SUPERSEDED by Bull. 1058-F

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COAL INVESTIGATIONS IN THE HOMER DISTRICT, KENAI COAL FIELD, ALASKA IN 1950 AND 1951

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

by
E. H. Cobb
1952

CONTENTS

TABLES

ILLUSTRATIONS

COAL INVESTIGATIONS IN THE HOMER DISTRICT, KENAI COAL FIELD, ALASKA, IN 1950 AND 1951

INTRODUCTION

This report presents the results of work done in the last three weeks of the 1950 field season and in all of the 1951 season, and supplements reports by Barnes (1949) and Cobb (1950, 1951). Barnes' report covers investigations of coal-bearing rocks of the Tertiary Kenai formation in a coastal belt between Bluff Point and the head of Kachemak Bay (pl. 2). Cobb's reports deal with similar rocks exposed along the coast between Bluff Point and the beach bluffs about 7 miles south of the village of Cohoe, and in the lower reaches of the Ninilchik River valley. The present report covers extensions of previous mapping in the valleys of Deep Creek and the Anchor River, and on high land between the area covered by Barnes' report and the Anchor River valley. The results of ground and aerial reconnaissance of most of the Homer district also are presented. The writer, assisted by F. J. Markewicz, carried on the field work which is the basis for this report, between August 13 and September 6, 1950, and between May 10 and August 30, 1951. Field work included traverses along Deep Creek and the Anchor River, and between the southeast end of Tustumena Lake and the head of Kachemak Bay. It included also the detailed measurement and tracing of coal beds on the upland north and northwest of Homer, sampling of coal beds along the northwest shore of Kachemak Bay and the southeast shore of Cook Inlet, and both ground and aerial reconnaissance of the rest of the Homer

district and adjoining areas. The writer is indebted to James W. Scott, Forester, U. S. Bureau of Land Management, Homer, Alaska, who accompanied him on a traverse from Tustumena Lake to Kachemak Bay and assisted at many other times during the 1950 and 1951 field seasons. Ralph Gaetano and Thomas Shelford of Homer were of great assistance in locating and reaching isolated outcrops of coal-bearing rocks. Daniel B. Krinsley, of the Alaska Terrain and Permafrost Section of the U. S. Geological Survey, has generously made available the results of many of his observations in remote parts of the Homer district which could not be visited by the writer.

GENERAL DESCRIPTION OF THE AREA

The Kenai coal field was defined by Barnes (1949, p. 2) as the coal-bearing part of the Kenai lowland (fig. 1), which lies between the Kenai Mountains on the east and Cook Inlet on the west and extends from Turnagain Arm to Kachemak Bay. The part of the Kenai coal field south of Tustumena Lake and the Kasilof River was defined as the Homer district, and that to the north as the Kenai district. To date, the only known occurrence of coal in the Kenai district is a single outcrop on the northeast bank of the Kasilof River at the Sterling Highway bridge.

Topographically the Homer district consists of a broad swampy area on the west, and a rolling upland in the central and eastern parts of the district. The swampy area rises gently from an elevation of 50 to 150 feet at the beach bluffs along the shore of Cook Inlet to about 600 feet at the foot of the upland to the east. Major streams such as the

Ninilchik and Anchor Rivers and Deep Creek meander through broad valleys incised in the rolling swampy surface. Smaller streams wander in tortuous courses across the surface, and either plunge down steep valley walls into the major streams or cascade into Cook Inlet through shallow notches in the top of the beach bluffs. All the streams in the area are underfit with respect to their modern valleys, except in their headwater reaches. The uplands that form the eastern and central parts of the Homer district rise abruptly from the swampy sloping plain to isolated knobs and ridges which culminate in the vicinity of Ptarmigan Head in the Caribou Hills. The elevations of the knobs and ridge crests increase from slightly more than 1,500 feet at Ohlson Mountain north of Homer and about 1,950 feet at Ninilchik Dome east of Cape Starichkof, to more than 3,000 feet at Ptarmigan Head about 10 miles north of the head of Kachemak Bay. The upland reaches the shore of Kachemak Bay at Bluff Point. A gently sloping bench, ranging in altitude from 50 to 500 feet and in width from 1 to 2 miles, borders the northwest shore of Kachemak Bay from a point about 2 miles west of Homer nearly to McNeil Canyon (pl. 2). The town of Homer and the most productive farms of the southern Kenai Peninsula are on this bench. To the east the upland drops off abruptly into the valley of the Fox River, which drains Chernof Glacier, near the northeast corner of the Homer district, and flows southward to the head of Kachemak Bay. East of the Fox River the glacier-mantled slopes of the Kenai Mountains rise to elevations of 4,000 to 6,000 feet. Except for relatively small streams which flow into Kachemak Bay and the Fox

