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COAL DEPOSITS IN THE VALLEY OF THE HEALY RIVER, ALASKA

by

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Accompanied by 6 Figures

R.D. Stewart
(His Copy)

INTRODUCTION

During the summer of 1944, the Geological Survey examined coal deposits in the valley of the Healy River, Alaska. An area extending 7 miles along the Healy River, east of the Suntrana mine, and from $\frac{1}{4}$ mile to 2 miles wide, was surveyed on a scale of 1:4800 (1 inch equals 400 feet). Detailed sections were measured on all large exposures of coal-bearing rocks along the Healy River. The field work was done during July through October by Clyde Wahrhaftig and Jacob Freedman, assisted by David M. Hopkins, Charles K. Currey, and Milton Morsing, and under the supervision of George O. Gates.

A party of the Bureau of Mines spent several weeks in the valley in 1943 and 1944, trenching the coal beds. Information gained from these trenches has been incorporated in the report.

The authors wish to acknowledge the kindness and cooperation of residents of the valley, in particular Messrs. A. E. Lathrop, James Newlan, and Charles E. Garrett, of the Healy River Coal Corporation, and T. E. Sandford, Joe Gagnon, and John Fern.

The Healy River is a westerly flowing stream on the north flank of the Alaska Range in east-central Alaska (fig. 1). It flows into the Nenana River at the station of Healy on the Alaska Railroad. Coal-bearing rocks lie along the lower 12 miles of the river. Healy is 112 miles from Fairbanks and 244 miles from Anchorage by railroad. From Healy, a spur line from the Alaska Railroad extends 4 miles up the Healy River to the Suntrana mine. An automobile road extends above the Suntrana mine for an additional 3 miles, and the entire length of the coal field is accessible by team and wagon and by tractor by way of river bars.

Coal has been known in the valley of the Healy River since 1898[1]. Brooks and Prindle[2] briefly examined the area geologically and described the coal beds in 1902. Capps[3] made further reconnaissance investigations in 1910.

The Healy River Coal Corporation opened a coal mine in the west bank of the Nenana River on the Alaska Railroad in 1920. The mine was operated until July 1922. About that time the Suntrana mine was opened by the same company, and, since the completion of a spur from the railroad in October 1922, has been in continuous production. In 1923, R. F. Roth acquired a lease on 2,080 acres at the east end of the coal deposits on the Healy River. He mapped and prospected the deposits and collected samples. No coal was produced from this ground and the lease has now lapsed.

In the spring of 1944, T. E. Sandford and Emile Usibelli contracted, under a U. S. Army coal license, to produce coal by strip mining from land on the Healy River east of the Suntrana mine.

The total production of coal from the valley of the Healy River through 1944 was 1,775,750 short tons.

1/ Collier, A. J., The Coal Resources of the Yukon, Alaska: U. S. Geol. Survey Bull. 218, p. 46, 1903.

2/ Brooks, A. H., and Prindle, L. M., The Mount McKinley region, Alaska: U. S. Geol. Survey Prof. Paper 70, pp. 188-192, 1911.

3/ Capps, S. R., The Bonnifield region, Alaska: U. S. Geol. Survey Bull. 501, 1912.

GEOLOGY

Stratigraphy

Birch Creek Schist

The oldest formation exposed in the valley of the Healy River is the Birch Creek schist, of supposed pre-Cambrian age4/. It consists in general of highly contorted quartz-mica and quartz-chlorite schist, cut by numerous veins of milky quartz. It ranges in color from light gray, through shades of gray and green, to black. The black schist, which is particularly abundant in a belt north of Gagnon Creek and the Healy River, (fig. 3) can be mistaken for coal when seen from a distance.

Coal-bearing formation

The coal-bearing formation in the valley of the Healy River consists of sandstone, conglomerate, siltstone, claystone, shale, and coal. The clastic sediments in the coal-bearing formation are poorly to moderately consolidated. The coal is subbituminous. The age of the coal-bearing formation has been determined as probably Miocene, on the basis of fossil fish5/. For purposes of discussion the coal-bearing formation is here divided into three members.

