Geology and Coal Deposits, Jarvis Creek Coal Field, Alaska

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GEOLOGY AND COAL DEPOSITS, JARVIS CREEK COAL FIELD, ALASKA

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ABSTRACT

The Jarvis Creek coal field lies on the north side of the Alaska Range, between latitudes 63°35′ and 63°45′ N., and longitudes 145°40′ and 145°50′ W. It is 3 to 6 miles east of the Richardson Highway. The coal field is about 16 square miles in area, the major part of which is a rolling plateau that slopes gently northward and is bounded on the east, south, and west by bluffs facing Jarvis Creek, Ruby Creek, and the Delta River.

The oldest rock is the Birch Creek schist of pre-Cambrian age, which is largely quartz-sericite schist with many quartz veins, and is locally intruded by rhyolite dikes. It is overlain by the Tertiary coal-bearing formation. Quaternary deposits include gravel, till, solifluctional debris, and windborne deposits.

The coal-bearing formation of the Jarvis Creek coal field is correlated with the lower member of the coal-bearing formation on Healy Creek. In the south part of the coal field, it is divided into three stratigraphic units: (1) A basal lenticular bed, 500 feet in maximum thickness, consisting of micaceous sandstone and quartz conglomerate, derived from sources in Birch Creek schist southwest of the coal field; (2) a middle unit, 450 to 700 feet thick, of buff arkosic sandstone derived from areas north of the coal field, with interbedded shale and coal; and (3) an upper unit, about 900 feet thick, of dark-gray claystone, sandstone, and thin coal beds. The coal-bearing formation is warped into a north-trending structural basin. Dips around the border of the basin range from 5° to 10°.

Thirty coal beds were found, but most are thin and discontinuous. Reserves total 5.9 million tons of indicated coal and 7.5 million tons of inferred coal. Stripping reserves are estimated to be between 100,000 and 300,000 tons. The greater part of the coal reserves is in a 50-foot zone of coal and shale at the base of the middle stratigraphic unit. The coal field potentially contains about 75 million tons of coal. Based on outcrop samples, the coal has a heating value of between 8,000 and 9,000 Btu (as received) and an ash content of 5 to 13 percent. It is classified as subbituminous C.

INTRODUCTION

Location.—The Jarvis Creek coal field lies on the north side of the Alaska Range, between latitudes 63°35′ and 63°45′ N. and longitudes 145°40′ and 145°50′ W. (fig. 85). The coal field lies entirely within the Mount Hayes C–4 quadrangle as mapped by the United States Geological Survey. The coal deposits underlie a rolling plateau that is bounded on the east by the valley of Jarvis Creek and its tributary Little Gold Creek (pl. 10), on the west by the valley of the Delta River, and on the south by the canyon of Ruby Creek, a tributary of the Delta River. To the north, the plateau merges into an area of irregular, hummocky topography that extends to the base of Donnelly Dome, a prominent landmark about 5 miles north of the coal field.

The plateau has a maximum altitude of 4,397 feet at its southeast corner and slopes northwestward, at a gradient between 250 and 500 feet per mile, to a minimum altitude of 2,750 feet at its northern end. The floor of Jarvis Creek valley, in the section bordering the coal field, drops from 2,750 feet at the south end to 2,400 feet at the north end; and the corresponding reach of the floor of the Delta River valley drops from 1,900 feet to 1,700 feet. The east, south, and west fronts of the plateau are surmounted by steep bluffs 500 to 1,000 feet high. Although the plateau fronts drain directly into Jarvis Creek, Little Gold Creek, Ruby Creek and the Delta River, the northwest-sloping surface of the plateau is drained by Ober Creek, a small stream that heads near the center of the coal field and flows northward about 14 miles to join Jarvis Creek.