River, all drainage is westward to Cook Inlet by way of the Kasilof, Ninilchik, and Anchor Rivers, and Deep and Stariski Creeks. The drainage divide is roughly parallel to, and generally less than 5 miles from, Kachemak Bay and the Fox River.

The climate of the Homer district is characterized by cool summers, winters that are mild for the latitude, and low precipitation (Barnes, 1949, p. 3). July and August, the warmest months, have a mean temperature of 50° to 55° F.; January and December, the coldest months, of 13° to 23° F. The mean annual precipitation is about 17 inches at Kasilof, and 27 inches at Homer.

The vegetation of the district is varied, and uneven in distribution. Fireweed, bluejoint, putschke (Heracleum lanatum), and other weeds and grasses are widespread in well-drained areas. On poorly drained terrain mosses, black spruce, alder, and several species of willow are abundant. Cottonwood, or balsam poplar, is scattered over most of the area of the Homer district, some trees reaching considerable size. Between the head of Tustumena Lake and the Fox River they grow in stands several hundred feet above the tree line for other species, though most individuals appear to be moribund, possibly as the result of recent harshening of climate. The only timber trees in the southern part of the Kenai Peninsula are Sitka and white spruce. Though many of the trees are small or deformed, several small sawmills supply much of the lumber used in local construction. Other trees and shrubs in the area include mountain ash, devil's club (Echinopanax horridum), Kenai birch, and aspen. Juniper