The lower member includes all the coal-bearing formation below the base of coal bed No. 1 (also known locally as the Mammoth bed) (fig. 4). This member ranges in thickness from 50 feet at French Gulch (fig. 2) to 1,500 feet at the east end of the field. It was deposited on an uneven erosion surface cut in Birch Creek schist, hills of which reach almost to the top of the lower member. The member is characterized by abrupt lateral change in lithology and by abrupt thickening and thinning of individual beds. Coal beds are numerous in this member, and some are as much as 30 feet thick, but the beds are not persistent. Consequently correlations between coal outcrops in this member are difficult, and at many points are open to considerable question.

The schist immediately beneath the unconformity is everywhere deeply weathered. Where the decomposition is most nearly complete, near the unconformity, the schist is a soft, sticky, creamy white to buff-colored mass of loose quartz grains in a sericite "paste". Landslides develop readily in this material. In places the weathered zone extends to a depth of several hundreds of feet below the base of the Tertiary rocks.

East of Suntrana the base of the formation is marked by a thin layer of conglomerate, consisting of angular fragments of quartz, as much as an inch in diameter, in a fine silty matrix, that commonly contains large amounts of sericite, and in many places some carbonaceous matter. At Suntrana the basal conglomerate contains pebbles of moderately fresh schist, and numerous fragments of quartzite, chert, and angular quartz.

4/ Capps, S. R., Geology of the Alaska Railroad region: U. S. Geol. Survey Bull. 907, pp. 95-97, 1940.

5/ Capps, S. R., op. cit., p. 122.

The sandstone in this member can be divided into two facies. One facies is buff to yellow sandstone, consisting almost entirely of quartz and weathered mica, which was derived from nearby weathered Birch Creek schist. This facies makes up most of the section below the Moose bed (fig. 4) east of Cripple Creek, and forms the sandstone beds at the mouth of Dora Creek (figs. 2 and 4). The other facies is coarse, light gray sandstone, consisting of grains of quartz, quartzite, and chert, and locally including pebbles of the same rocks and minerals. The pebbles commonly are in lenses and discontinuous layers ranging from 6 inches to several feet in thickness. The sandstone beds shown in section C, figure 4, in this member, are of this facies. A thick bed of conglomerate of this facies lies below coal bed No. 1 in the Suntrana mine. This conglomerate lenses out to the east, and is absent at Cripple Creek and Coal Creek. It reappears on the Healy River east of Coal Creek (fig. 4).

The upper half of the lower member of the coal-bearing formation is characterized by claystone and siltstone. A thick and persistent sequence of yellow-brown varved silt and clay occurs between the F and G beds in the Suntrana mine and immediately above the Moose bed in the eastern part of the coal-bearing area (fig. 4).

Coaly material occurs in the sandstone as thin cross-cutting or wavy stringers and lenses. The coal beds of this member are described in the section on coal deposits.

The middle member of the coal-bearing formation includes beds between the base of coal bed No. 1, and the top of coal bed No. 6 (fig. 4). Its known thickness ranges from 600 feet at Suntrana Creek to 1065 feet at Coal Creek, 7 miles east. This change in thickness is due chiefly to increases in the thickness of the clastic beds in the member. The coal beds, as a result, are farther apart stratigraphically in the eastern part of the field than in the western part. This spreading of the beds is reflected by divergence of gangways on beds Nos. 4 and 6 in the Suntrana mine (fig. 2). The thicker coal beds in this member are continuous for at least 8 miles along the strike. Coal bed No. 6 has been recognized for 12 miles along the strike.

In general, the deposition of the middle member was cyclic, parts of seven cycles being represented at Suntrana. Individual cycles consist, in general, of coarse cross-bedded sandstone at the base, containing pebble beds and scattered pebbles, overlain by silt and clay, which in turn is overlain by coal. The coarse sandstone, composed of quartz and black chert, has a "salt-and-pepper" aspect close at hand, but appears white from a distance. At most places a zone of interbedded and cross-bedded fine sandstone and silt overlies the coarse sandstone, with a gradational contact. The silt and fine sandstone grade upward into gray and green clay, in places shaly. In some places the zone of interbedded silt and sandstone is absent, and the clay rests directly on coarse sandstone. The clay is micaceous and silty in places, and contains numerous scattered carbonized rootlets. It grades sharply through carbonaceous claystone and bone to coal above. The clay beds are commonly less than 10 feet thick, although in places as much as 40 feet of clay is below the coal.

