are in stream canyons that cut across the strike of the strata. Attempts were made, with some success, to trace individual beds across slopes between canyons by digging with shovels and hand auger. The Cooper bed, near the base of the exposed part of the formation, was traced with comparative ease from the Homer Coal Corporation mine westward to Bluff Point, a distance of more than 3 miles.

From Coal Creek eastward to Fritz Creek most of the correlations between sections were made by walking out the outcrop of a single coal bed, guided in part by natural or artificial exposures and in part by projecting the trace of the bed along the generalized strike and dip of the strata. The correlation lines shown on plate 2 are therefore subject to correction of errors resulting from deviations of actual from assumed general strike and dip, and possibly also from offsets along undetected faults in covered areas. Practically none of the coal beds shown on plate 2, with the possible exception of the Cooper bed, is distinctive enough in appearance to be identifiable in isolated outcrops. Similarly, no distinctive and persistent lithologic subdivisions or key beds have been recognized in the Kenai formation that would aid in correlation of coal beds.

Between Fritz Creek and the head of Kachemak Bay the correlation of coal beds was comparatively easy, because of nearly continuous exposures in the cliffs along the beach. (See pl. 3). Between Fritz Creek and McNeil Canyon (pl. 1) a component dip to the northeast resulted in progressively higher beds being exposed in each succeeding section. Beyond McNeil Canyon a gentler northeast dip, two slight reversals in dip, and numerous faults in which upthrow on the northeast predominated, resulted in the same beds being traced through succeeding sections for more than 5 miles (pl. 3).

6/ Barnes, F. F., and Byers, F. M., Jr., Geology and coal resources of the eastern part of the lower Matanuska Valley coal field, Alaska: U. S. Geol. Survey, 1945 (Mimeographed), p. 4.

Examination of the stratigraphic sections on plates 2 and 3 reveals a general lack of uniformity in the sequence of strata exposed in neighboring sections. Many coal beds, including most of the thinner ones and many of the thicker ones, were identified at only one or two section localities, and the thicker, more extensive beds change markedly in both thickness and quality along the strike. (See pl. 4.) Similar lateral changes in thickness and character of the enclosing strata support the conclusion that, although there apparently was no major change in environment during deposition of the Kenai formation, local conditions of sedimentation were highly varied.

Physical and chemical properties

The coal of the Kenai Peninsula has generally been considered to be lignite, but the analyses given in the accompanying table indicate that according to present standards of classification[1] it is of subbituminous rank. In fresh exposure the coal is generally dull black but includes many bright, lustrous bands, and has a dark-brown streak. Locally it has both a prominent cleat or fracture, and a poorer one, at right angles to each other and to the bedding. The strike of the prominent cleat is remarkably uniform throughout the area studied, all measurements falling between N. 40° W. and N. 60° W. Where erosion is rapid, as in beach cliffs and stream beds, the coal breaks off in large slabs parallel to the bedding. In weathered exposures it is dark gray and its woody texture is emphasized, resulting in a platy fracture parallel to the bedding.

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[1] Cooper, H. M., and others, Analyses of mine, tipple, and delivered samples, in Analyses of Alaska coals: U. S. Bur. Mines Tech. Paper 682, pp. 20-22, 1946.

Analyses of coal from the Homer district, Kenai coal field, Alaska
(Analyses by H. M. Cooper, U. S. Bureau of Mines)