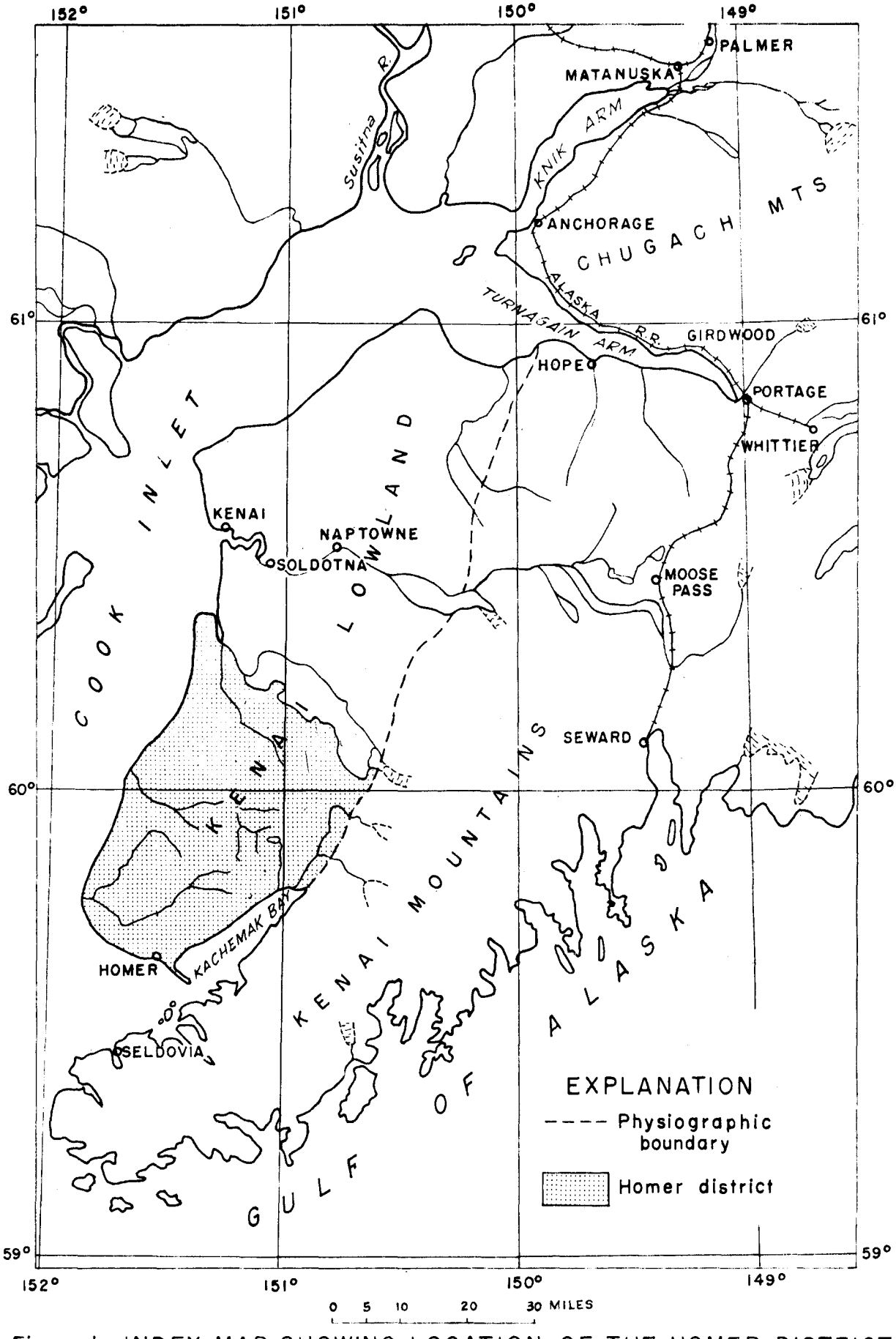

Figure 1: INDEX MAP SHOWING LOCATION OF THE HOMER DISTRICT KENAI COAL FIELD, ALASKA

grows in abundance on the lower slopes of the Kenai Mountains southeast of the head of Tustumena Lake. Edible berries include high- and low-bush cranberry, high- and low-bush blueberry, salmonberry, watermelonberry, and a few wild strawberries. The higher slopes and ridge crests are carpeted with several kinds of moss and lichen, blueberries, grasses, and dwarf birch.

Game is fairly plentiful in the more remote parts of the Homer district, though the fame of the area as a big-game-hunting ground seems to be leading to a decline in the numbers of several species. One of the largest game animals is the moose, the meat of which supplies a significant part of the winter diet of many residents. Black and brown bear are numerous, as are coyotes. Annually a few wolves are reported, but the reports are not always verified. Formerly the Kenai grizzly bear inhabited the Kenai Mountains and the eastern part of the Homer district, but is now considered to be extinct, though an animal answering the description of the Kenai grizzly was seen at twilight by the writer in the valley of Crystal Creek near the head of Tustumena Lake early in June 1951. Sheep and goats are known to live in the Kenai Mountains, but not for many years have any been seen in the Homer district itself. Smaller forms of wild life include wolverine, shrews, mice, a few rabbits, ptarmigan, spruce hens, eagles, ravens, crows, and many species of small birds. In Cook Inlet and Kachemak Bay hair seals are very common, and whales are not rare. The major food fish are several kinds of salmon and halibut. King and Dungness crabs and razor clams are abundant and form an important part of the local food supply. Trout are plentiful in most of the larger streams.

The principal settlement of the district is Homer, a town with several stores, garages, and other businesses. A dock at the end of Homer Spit accommodates freighters of the Alaska Steamship Company and tankers of the Standard Oil Co. of California. The 5,000-foot Homer air field is maintained by the Civil Aeronautics Administration. Daily air service from Homer to other points on the Kenai Peninsula and to Anchorage is supplied by Pacific Northern Airlines and Alaska Airlines. Less frequent service to Kodiak and Bristol Bay is given by Pacific Northern Airlines. Alaska Airlines has a daily schedule to Seldovia, a fishing town on the southeast side of Kachemak Bay. Other airlines and local bush pilots also make non-scheduled and charter flights to and from Homer. Other settlements in the general area are Anchor Point, Ninilchik, Cohoe, Kasilof, Kenai, Soldotna, and Naptowne. The latter four settlements are outside the Homer district, but are either on the Sterling Highway or on spur roads from it. The Sterling Highway connects Homer and other towns and villages of the Kenai lowland with roads leading to Seward, Anchorage, and intermediate points on the Alaska Railroad. Most supplies used in the Kenai lowland are trucked from Seward, Homer, or Moose Pass, but some small-bulk commodities are shipped in from Anchorage by air. In addition to the air field at Homer, smaller strips are located at Anchor Point, Ninilchik, and Kasilof. The Civil Aeronautics Administration maintains and staffs a 5,000-foot field at Kenai.