The coal beds of this member are described in the section on coal deposits.

The upper member of the coal-bearing formation, including that part of the formation between the top of coal bed No. 6 and the base of the Nenana gravel, ranges in thickness from 515 feet, 3 miles west of Suntrana, to 945 feet at Coal Creek. It contains no coal beds now of economic importance. Like the middle member, it consists of a cyclic repetition of sandstone, siltstone, shale, claystone, and coal beds. However, the coal beds, unlike those below, are thin, woody, and apparently discontinuous.

Individual cycles consist of coarse, cross-bedded, pebbly sandstone at the base, overlain by and transitional with interbedded greenish silt and clay, commonly containing two or three thin coal beds. The coal is bony and woody. Flattened coalified twigs can be picked out of the upper parts of most of the coal beds. The sandstone is buff in color, and is composed of grains of quartz and chert, with variously colored grains of other rocks and minerals.

At the top of the coal-bearing formation, and immediately beneath the base of the Nenana gravel, is a persistent bed of green to gray claystone and shale, with some thin sandstone layers in the upper part.

The middle and upper members of the coal-bearing formation were distinguished on the basis of the relative proportions of pebbles of different composition in the lower parts of the sandstone beds. Pebble counts were made at numerous localities throughout the valley of the Healy River; the results of these counts are indicated by "star" diagrams to the right of each of the stratigraphic sections in figure 4. The circle at the center of each diagram is directly opposite the place in the section where the sample studied was collected. From a study of these diagrams it will be seen that the pebbles in the sandstone of the middle member, as well as of some of the sandstone and conglomerate beds of the lower member, are composed largely of quartz, quartzite, chert, and argillite, with minor amounts of schist and greenstone. Pebbles of all other types are rare or absent. Above coal bed No. 5 pebbles of granite, volcanic rocks, and a few other types occur in small though significant amounts. Above coal bed No. 6 pebbles of granite, graywacke, volcanic rocks, and dark green ophitic diorite are very abundant. Pebbles of the last-named rock are diagnostic of parts of the coal-bearing formation and the Nenana gravel. This diorite is green, commonly rusty on the surface, and is course grained. It consists of euhedral crystals of andesine in a mass of dark green minerals. A black metallic mineral, probably ilmenite, can usually be recognized in hand specimens. Under the microscope the feldspar is seen to be almost completely altered to epidote and chlorite. Pyroxene is the common ferromagnesian mineral. Interstitial quartz constitutes as much as 15 percent of the rock.

In general, below coal bed No. 5 at least 70 percent and in most places more than 80 percent of the pebbles are composed of quartz, quartzite, chert, and argillite. Between coal beds Nos. 5 and 6, 70 to 90 percent of the pebbles commonly are composed of these rocks. Above coal bed No. 6, in pebble samples taken near the base of sandstone beds, less than 70 percent and in most places less than 60 percent of the pebbles are composed of these rocks. Care must be used in making the pebble counts; samples should include 100 pebbles and should be taken as close to the base of the sandstone as possible. It has been found that pebble counts of small or scattered pebbles in the upper parts of sandstone beds in the upper member are relatively high in quartz, quartzite, and chert. Pebble counts should be used in conjunction with other criteria, such as the color of the sandstone and the presence or absence of thick coal beds, for distinguishing the members.

Nenana gravel

The thick, poorly consolidated conglomerate overlying the coal-bearing formation has been named the Nenana gravel by Capps6/. The Nenana gravel lies conformably on the coal-bearing formation in the valley of the Healy River and therefore dips parallel to the underlying beds. At least 4,000 feet of Nenana gravel is exposed in the hills north of the Healy River. The most common rock types represented by pebbles in the Nenana gravel are graywacke and conglomerate. Below 900 feet stratigraphically above its base, the gravel is characterized by an abundance of pebbles of light blue dacite with prominent phenocrysts of quartz and feldspar, and by the absence of pebbles of the green ophitic diorite described above. Between 900 feet and 1,900 feet above the base, the Nenana gravel contains pebbles of both dacite and the green ophitic diorite. Above 1,900 feet, dacite is absent, and the green ophitic diorite is very abundant. The lower 2,700 feet of the Nenana gravel is brown, and contains numerous lenses of cross-bedded sandstone. Above 2,700 feet the Nenana gravel is generally dark red, and contains numerous, evenly spaced, thin beds of purplish clay that are commonly overlain by a thin layer of fine white gravel.