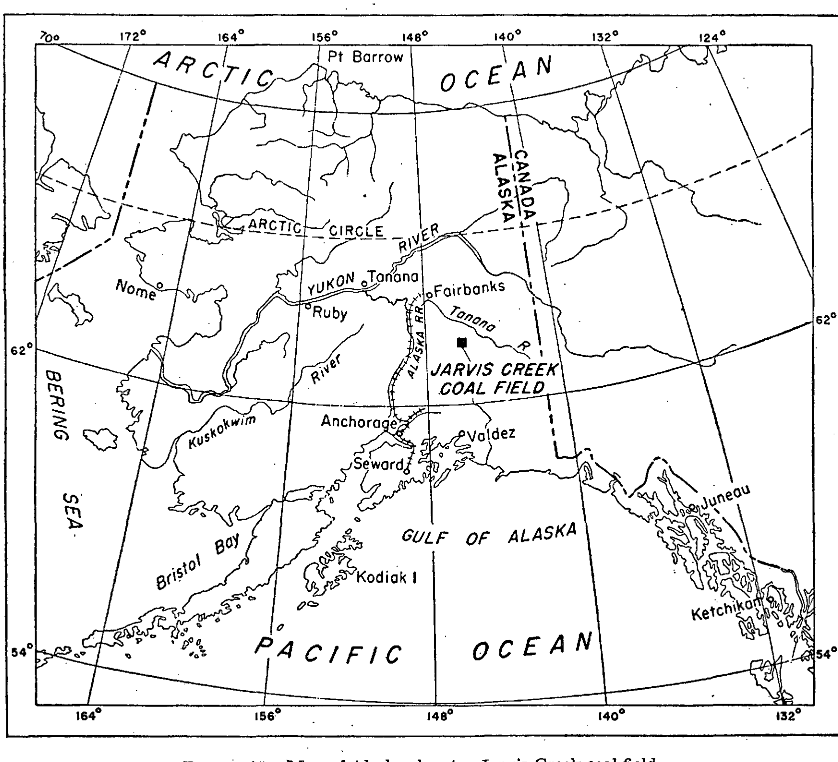

FIGURE 85.—Map of Alaska showing Jarvis Creek coal field.

The coal field lies 3 to 6 miles east of the Richardson Highway (pl. 10). A tractor trail leaves the highway about 3 miles north of Donnelly and extends 8 miles across the tundra and along Jarvis Creek to the mouth of Little Gold Creek. With moderate difficulty, this tractor trail could be improved into a truck road and extended to all parts of the coal field. The coal field has no permanent inhabitants. Donnelly, an Alaska Road Commission camp on the Richardson Highway, lies 3 miles west of the coal field. A single cabin is located on the northwest edge of the coal field.

Climate.—No climatological data are available from the immediate vicinity of the Jarvis Creek coal field; however, weather stations are maintained by the Civil Aeronautics Administration at Big Delta, 25 miles to the north; Gulkana, 90 miles to the south; and Tanacross, 80 miles to the east. All these stations are located in broad valleys, and their records probably do not reflect closely the weather prevailing in the coal field, which lies on the north side of the Alaska Range at a much higher altitude than any of the stations. However, their records probably indicate the average temperature of the coal field fairly closely and give a rough approximation of the amount of precipitation. Judging from the records of these stations, the monthly average temperature at the coal field probably ranges from about −5° F in December and January to 55° F in June and July, and the annual precipitation is between 12 and 18 inches, with more than 50 percent falling in the months of June, July, August, and September.

Vegetation.—The Jarvis Creek coal field is largely covered by tundra which consists of mosses, sedges, lichens, grasses, and low brush (chiefly dwarf birch, blueberries, cranberries, and various species of willows). Dense stands of brush up to 20 feet high, consisting of alders, willows, dwarf birch, and, locally, aspen, are found on fairly steep well-drained slopes. A few patches of spruce occur in the valleys of Jarvis and Ober Creeks and in the lower valley of Ruby Creek. The east wall of the Delta River valley is mantled with spruce timber, most of which are less than 18 inches in diameter.

Previous investigations.—Moffit (1942, p. 109) spent several days in the area in 1939, at which time he mapped the extent of the coal-bearing formation and measured a few of the coal beds. In 1944 Van Alstine and Black [1] spent two days in the area and took several coal samples.