The major income of the Homer district is from commercial salmon fishing. Probably half the families of the area have at least one member actively engaged in some part of the fishing industry during the season. Attempts have been made to start a commercial crab industry in Homer, but without great success to date. Farming has generally been on a small scale, with emphasis on truck crops. Most produce is consumed locally, but some is shipped by air to Kodiak and Bristol Bay during the fishing season. The completion of the highways that connect Homer with Anchorage and other major population centers of the Territory will probably provide a spur to further agricultural development. In addition to growing truck crops, moderately successful attempts at raising poultry and goats have been made. Some residents believe there is a bright future for cattle raising on the Kenai Peninsula, but so far there have been few attempts to develop this industry.

STRATIGRAPHY

The oldest rocks in the Homer district are pre-Tertiary slates, graywackes, cherts, ellipsoidal lavas, greenstones, and other metamorphosed rocks exposed along the eastern boundary of the district. At one time these rocks were considered to be Mesozoic, and possibly in part Paleozoic, in age (Martin, Johnson, and Grant, 1915, pp. 44-55, 60-63), but more recent work on similar rocks in the Girdwood district, north of the eastern end of Turnagain Arm, by Park (1933, pp. 389-394) suggests a late Cretaceous age for many of the rocks near Kachemak Bay that formerly had been considered to be much older. As these rocks occur only along the eastern margin of the Homer district they are not described in this report.

The next oldest formation in the district is the coal-bearing Kenai formation, which is of Tertiary age, and on the basis of plant fossils has been placed in the Eocene series (Smith, 1939, p. 61). Rocks of this formation are exposed almost continuously in the beach bluffs between the head of Kachemak Bay and Fritz Creek. They are exposed at intervals in the steep escarpment north of Homer, between Fritz Creek and Bluff Point, along the shore of Kachemak Bay from Bluff Point nearly to Anchor Point. Key beds have been traced and individual stratigraphic sections correlated over most of this distance (Barnes, 1949; Cobb, 1950). Rocks of the Kenai formation are exposed also in the beach bluffs along Cook Inlet from the vicinity of Cape Starichkof to a point within a few miles of the mouth of the Kasilof River (Cobb, 1951). Isolated outcrops have been mapped in the valleys of the Ninilchik and Anchor Rivers and Deep Creek and on the upland between Homer and the Anchor River. Reconnaissance, both aerial and ground, has shown the presence of large areas underlain by Tertiary rocks in the drainage basin of the Anchor River, on Bald Mountain northwest of McNeil Canyon, in the valleys of the Fox River and its tributaries from the west, and in the valley of Fox Creek. Small areas in the Caribou Hills and near the head of Tustumena Lake are underlain by rocks of the Kenai formation. D. B. Krinsley of the Alaska Terrain and Permafrost Section of the Geological Survey reported Tertiary rocks northeast of Ptarmigan Head and in the valley of a tributary of Deep Creek near Ninilchik Dome also (Personal communications, October, 1951).

The Kenai formation consists of partly indurated sand, silt, and clay in interfingering lenses and beds, with interstratified thin conglomerate lenses and many beds of subbituminous coal and lignite less than 6 feet thick. Ferruginous masses are fairly abundant in the formation in the southern part of the district, but are scarcer north of Ninilchik. Stratigraphic sections measured in various parts of the Homer district are similar except that the proportion of sandstone increases and coal beds become scarcer northward. In the southern two-thirds of the district it is difficult to find a 150-foot stratigraphic section that does not contain at least one coal bed, but in the northern third several 200-foot barren sections were measured. The total thickness of the formation is not known, as neither the top nor bottom has been identified. The maximum known thickness is about 3,450 feet (Cobb, 1950, p. 4), which is the cumulative thickness of stratigraphic sections measured between Anchor Point and the head of Kachemak Bay. The 2,000-foot section exposed south of Ninilchik and other beds between Deep Creek and Cohoe probably duplicate parts of the section east of Anchor Point, but the amount of duplication cannot be estimated because of the lack of recognizable key beds for correlation across concealed intervals and across faults of unknown displacement (Cobb, 1951, p. 5). Results of field work done in 1951 indicate that the total thickness of the formation probably is much more than 3,450 feet, but data are inadequate to calculate it accurately. The total thickness of the Kenai formation is probably more than 5,000 feet.