Quaternary and Recent terrace gravels

The Healy River and its tributaries have cut several terraces across the tilted beds of the coal-bearing formation, Nenana gravel, and Birch Creek schist. These terraces are covered for the most part with a layer of coarse, poorly sorted, streamlaid gravel. On the lower terraces, from 10 to 40 feet above the river, the gravel cover generally is 5 to 10 feet thick. On the intermediate terraces, about 100 feet above the Healy River and Coal Creek, and including the 60-foot terrace on Cripple Creek, the gravel averages 20 feet thick. The thickness of the gravel on the extensive terraces about 200 feet above the streams ranges from 20 to 130 feet. The latter thickness includes a remnant of a large alluvial fan which was built by Coal Creek on the 200-foot terrace. This remnant lies on the upstream side of the creek, near its mouth.

The gravel on the terraces north of the Healy River and east of Gagnon Creek, and everywhere south of the Healy River, is composed of very coarse, subangular boulders of schist and quartz. On the north side of the river west of Gagnon Creek, gravel mantles a series of terraces which slope toward the river from hills of Nenana gravel. The gravel on these terraces is derived from the Nenana gravel and resembles it closely. Its lack of deformation, and the fact that it caps terraces, distinguish it from the Nenana gravel.

In many places the terrace gravel is overlain by a layer of brown windblown sand and silt, as much as 20 feet thick.

Structural geology

The Tertiary rocks in the valley of the Healy River are believed to be part of a fault block tilted approximately 35 degrees to the north. The faulting and tilting involve all rocks up to and including the Nenana gravel. The area of Tertiary rocks in the valley of the Healy River is bounded on the north by a fault with a

6/ Capps, S. R., The Bonnifield region, Alaska: U. S. Geol. Survey Bull. 501, p. 30, 1912.

stratigraphic displacement of about 3,000 feet. This fault trends N. 75° - 80° W., and dips 65° - 75° N. Birch Creek schist was upthrown and is exposed at the surface on the north side of the fault.

The axis of a large syncline involving the Tertiary sediments parallels the fault at distances of 1,500 to 2,000 feet to the south. (figs. 3 and 6). The beds on the south side of the fold strike N. 65° E. to E., and dip 25° - 40° N. The beds between the axis of the syncline and the fault strike N. 65° - 70° W. and dip 65° S. to vertical. Locally the beds are overturned. The beds bend sharply around the axis of the syncline, but to within a very short distance of the axis the strike and dip are remarkably constant. (fig. 3). The syncline plunges 20° to the west. Structure contours drawn on the base of coal bed No. 1 (fig. 5) show the configuration of the coal beds in the syncline. Vertical cross sections through the coal beds are shown in figure 6.

In places the coal beds are involved in minor drag folds and are faulted. Two minor folds were observed in the bluff on the south side of the Healy River; one involves coal beds near the base of the Tertiary coal-bearing formation in the SE$\frac{1}{4}$, sec. 12, T. 12 S., R. 6 W., and the other the Moose bed, in the SW$\frac{1}{4}$, sec. 12, T. 12 S., R. 6 W. (fig. 3). In the latter fold the thickness of the Moose bed appears to have been increased by thrusting. Both of these folds lie on the north limb of the syncline. The small coal beds between coal bed No. 5 and coal bed No. 6 are lacking in section L (fig. 4), exposed on the north side of the Healy River. They have apparently been cut out by faults which lie at a small angle to the bedding.

The calculated thickness of the coal-bearing formation in the valley of Gold Run is much less than the measured thicknesses on Coal Creek and Cripple Creek, on the opposite side of the syncline. It is believed that strike faulting has cut out part of the section. Exposures are not complete enough to indicate the position of the faults.