Present investigations and acknowledgments.—The Jarvis Creek coal field was mapped in the period June 15 to July 18, 1946, by C. A. Hickcox, assisted by J. F. Harvey, and O. L. Smith, Jr. The geology was plotted on trimetrogon aerial photographs and detailed sections

[1] Van Alstine, Ralph, and Black, R. F., 1944, Coal deposits near Jarvis Creek: Memorandum report [in files of U. S. Geol. Survey].

of many outcrops were measured. A reconnaissance topographic and geologic map was prepared from the photographs by the Topographic Division with the aid of control points obtained by planetable surveying. In the period July 20–28 and August 4–8, 1951, the area was reexamined by Clyde Wahrhaftig, assisted by Allan Cox. The geologic contacts and outcrops were plotted on new base maps recently made available by the Topographic Division of the Geological Survey, Hickcox' sections were reexamined, and additional sections were measured.

Acknowledgments are due Mr. Marvin Williams of the Alaska Road Commission and Messrs. Charles De Witt and Del Hosler, of Fairbanks, Alaska, for help given during the 1946 season. Troy L. Péwé, of the Geological Survey, had several conferences in the field with Wahrhaftig and gave invaluable advice and assistance.

GEOLOGY

STRATIGRAPHY

PRE-TERTIARY ROCKS

The Birch Creek schist, of "early pre-Cambrian age" (Mertie, 1937, p. 55) is the oldest rock unit in the area. It is light-gray to greenish-gray quartz-sericite schist in which the quartz and sericite occur as alternating thin, sheetlike lenses less than a quarter of an inch thick. At some points it grades into almost pure quartzite and at others into almost pure mica schist. Bands of black carbonaceous schist, locally pyritiferous, are present in the Birch Creek schist on the north side of Ruby Creek near the western edge of the coal field, and near the forks of Little Gold Creek. Moffit (1942, p. 120) points out that the Birch Creek schist contains abundant quartz in the form of veins, both parallel to the foliation and at large angles to it.

The Birch Creek schist is a completely recrystallized and metamorphosed sequence of clastic sediments. It has both flow cleavage, resulting from the parallel orientation of platy minerals, and closely spaced fracture cleavage. Nearly all evidence of original sedimentary structure has been destroyed.

Several nearly vertical rhyolite dikes striking about N. 35° E. cut the Birch Creek schist on Ruby Creek, about 2 miles east of the Richardson Highway (pl. 10). These dikes are about 5 feet thick. These may be an offshoot of the porphyritic granodiorite that Moffit (1942, p. 123–126) mapped on Granite Mountain.

COAL-BEARING FORMATION OF TERTIARY AGE

LITHOLOGY

The coal-bearing formation in the Jarvis Creek coal field consists of a sequence of interbedded lenses of poorly consolidated sandstone, siltstone, claystone, conglomerate, and lignitic coal. In mapping the southern part of the coal field, the formation has been separated into three stratigraphic units. The lower unit is characterized by angular to subangular quartz conglomerate and sandstone, with a matrix of sericite paste. Locally the unit contains beds and lenses of clay, coal, and bone. It has a maximum measured thickness of 500 feet in the vicinity of measured sections 11 and 9 on Little Gold Creek (pl. 10), but it thins rapidly westward and appears to pinch out along a line from measured section 4 to the ridgetop a quarter of a mile west of section 2. To the northeast, its area of probable outcrop is covered by a dense growth of vegetation or is buried beneath Quaternary deposits.

Conglomerate beds are most abundant, and the unit as a whole is coarsest in the southwesternmost exposures, in the vicinity of measured sections 2 and 5. Coal and bone are absent from the lower unit in this area. To the northeast, coal and bone are present in the lower unit and thicken northeastward, and the beds of sandstone and conglomerate interfinger northeastward with claystone and siltstone. One bed of coal greater than 2½ feet in thickness is present locally in this unit. As indicated by the measured sections in plate 11, the increase in thickness of this unit to the northeast is due, not to the gradual thickening of beds in the unit, but rather to the appearance of successively lower and older beds of sandstone, claystone, and coal. In other words, there is stratigraphic overlap southwestward of the higher beds in this unit. The thickening of the lower unit as a result of this overlap is at a rate of 1 foot in 20 feet, which is probably a minimum measure of the original slope on which the coal-bearing formation was deposited.