Beds in the northernmost outcrops mapped to date as Kenai formation about 7 miles south of Cohoe, appear to be much younger than Tertiary strata mapped in most parts of the Homer district (Cobb, 1951, p. 5) but were not separated from other Tertiary rocks on the geologic map of the district (pl. 2). Rocks exposed in the valley of Crystal Creek may be correlative with those south of Cohoe, but data are inadequate to make such a correlation certain. The rocks near Crystal Creek are visible only in a steep bank at the bottom of a deep canyon and are separated from exposures of pre-Quaternary rocks by glacial deposits and vegetation-covered slopes. They comprise about 35 feet of coarse conglomerate, sand, siltstone, silty claystone, and carbonized wood fragments, all of which appear to grade upward into till. No definite contact between undoubtedly glacial and pre-glacial deposits could be determined. The relatively steep dip (20° to 25°) of the strata in the lower part of the exposure, as well as the presence of carbonized wood fragments identical in appearance with those exposed 7 miles south of Cohoe, indicate that these beds are considerably older than the overlying glacial deposits. These rocks have been mapped as part of the Kenai formation, although it is recognized that they may be younger than Eocene, possibly correlative with the Miocene or Pliocene rocks that are on Kodiak Island described by Capps (1937, pp. 153-155).

Individual strata in the Kenai formation, including the coal beds, are all lenticular and vary greatly in thickness and character within very short distances. For example, a sandstone bed that is 10 feet thick in one measured section may be represented in another section less than

than a quarter of a mile away by a siltstone bed 3 feet thick. Such rapid local changes indicate variable environmental conditions in any given small part of the basin of deposition of the Kenai formation. On the other hand, the general similarity of stratigraphic sections measured in different parts of the district, but representing deposition at approximately the same time, indicates that general conditions throughout the basin of deposition were fairly uniform. Likewise, the general monotonous similarity of stratigraphic sections representing deposition at different times, even in neighboring parts of the basin of deposition, indicates that general conditions were constant throughout the time during which the Kenai formation was being deposited.

Quaternary deposits cover most of the area up to the base of the Kenai Mountains. This base forms the eastern boundary of the Homer district. Quaternary deposits comprise till, outwash, ice-contact deposits, modern stream and beach gravels, landslide debris at the foot of beach bluffs, estuarine deposits near the north limits of the district, eolian deposits mantling most of the area, and colluvium and frost-heaved rubble. The Quaternary mantle ranges in thickness from a few inches on some of the upland surface north and northwest of Homer to several hundred feet in what are probably buried stream channels. Colluvium and rubble effectively mask the Tertiary bedrock nearly everywhere--even where the total thickness of Quaternary material is only a few feet. With the exception of a large landslide above the beach near Bluff Point, and of outwash gravels capping Ohlson Mountain, Quaternary deposits have not been

13

mapped separately in this report. Forthcoming reports by members of the Alaska Terrain and Permafrost Section of the U. S. Geological Survey will include descriptions of the Quaternary geology of the Kenai lowland.

STRUCTURE

The structure of the Homer district is relatively simple and is characterized by gentle folds in which dips are less than 20°, and generally less than 8°, superposed on a regional structure in which the strike is roughly parallel to the beach bluffs and the dip landward (Barnes, 1949, pp. 4-5; Cobb, 1950, pp. 5-6; Cobb, 1951, pp. 6-8). In most of the isolated inland outcrops, dips are toward the Kenai Mountains. Near Crystal Creek, however, where a dip of 20°-25° was measured, the direction of dip is to the west, away from the mountains. In one area on Deep Creek also, dips are steeper than in the coastal part of the area, the beds having been folded into two fairly sharp anticlines separated by a narrow syncline. The maximum dip measured in the valley of Deep Creek is 19°, on the west limb of the syncline. Although no faults were observed, the possibility that faulting may have complicated the structure in this part of the area cannot be discounted, as exposures are not continuous and Deep Creek was traversed only in a rapid reconnaissance.