Several faults of small displacement cut coal beds in the New Hill crosscut tunnel of the Suntrana Mine, about 850 feet east of the entrance of the main cross-cut tunnel (fig. 2). When a gangway was driven on the F bed in the summer of 1944, this bed was found to be offset by numerous minor faults and rolls. These structures do not extend into the overlying beds. In the N. $\frac{1}{2}$, sec. 20, T. 12 S., R. 6 W. a fault and anticline are inferred on the basis of an anomalous outcrop just north of the east end of the road (fig. 2). Beds in this outcrop dip to the south. The steep dips of the coal beds south of the river in the E. $\frac{1}{2}$, sec. 19, T. 12 S., R. 6 W., suggest that the fault continues to the westward to this locality, but apparently dies out before reaching the next outcrops to the west. None of these anomalous dips and strikes can be explained by slumping or landsliding, because the beds are near the level of the river, and are overlain by undisturbed terrace gravel

MINERAL DEPOSITS

Coal deposits

The total thickness of coal in the coal-bearing sediments of the valley of the Healy River ranges from 185 feet at French Gulch to 375 feet at the east end of the coal-bearing area. The number of coal beds in the section ranges from 30 to 32, and the beds range in thickness from less than 1 foot to more than 55 feet.

Character of the coal

On the basis of proximate analyses (table 1), the coal in the valley of the Healy River is classified as subbituminous B and subbituminous C, according to the classification of the American Society for Testing Materials.[7] The coal is black and has a dark brown streak. It is generally dull in luster, except for the coal on the north flank of the syncline, which has a luster ranging from dull to bright. A layer of coal which has the appearance of a mat of flattened twigs commonly forms the upper few feet of the thick coal beds above coal bed No. 4. Nearly all the coal beds in the upper member of the coal-bearing formation are composed of the matted type of coal.

Most of the analyses have been of outcrop samples, and to draw conclusions from them as to the variation in rank of coal within the field is unsafe. Study of ash- and moisture-free heating values shows that, in general, the coal near the base of the formation is higher in heating value than that near the top. Analyses of coal taken from bed No. 6 at various places over a distance of 8 miles show no systematic variation in rank along the strike.

In computing reserves (see below) no attempt was made to classify the coal as to ash content, other than to eliminate beds of very bony coal. It is believed that all the coal included in the reserve estimates has an ash content of less than 20 percent. Most of the coal has an ash content of less than 10 percent, and much of it has an ash content of 4 to 8 percent.

Coal reserves

The beds of minable coal in the valley of the Healy River, with one exception, are within the two lower members of the coal-bearing formation. The beds in the middle member were correlated with ease, and the names given to these beds at Suntrana have been used throughout the field. The beds in the lower member were correlated with difficulty and some could not be correlated.

Coal beds which maintain a thickness of at least 4 feet between any two widely spaced outcrops were included in the tonnage calculations. It was assumed that the thickness of the coal beds changes uniformly between outcrops. Where only one exposure of a bed is known, as is true for some of the beds near the base of the formation, the probable extent of the bed was inferred from the correlation chart, and the geologic maps (figs. 2, 3, and 4). The volume of one ton of coal in place was assumed to be 25 cubic feet. In computing reserves only coal within 3,000 feet of the surface was included.

A total of approximately 850,000,000 tons of coal is indicated in the area shown in figures 2 and 3. An additional 215,000,000 tons of coal is inferred in this area. Approximately 70,000,000 tons of the indicated coal lies above an altitude of 1,700 feet east of French Gulch. Of the inferred coal, 25,000,000 tons is above 1,700 feet altitude and east of French Gulch. Approximately 460,000 tons of coal are believed to be minable by stripping. Table 2 gives the reserves, for individual beds, of coal above 1,700 feet in the area shown in figure 3. Insufficient data are available to calculate the reserves above 1,500 feet in the area shown in figure 2. Table 3 gives the size and location of coal deposits that are judged to be minable by stripping methods.

7/ Analyses of Illinois Coals; U. S. Bureau of Mines Technical Paper 641, p. 64, 1942.

Clay deposits

Numerous clay beds occur in the Tertiary coal-bearing formation and their use as a source for clay products has been suggested. Most of the clay is green or brown which suggests a high iron content. Where coal beds beneath the clay beds have burned, the clay is baked a bright red or brown. Most of the clay is immediately beneath coal beds, in beds generally less than 10 feet thick. Two persistent thick beds of clay are known in the Tertiary coal-bearing formation. One, in which the clay is varved, gritty, and brown, lies near the top of the lower member of the formation. The other lies near the top of the upper member. The upper clay bed is green, shaly in part, and has numerous layers of sand and silt in its upper part. This clay bed locally contains nodules of the bright blue hydrous iron phosphate, vivianite. White plastic clay is exposed at the base of coal bed No. 1 in Cripple Creek and Coal Creek. Its thickness, although unknown, is as least 4 feet.