Although the contact between the coal-bearing formation and the Birch Creek schist along the northwest side of the coal field is not exposed, the lower unit is not believed to be present there, for otherwise the distinctive angular quartz pebbles that characterize it would probably appear as hillside float and in stream beds. A bed of well-cemented conglomerate, consisting of pebbles of quartz and chert, with subordinate amounts of rhyolite, granite, and schist, appears at the base of the coal-bearing formation at the extreme north end of the Jarvis Creek coal field, and may be the stratigraphic equivalent of this lower unit.

Immediately beneath the coal-bearing formation the Birch Creek schist has been reduced to a mass of sericite clay containing angular quartz grains. For several tens of feet stratigraphically below the contact, the schist is friable and forms smooth hillsides that are covered by a layer of solifluctional debris which consists of fragments of schist and quartz in a matrix of mica and quartz grains. This is not at all typical of the Birch Creek schist elsewhere in this part of the Alaska Range, where it characteristically forms jagged peaks and ridges, castellated outcrops, and narrow canyons with vertical and overhanging cliffs of hard rock. The friable and disintegrated schist immediately adjacent to the base of the coal-bearing formation is interpreted as a weathered or soil zone formed just prior to the deposition of the Tertiary rocks. The angular quartz conglomerate and sericitic sandstone, which compose both the lower unit of the coal-bearing formation and the layers of micaceous quartz sandstone found within the coal-bearing formation, are all believed to have been derived from such weathered Birch Creek schist. The pebbles are from the abundant quartz veins within the schist. The clastic part of the lower unit presumably had its source to the south, for the sediments become coarser in that direction; furthermore, the bedrock to the northeast is largely granite, which would have supplied sandstone and conglomerate of an entirely different mineralogic constitution.

The middle stratigraphic unit of the coal-bearing formation in the Jarvis Creek coal field has at its base a coal-bearing zone ranging from 1 to 50 feet in thickness. This zone contains the thickest known coal beds of the Jarvis Creek coal field and most of its coal resources. Interbedded with the coal are well-cemented platy orange-weathering shale and shaly sandstone, which make this coal-bearing zone a distinctive stratigraphic marker. Both the thickness of the coal-bearing zone and its coal content increase eastward. The zone pinches out to the west, where it is overlapped by higher beds of the middle stratigraphic unit.

The part of the middle unit above the coal-bearing zone ranges in thickness from 400 feet near section 3 to 650 feet near measured section 8. About two thirds of this part of the middle unit is medium to coarse buff arkosic sandstone in beds 10 to 50 feet thick, containing scattered iron carbonate concretions. The remainder is largely gray to brown silty claystone with a few lenticular coal beds 6 inches to 3 feet thick. Iron-carbonate concretions as much as 6 feet in diameter are common in the claystone beds. Coal makes up 3 to 6 percent of the middle stratigraphic unit, exclusive of the coal-bearing zone at its base.

The abundant feldspar in the sandstone indicates that this unit was derived from a feldspathic terrain. Presumably, therefore, it came from the north or northeast, either from the granite of Granite Mountain (Moffit, 1942, p. 124) or from Totatlanika schist that may be buried beneath young Tertiary and Quaternary deposits in the Tanana Valley to the north (Capps, 1912, p. 22–26).

The upper stratigraphic unit of the coal-bearing formation consists predominantly of dark-gray claystone and siltstone in beds 5 to 60 feet thick, interbedded with dark-gray sandstone, coal, and bone. The sandstone is in strikingly lenticular beds 5 to 20 feet thick and is locally concretionary. The coal is in beds, 3 inches to 7 feet thick, which exhibit abrupt lateral variation in thickness and quality. Individual coal beds grade into sections of bone or claystone by splitting or lensing within distances of a few hundred or a few thousand feet. Coal makes up about 10 percent of the upper stratigraphic unit. The total thickness of the upper unit is not known, because its top has been removed by erosion. The greatest exposed measured thickness is about 450 feet at measured sections 1 and 3, but the structure sections (pl. 10) indicate that its maximum thickness beneath the surface of the plateau may be as much as 900 feet.