Along the shores of both Cook Inlet and Kachemak Bay many high-angle faults cut the Kenai formation (Barnes, 1949, p. 5; Cobb, 1950, p. 6; Cobb, 1951, p. 7). Exposures away from the beach bluffs are not continuous enough to determine the presence or absence of similar faulting in the interior of the district, but, by analogy, it may be assumed that such

faults exist and would complicate mining. The steep dip of beds exposed in the valley of Crystal Creek may be a combination of original dip and post-depositional uplift of the Kenai Mountains; faulting, however, is probably at least partly responsible for the present attitude of the rocks.

COAL BEDS

The coal of the Homer district occurs in many beds, all less than 6 feet thick and distributed throughout the thickness of the Kenai formation (Barnes, 1949, p. 6; Cobb, 1950, pp. 6-7; Cobb, 1951, pp. 8-9). In the northern part of the district, however, coal beds are thinner, bonier, and more widely separated.

In fresh exposures the coal is generally dull black with many bright lustrous bands and streaks. Some beds are wholly or partly made up of flattened coalified tree limbs and trunks, some of which are so well preserved and so little altered as to retain original grain structure and to split like wood. In weathered exposures the woody structure is much more pronounced than on fresh surfaces and results in a platy fracture parallel to the bedding. Locally the coal has a prominent cleat and a poorer one at right angles to it; both are normal to the bedding. The strike of the prominent cleat is remarkably uniform throughout the district, all measurements falling between N. 40° W. and N. 60° W.

Analyses of coal samples collected by the writer in 1950 and 1951 are given in table 1. Study of all available analyses, including those published in previous reports on the Homer district (Barnes, 1949, p. 8; Cobb, 1951, p. 10), show two of the samples analyzed to be lignite and

Table 1. Analyses of coal from Homer district, Alaska
(Analyses by H. M. Cooper and R. F. Abernethy, U. S. Bureau of Mines)

Lab. no.	Locality no. (Plate I)	Air-drying loss	Form of analysis[1]	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Heating value B.t.u.	Thickness of sample (ft.)	Coal in sample (ft.)
D-51009	I	13.8	A	26.0	34.2	27.8	12.0	0.2	7260	6.07	5.68
			B	14.1	39.7	32.3	13.9	0.2	8420		
			C		46.2	37.6	16.2	0.2	9800		
			D		55.1	44.9		0.3	11700		
D-49804	II	14.2	A	27.0	34.5	28.8	9.7	0.2	7590	4.08	4.08
			B	14.9	40.2	33.6	11.3	0.2	8850		
			C		47.3	39.4	13.3	0.3	10390		
			D		54.5	45.5		0.3	11980		
D-49015	III	11.3	A	27.0	35.3	30.0	7.7	0.2	7800	3.30	3.30
			B	17.7	39.8	33.8	8.7	0.2	8800		
			C		48.3	41.2	10.5	0.2	10690		
			D		54.0	46.0		0.3	11950		
D-48110	IV	7.7	A	22.1	31.2	24.1	22.6	0.2	6550	3.90	3.30
			B	15.6	33.8	26.1	24.5	0.2	7100		
			C		40.1	30.9	29.0	0.3	8410		
			D		36.4	43.6		0.4	11850		
D-48905	V	8.5	A	21.2	35.6	27.8	15.4	0.3	7920	3.42	3.17
			B	13.9	38.9	30.4	16.8	0.3	8650		
			C		45.1	35.4	19.5	0.4	10050		
			D		56.1	43.9		0.5	12480		
D-70511	VI	11.3	A	24.1	35.1	32.1	8.7	0.2	8280	2.91	2.91
			B	14.4	39.6	36.2	9.8	0.3	9340		
			C		46.2	42.4	11.4	0.3	10900		
			D		52.2	47.8		0.3	12310		
D-71164	VII	11.0	A	22.6	33.3	27.1	17.0	0.4	7350	4.40	4.40
			B	13.0	37.4	30.5	19.1	0.5	8260		
			C		43.0	35.1	21.9	0.6	9490		
			D		55.0	45.0		0.7	12160		
D-70512	VIII	11.9	A	22.6	31.7	26.2	19.5	0.3	6980	4.39	4.32
			B	12.1	36.0	29.8	22.1	0.3	7920		
			C		40.9	33.9	25.2	0.3	19010		
			D		54.7	45.3		0.5	12040		
D-70513	IX	19.8	A	30.3	33.3	30.3	6.1	0.1	7400	3.45	3.45
			B	13.1	41.5	37.8	7.6	0.1	9230		
			C		47.8	43.4	8.8	0.2	10630		
			D		52.4	47.6		0.2	11650		
D-71165	X	14.1	A	23.4	33.1	27.3	16.2	0.4	7290	1.70	1.70
			B	10.8	38.5	31.9	18.8	0.5	8480		
			C		43.2	35.7	21.1	0.5	9510		
			D		54.7	45.3		0.7	12050		