TABLE 2

RESERVES OF COAL ABOVE ALTITUDE OF 1,700 FEET
AND EAST OF FRENCH GULCH

(area shown on fig. 3)

Designation of bed	Thickness (average)	Indicated coal reserves (short tons)	Inferred coal reserves (short tons)
Bed No. 1 (S. of axis of syncline)	50 ft.	25,000,000	
Bed No. 2 (" " " " ")	29 ft.	11,600,000	
Bed No. 3 (" " " " ")	13 ft.	4,900,000	
Bed No. 4 (" " " " ")	12 ft.	3,500,000	
Bed No. 5 (" " " " ")	10 ft.	2,200,000	
Lowest bed betw. beds nos. 5 and 6 (S. of axis of syncline)	5 ft.	600,000	
Bed No. 6 (S of axis of syncline)	18 ft.	3,000,000	
Bed at base of highest coarse sandstone member	5 ft.	300,000	
Coal beneath bed No. 1 (S. side of axis of syncline)		9,700,000	
Coal beneath bed No. 1 (S. side of axis of syncline)			18,000,000
Coal N. of axis of syncline		9,000,000	
Coal N. of axis of syncline			8,000,000
Total		69,800,000	26,000,000

95,800,000

TABLE 3

RESERVES OF STRIPPING COAL IN THE VALLEY OF THE HEALY RIVER, ALASKA, EAST OF FRENCH GULCH.

Location of coal	Measured coal (short tons)	Overburden (for measured coal only) (cubic yards)	Indicated coal (short tons)
Four blocks on middle fork Gold Run, SE¼ NE¼, sec. 10, T12S R6W.			15,600
Bed No. 1 (Mammoth), N. side Healy River in E½ SE¼, sec. 11 and W½ SW¼, sec. 12, T12S R6W.	11,094	3,024	
2nd bed below bed No. 1, N. side Healy River in W½ SW¼, sec. 12, T12S R6W.			2,000
Bed No. 1, S. side Healy River in SW¼ SW¼, sec. 12, T12S, R6W.			24,640
Bed No. 2, S. side Healy River in SW¼ SW¼, sec. 12, T12S R6W.			14,400
1st bed below bed No. 1, S. side Healy River in SW¼ SW¼, sec. 12, T12S R6W.			8,400
Moose bed, S. side Healy River in SE¼ SW¼, sec. 12, T12S R6W.			48,000
Basal bed, S. side Healy River, SE¼ SE¼, sec. 12, T12S R6W.			25,000
2nd bed above basal bed, S. side Healy River, S½ SE¼, sec. 12, T12S R6W.			4,000
3rd bed above basal bed, S. side Healy River in S½, sec. 12, T12S R6W.			1,900
Bed No. 4, S. side Healy River SE¼ SE¼, sec. 12, T12S R6W.	2,962	3,394	
Bed No. 5, S. side of Healy River, E. of Coal Creek, S½, sec. 11, N½ NW¼, sec. 14, T12S R6W.	9,885	9,153	

TABLE 3 - Continued.

Bed No. 1, W. side Coal Creek, NW$\frac{1}{4}$, sec. 14, T12S R6W.	17,410	4,224	
Bed No. 1, W. side Coal Creek, NW$\frac{1}{4}$, sec. 14, T12S R6W (2 blocks).			120,000
Bed No. 2, W. side Coal Creek, NW$\frac{1}{4}$, sec. 14, T12S R6W.			30,000
Moose bed, W. side Coal Creek, SW$\frac{1}{4}$, NE$\frac{1}{4}$, sec. 14, T12S R6W.			60,000
Bed No. 6, S. side of Healy River, W. of Coal Creek, in NE$\frac{1}{4}$ NE$\frac{1}{4}$, sec. 15, T12S R6W.	9,432	878	
No. 1 bed, W. side Cripple Creek, SW$\frac{1}{4}$, SW$\frac{1}{4}$, sec. 15, T12S R6W.			44,800
Bed No. 2, W. side Cripple Creek, W$\frac{1}{2}$ SW$\frac{1}{4}$, sec. 15, T12S R6W.			12,000
Bed No. 6, W. side Cripple Creek, E$\frac{1}{2}$, sec. 16, T12S R6W.			1,800
	50,783	20,673	412,540