AGE AND CORRELATION

Moffit (1942, p. 130) collected plant remains from the shale of section 10. Regarding these remains, he stated:

> A small collection of fossil plant fragments was made from the fresh-water shale and sandstone of the small hill on the west side of Little Gold Creek described on pages 128–129. This collection was referred to R. W. Brown for identification and determination of age. Although the specimens were poor, Brown identified three of the forms as *Glyptostrobus europaeus* (Brongniart) Heer, *Alnus* sp., and *Fagus antipofi* Abich. He says of them, "There is no doubt of the Tertiary age of these fossils, but knowledge of the Alaska Tertiary floras is not yet sufficiently detailed to permit a more precise statement of age.

The coal-bearing rocks of the Jarvis Creek coal field are strikingly similar in lithology, stratigraphic position, and topographic expression to coal-bearing rocks 90 miles to the west, in the Nenana coal field. The entire section at Jarvis Creek is tentatively correlated with the lower member of the coal-bearing formation on Healy Creek (Wahrhaftig, Hickcox, and Freedman, 1951, p. 147). This tentative correlation is based on the following features common to both areas: (1) The beds are lenticular and show marked lateral variation; (2) the clastic members show that they were derived from nearby bedrock sources; (3) the characteristic pebble and sandstone types of the middle and upper members of the coal-bearing formation on Healy Creek are very rare or absent.

The separate members of the coal-bearing formation as described on Healy Creek (Wahrhaftig, Hickcox, and Freedman, 1951, p. 147–150) were traced as far east as the Wood River, 65 miles to the west of the Jarvis Creek coal field, by Wahrhaftig and R. A. Eckhart, in 1950. Although correlation solely on lithologic grounds for a distance of 65 miles may be regarded as unsound, the correlation is strengthened by the presence, about 5 miles northwest of the Jarvis Creek coal field, of both the middle and lower members of the coal-bearing formation, as recognized on Healy Creek. These beds were first examined by the Geological Survey in 1951.

QUATERNARY DEPOSITS

Quaternary deposits in the vicinity of the Jarvis Creek coal field consist of river gravels, glacial moraine, solifluctional deposits, and windborne deposits. These deposits are the subject of an intensive study now being conducted throughout the Delta River valley by Troy L. Péwé of the U. S. Geological Survey. Most of the statements made below are based on Péwé's observations and conclusions.

GLACIAL DEPOSITS

Péwé recognizes at least two, and probably three, major glacial stages in the Delta River valley. The glacial deposits of the younger of these stages lie west of the west fork of Ober Creek. The plateau country lying to the west and north of this stream is covered by a thick glacial moraine, on which the topography created during the retreat of the glacier is almost perfectly preserved. This area contains a chaotic assemblage of low irregular ridges and mounds that separate numerous depressions, most of which are occupied by lakes. The material making up the ground moraine consists of coarse boulders of granite, Birch Creek schist, and greenstone and of fine gravel and coarse sand. This till was apparently deposited by a glacier moving northward down the Delta River; the surface of the glacier stood at an altitude of 3,250 feet near the south edge of the mapped area (pl. 10) and at 2,750 feet near the north edge. The eastern boundary of this glacier followed the present course of Ober Creek.

Older till forms a deposit 10 to 100 feet thick that mantles the southern part of the plateau of the Jarvis Creek coal field, including the 4,397-foot hill at its southeast corner. Deposits of old till also cap hills south of measured section 18 and northwest of section 21, and patches of old till were found on the mountains south of the head of Little Gold Creek as high as 4,750 feet. The old till consists largely of granite boulders that range from several inches to 5 feet in diameter, boulders of greenstone, and a few boulders of Birch Creek schist, all in a matrix of coarse sandstone. The original glacial topography of the old till has been completely destroyed. The presence of the old till only on the tops of high hills and interfluves indicates that considerable erosion, including several hundred to a thousand feet of downcutting by the present streams, has taken place since the old till was deposited.