Laboratory no.	Air-drying loss	Condition[1]	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Heating value B. t. u.	Thickness of coal in sample Ft.	in.	Remarks
C-61783	9.8	A	16.5	30.3	41.1	12.1	0.4	9,020	6	1	Cooper bed, 23 ft. inside portal of Tunnel No. 2, Homer Coal Corp. mine. Sampled by A. L. Toenges and T. R. Jolley, U. S. Bur. of Mines, July 26, 1946.
		B	7.5	33.6	45.5	13.4	.5	9,990			
		C	—	36.3	49.2	14.5	.5	10,800			
		D	—	42.5	57.5	—	.6	12,620			
C-61954	12.9	A	22.7	35.0	33.7	8.6	.3	8,600	3	2	Uppermost bed exposed in beach cliff ½ mile west of Homer Coal Corp. mine. Sampled by T. R. Jolley, August 6, 1946.
		B	11.2	40.2	38.7	9.9	.4	9,880			
		C	—	45.2	43.6	11.2	.4	11,120			
		D	—	50.9	49.1	—	.5	12,520			
C-61955	14.9	A	24.2	34.9	33.1	7.8	.3	8,490	3	9	Uppermost bed exposed in beach cliff at Coal Creek. Sampled by T. R. Jolley and F. F. Barnes, August 7, 1946.
		B	10.9	41.1	38.8	9.2	.3	9,980			
		C	—	46.1	43.6	10.3	.4	11,200			
		D	—	51.4	48.6	—	.4	12,480			
81609	—	A	21.6	38.1	31.2	9.1	.3	8,380	5	6	Composite of three samples from Cooper bed in Bluff Point mine. Sampled by B. W. Dyer, U. S. Bur. of Mines, August 23, 1921.
		C	—	48.7	39.5	11.8	.4	10,690			
		D	—	55.1	44.9	—	.5	12,100			
C-83515	18.4	A	27.7	38.1	31.0	3.2	.1	8,220	2	9	Stripped outcrop on Kranich farm, in SW¼ sec. 12, T. 6 S., R. 14 W. Sampled by F. F. Barnes, Sept. 3, 1947.
		B	11.4	46.7	37.9	4.0	.2	10,080			
		C	—	52.7	42.8	4.5	.2	11,370			
		D	—	55.2	44.8	—	.2	11,900			
D-1423	16.3	A	23.8	32.5	26.7	17.0	—	—	4	8½	Outcrop of Curtis seam in beach cliff ¼ mile west of McNeil Canyon, in SW¼ sec. 25, T. 5 S., R. 12 W. Sampled by F. F. Barnes August 7, 1948.
		B	8.9	38.9	31.9	20.3	—	—			
		C	—	42.6	35.1	22.3	—	—			
		D	—	54.9	45.1	—	—	—			

1/ A, as received; B, air-dried; C, moisture-free; D, moisture- and ash-free.

Burning of coal beds

Coal beds have burned along the outcrops in many parts of the area studied, and particularly near the head of Kachemak Bay. Burning is indicated by thick zones of yellow to brick-red shaly rock that is generally highly shattered and baked to flinty hardness. The coal beds themselves are generally represented by an inch or two of yellow ash at or near the base of the baked zone.

A few small burned areas were noted in the bluffs between Bluff Point and Fritz Creek. Several large burned zones are exposed in the beach bluffs in the vicinity of Cottonwood Creek, and for long intervals between Eastland Canyon and Swift Creek practically all the coal beds have burned, the only unburned outcrops being in the bottoms of ravines where the coal is kept wet by springs.

Much of the burning is believed to have occurred in comparatively recent years. According to local reports many of the beds were burning within the memory of older residents. At a few places beds of ash and baked shale were found beneath several feet of soil, indicating that some burning occurred much earlier, possibly in prehistoric time. Little evidence was found to indicate the depth to which the coal had burned, but it is doubtful that it extended more than a few tens of feet under cover.

Coal reserves

In the classification of public lands the Geological Survey considers to be coal bearing lands underlain by coal with a heating value of 10,000 B. t. u., air dried, and with a minimum thickness of 18 inches. Coals with a lower heating value must be correspondingly thicker in order for the lands to be classified as coal-bearing. 8/ As the samples of Homer coal represented by the accompanying analyses average about 9,980 B. t. u., lands underlain by coal beds little more than 18 inches thick could thus be classed as coal bearing. As it is doubtful that beds 18 inches thick can be profitably mined in Alaska in the foreseeable future 2 feet was chosen, more or less arbitrarily, as the minimum thickness of coal in calculating reserves in the Homer district. Under present economic conditions it is questionable whether a bed less than 4 feet thick would be considered minable.