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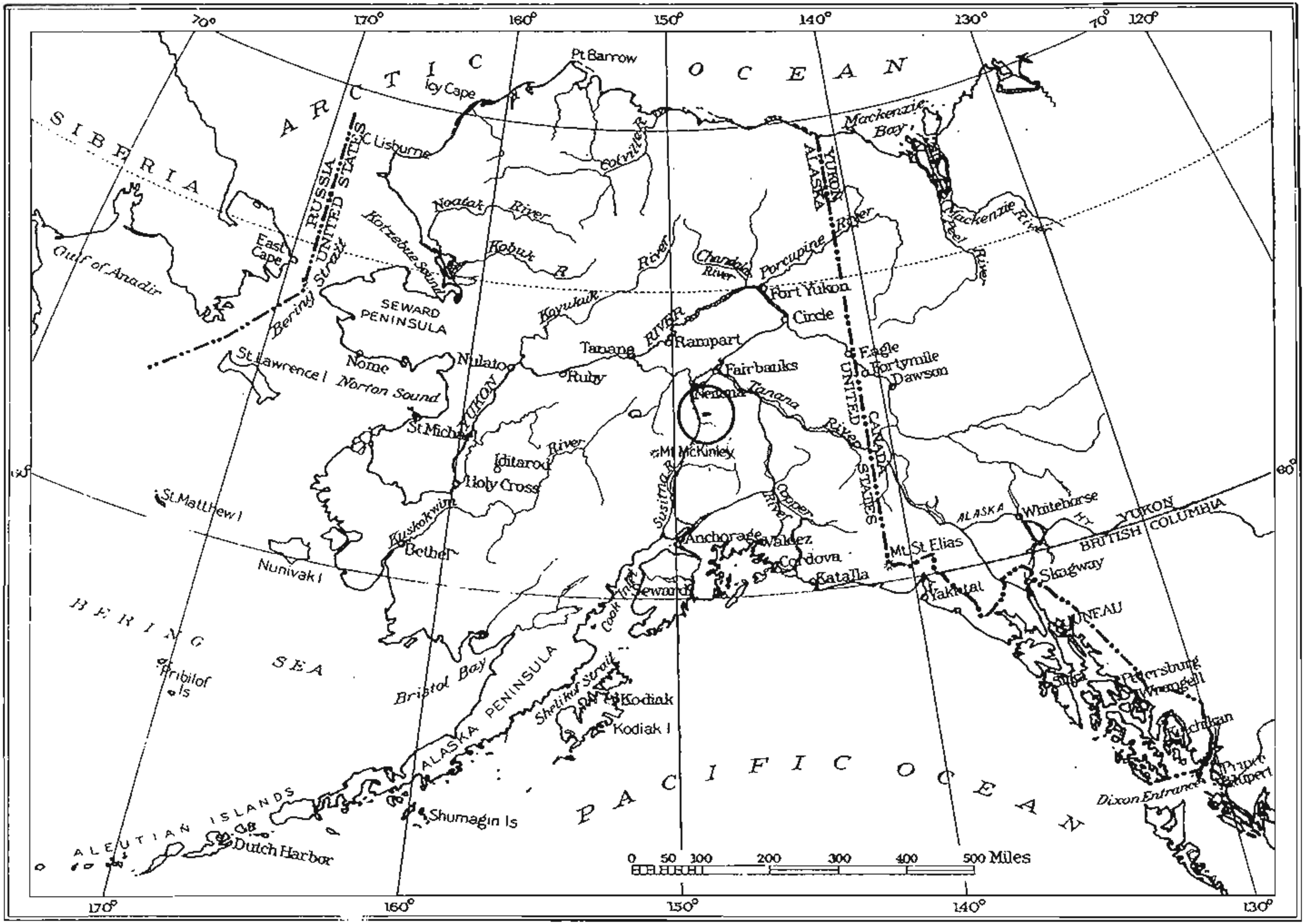

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Figure 1: Map of Alaska, showing location of the area covered