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

the rest subbituminous coal, according to present standards of classification (Cooper, et al., 1946, pp. 21-22). The average heating value of all coal analyzed is about 8,875 B.t.u., air-dried, and the ash content ranges from 4.0 to 24.5 percent.

COAL RESERVES

In the classification of public lands the Geological Survey (Smith, et al., 1913, pp. 69-70) considers to be coal-bearing those lands underlain by coal with a heating value of 10,000 B.t.u., air-dried, and with a minimum thickness of 1.5 feet. Coal of a lower heating value must be correspondingly thicker in order for the lands to be classed as coal-bearing. Barnes (1949, pp. 9-12) and Cobb (1950, pp. 7-9), on the basis of the analyses then available, used a minimum thickness of 2.0 feet in calculating reserves for the southern and southwest margins of the Homer district. Cobb (1951, pp. 10-12), on the basis of new data on the heating value of coal north of Anchor Point, used a minimum thickness of 3.0 feet in calculating reserves for the northwest margin of the district. Under present economic conditions, however, it is doubtful that a bed less than 4 feet thick could be mined profitably by underground methods in the Homer district, although thinner beds might be minable by stripping. In the calculation of reserves in the present report (table 2), a minimum thickness of 3.0 feet has been used, though in some instances this may lead to an over-optimistic picture of reserves of minable coal.

As in previous reports on the Homer district, the thickness of each individual bed has been corrected for partings by the pricing method used by the U. S. Geological Survey (Smith, et al., 1913, p. 70), which is based on the premise that a given amount of coal in two or more benches is less valuable than if in a single bed. Each acre-foot of coal was assumed to weigh 1,750 tons. In the absence of information on the inland extensions of potentially minable coal beds exposed in the beach bluffs, the tonnage figures in table 2 were computed on the assumptions that each bed extends inland for a distance equal to half the known length of outcrop and that each bed maintains the same average thickness as at the outcrop. No reserves were calculated for coal exposed below high tide level. For beds exposed inland from the beach bluffs reserves were calculated on the assumptions that each bed underlies one quarter section (160 acres), except where there was definite evidence for the use of some other figure, and that each bed maintains the same average thickness as at the outcrop. Reserve estimates by Barnes (1949, p. 14) and Cobb (1950, p. 9; 1951, p. 12) were used, except that all reserves for coal beds less than 3.0 feet thick have been omitted. Estimates for additional beds in the areas covered by the older reports have been added where new data have made this possible.

More than half of the indicated reserves shown in table 2 are in T. 6 S., R. 14 W. This is due in large part to the fact that this township has been more thoroughly examined than any other in the Homer district. Of the more than 35,000,000 tons calculated as reserves in beds more than 3 feet thick in this township, about 25,000,000 tons are

Table 2. Indicated coal reserves in part of the Homer district, Kenai coal field, Alaska