In the stratigraphic sections (pls. 2 and 3), the thicknesses shown opposite the coal beds have been corrected for partings by the pricing method formerly used by the Geological Survey, 9/ which is based on the premise that a given amount of coal in two or more benches is less valuable than the same amount of coal in a single bed. This insures that the reserve calculations are conservative. The locations of the sections are shown on geologic map (pl. 1). In view of the general lack of outcrops in the western

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8/ Smith, G. O., and others. The classification of the public lands: U. S. Geol. Survey Bull. 537, pp. 69-70, 1913.

9/ Idem, p. 70.

part of the mapped area and the restriction of outcrops to a single steep bluff in the eastern part of the area, no attempt was made to show the outcrops of coal beds on the map.

One object of the field work to date, and a principal reason for concentrating on the relatively continuous exposures along the shore of Kachemak Bay was to learn as much as possible of the general character and habit of the coal beds, particularly their lateral extent and continuity. Unfortunately the structure of the formation is such that the exposures of most of the beds are limited on the one hand by the top of the bluffs and on the other by the beach, so that their original full extent is not known. The greatest distance a single bed was traced was 5 miles (bed 5), but through much of this distance the bed is too thin or dirty to be of value. The greatest distance through which it maintains a minimum thickness of 2 feet is about a mile. The Cooper bed averages 4 feet in thickness for at least 3 miles, but few other beds exceed 2 feet in average thickness for more than $1\frac{1}{2}$ miles.

In the absence of more exact information on the probable inland extent of potentially minable coal beds, the following tonnage figures were computed on the assumption that each bed extends inland for a distance equal to half the length of known outcrop and with the same average thickness as the outcrop. Each acre-foot of coal was considered to equal 1,750 tons.

Indicated coal reserves in part of the Homer district, Kenai coal field, Alaska

Township and coal bed	Thickness (Feet)	Area (Acres)	Tons
T. 6 S., R. 14 W.:			
Cooper	4.0	3175	22,225,000
			22,225,000
T. 6 S., R. 13 W.:			
Cabin	3.4	370	2,201,000
Woodman	2.8	180	882,000
Fletcher	2.5	12	52,000
			3,135,000
T. 5 S., R. 13 W.:			
Fletcher	2.5	550	2,406,000
			2,406,000
T. 5 S., R. 12 W.:			
Bed near Stone Steps	2.6	20	91,000
Bed 1	3.3	39	225,000
Bed 2 (Curtis seam)	4.2	146	1,073,000
Bed 3	3.6	65	409,000
Bed 4	3.0	585	3,071,000
Bed 5	4.1	236	1,694,000
			6,563,000
T. 5 S., R. 11 W.:			
Bed 4	3.0	135	709,000
Bed 5	2.9	545	2,765,000
Bed 6	2.0	506	1,771,000
Local bed 20 feet above bed 6	2.7	353	1,668,000
Bed 10	2.5	449	1,964,000
Bed 11	2.9	96	487,000
			9,364,000
T. 4 S., R. 11 W. (unsurveyed):			
Bed 10	2.5	449	1,964,000
Bed 11	2.9	96	487,000
Bed 12	2.5	16	70,000
Bed 13	4.9	231	1,981,000
			4,502,000
Grand total			48,195,000

The tonnage figures given in the accompanying table are believed to represent only a small fraction of the total valuable coal in the townships bordering Kachemak Bay, but available information does not warrant estimates for the total areas of the townships. Further field work, including detailed examination of scattered outcrops but consisting largely of exploratory drilling and trenching, will be required before reliable estimates of the coal resources farther inland can be made.

Reconnaissance examinations, on the ground along the upper course of the Anchor River and from the air along the middle course of Deep Creek, have shown that coal beds several feet thick are present in these areas. It is a reasonable geologic inference that beds of like thickness underlie all the area between Deep Creek and Kachemak Bay, or roughly the southern half of the Homer district. If this area, totaling at least 400 square miles, is assumed to be underlain by an average of 5 feet of potentially minable coal, reserves of more than 2 billion tons can be inferred.

Available information on the regional geology suggests that similar geologic conditions and a corresponding quantity of coal are to be found in the northern half of the Homer district.

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