Township and coal beds	Aggregate area (acres)	Tons	Totals (tons)
T. 2 N., R. 12 W.			
1 bed, 3.0 - 3.9 feet	113	734,000	734,000
T. 1 N., R. 12 W.			
1 bed, 3.0 - 3.9 feet	89	578,000	578,000
T. 1 N., R. 13 W.			
1 bed, more than 4 feet	6	50,000	
4 beds, 3.0 - 3.9 feet	123	734,000	784,000
T. 1 S., R. 14 W.			
2 beds, more than 4 feet	45	333,000	
2 beds, 3.0 - 3.9 feet	27	151,000	484,000
T. 2 S., R. 13 W. (unsurveyed)			
3 beds, more than 4 feet	480	3,640,000	
3 beds, 3.0 - 3.9 feet	480	3,024,000	6,664,000
T. 2 S., R. 14 W.			
5 beds, more than 4 feet	521	4,223,000	
3 beds, 3.0 - 3.9 feet	90	477,000	4,700,000
T. 3 S., R. 14 W.			
1 bed, more than 4 feet	26	210,000	
4 beds, 3.0 - 3.9 feet	116	650,000	860,000
T. 4 S., R. 11 W. (unsurveyed)			
1 bed, more than 4 feet	231	1,981,000	1,981,000
T. 5 S., R. 11 W.			
1 bed, 3.0 - 3.9 feet	135	709,000	709,000
T. 5 S., R. 12 W.			
2 beds, more than 4 feet	382	2,767,000	
3 beds, 3.0 - 3.9 feet	689	3,705,000	6,472,000
T. 5 S., R. 13 W.			
1 bed, more than 4 feet	160	1,250,000	
1 bed, 3.0 - 3.9 feet	80	546,000	1,796,000
T. 5 S., R. 14 W.			
1 bed, 3.0 - 3.9 feet	20	136,000	136,000
T. 5 S., R. 15 W.			
1 bed, 3.0 - 3.9 feet	6	40,000	40,000
T. 6 S., R. 13 W.			
2 beds, 3.0 - 3.9 feet	450	2,747,000	2,747,000
T. 6 S., R. 14 W.			
5 beds, more than 4 feet	4,654	32,658,000	
4 beds, 3.0 - 3.9 feet	422	2,360,000	35,018,000
T. 6 S., R. 15 W.			
2 beds, 3.0 - 3.9 feet	107	600,000	600,000
GRAND TOTAL			64,303,000

in the Cooper bed, which has been mined by the Homer Coal Corp. and its predecessors. This bed has been traced for more than 3 miles in the beach bluffs. Another 7,000,000 tons has been calculated as the reserves of the bed traced in secs. 2, 3, 10, 11, and 12. The Cooper bed is under too deep a cover to be exploited by strip mining, but the bed in the northeast part of the township possibly can be stripped along its outcrop and might yield several hundred thousand tons. Most of the area underlain by this bed, however, probably could not be stripped economically, as overburden reaches a thickness of 200 to 300 feet. The only other reasonably accessible area in the district where more than very small stripping operations might be carried out is in the lower valley of Deep Creek (pl. 4). Data are inadequate for even a rough estimate of the possible reserves of stripping coal there.

The tonnage figures given in table 2 are conservative and probably represent only a small fraction of the total coal in beds more than 3 feet thick in the Homer district, but available data do not warrant estimates for entire townships or for the district as a whole. Considerable exploratory drilling and trenching will be required before reserves of the inland areas can be estimated with any degree of accuracy.

REFERENCES

Barnes, F. F., 1949, Coal investigations on the southern margin of the Homer district, Kenai coal field, Alaska, in 1947-48: U. S. Geol. Survey, 12 pp., 4 pls., 1 fig. (mimeographed).

Capps, S. R., 1937, Kodiak and adjacent islands, Alaska: U. S. Geol. Survey Bull. 880-C, pp. 111-183.

Cobb, E. H., 1950, Coal investigations on the southwest margin of the Homer district, Kenai coal field, Alaska, in 1949: U. S. Geol. Survey, 10 pp., maps and sections (mimeographed).

Cobb, E. H., 1951, Coal investigations on the northwest margin of the Homer district, Kenai coal field, Alaska, in 1950: U. S. Geol. Survey, 13 pp., 3 pls. (mimeographed).

Cooper, H. M., Snyder, N. H., Abernethy, R. F., Tarpley, E. C., and Swingle, R. J., 1946, Analyses of mine, tipple, and delivered samples, in Analyses of Alaska coals: U. S. Bur. Mines Tech. Paper 682, 114 pp.

Martin, G. C., Johnson, B. L., and Grant, U. S., 1915, Geology and mineral deposits of Kenai Peninsula, Alaska: U. S. Geol. Survey Bull. 587, 243 pp.

Park, C. F., Jr., 1933, The Girdwood district, Alaska: U. S. Geol. Survey Bull. 849-G, pp. 381-424.

Smith, G. O., and others, 1913, The classification of the public lands: U. S. Geol. Survey Bull. 537, 197 pp.

Smith, P. S., 1939, Areal geology of Alaska: U. S. Geol. Survey Prof. Paper 192, 100 pp.