STREAM AND TERRACE GRAVEL

The Delta River and Jarvis Creek are braided streams flowing across bare fields of gravel that was either deposited in Recent time or is still in transit to the Tanana River. Gravel terraces 10 to 50 feet high border both of these streams and presumably represent times when the stream gradients were higher than they are now. Because these gravel terraces are within valleys that were occupied by ice of the latest glacial advance, they are assumed to be postglacial in age. Patches of terrace gravel on mountain slopes along Ruby and Bear Creeks, at an altitude of 3,000 to 3,250 feet, are presumed to have been deposited by these streams when a glacier occupying the Delta River valley dammed them to that altitude. They are therefore considered to be contemporaneous with the younger till.

SOLIFLUCTIONAL DEPOSITS

A thin layer of material, moved downslope by the combined action of solifluction and creep resulting from Arctic climatic conditions, probably mantles most hillsides except those occupied by badlands and bare outcrops. Evidence of solifluction and creep, probably very active at the present time, includes soil lobes, terracettes, and block fields, which are particularly abundant on the subdued hills formed on the weathered zone of Birch Creek schist, and on the angular quartz conglomerate derived from it.

WINDBORNE DEPOSITS

The surface of the plateau of the Jarvis Creek coal field is mantled by a deposit of windborne sand and silt, interbedded with peat and vegetable matters. Cliff-head dune deposits on the north edge of the canyon of Ruby Creek are locally 10–20 feet thick. Windborne deposits are also present at the top of the bluff facing Little Gold Creek. Great dust clouds blowing down Jarvis Creek and the Delta River were observed and photographed by the senior author. Deposition of windborne material is evidently still going on at a considerable rate in this region. Some south-facing bluffs in badlands along the west side of Little Gold Creek and near the pass between Little Gold Creek and Ruby Creek have horizontal projections which extend as much as 1 foot outward from the face of the bluff. The projections are protected by isolated pebbles and concretions. Elsewhere on these bluffs, conglomerate layers project as much as 2.5 feet beyond sandstone layers below them. Presumably these phenomena are the result of wind erosion and indicate that wind action is transferring a significant amount of material from the coal-bearing formation to the windborne deposits.

STRUCTURE

BIRCH CREEK SCHIST

Structures in the Birch Creek schist consist of a primary foliation, which is the result of the parallel arrangement of quartz and mica flakes and their separation into fine bands, and a secondary fracture cleavage, which cuts the primary foliation at angles of as much as 90 degrees where well developed. The primary foliation is parallel to the bedding, where both are present, although the Birch Creek schist commonly has been so thoroughly metamorphosed that bedding has been destroyed. The secondary cleavage, where present and distinct from the primary foliation, is parallel to the axial planes of small drag folds in the primary foliation. These drag folds are in part gentle sinusoidal waves, with amplitudes considerably less than their wave lengths, and in part very tight, locally isoclinal, folds, with the amplitude of the folding many times the wave length. Generally the drag folds have wave lengths between 1 and 10 feet.

Dips in the foliation of the Birch Creek schist range from horizontal to 30 degrees. In general, within the area shown on plate 10, foliation in the Birch Creek schist dips toward the nearest area underlain by coal-bearing formation, at an angle close to the dip of the overlying coal-bearing formation. From this fact one may conclude that the foliation in the Birch Creek schist was more nearly horizontal when the coal-bearing formation was deposited than at present.

COAL-BEARING FORMATION

The structure of the coal-bearing formation was determined on the basis of the following three sets of observational data: (1) Measured dips and strikes of the coal-bearing strata; (2) information gained from the configuration and altitude of contact lines; and (3) the altitude and shape of areas of gently rolling topography that are believed to be remnants of the folded and exhumed surface on which the coal-bearing formation was deposited. These areas of gently rolling topography, separated from slopes around them by abrupt breaks in slope, are believed to be remnants of this exhumed surface of deposition because: (1) Many of them are covered by scattered patches of coarse white quartz conglomerate, with or without bony layers; (2) many of them lie on the projected contact between the coal-bearing formation and the Birch Creek schist; and (3) in general they truncate the structure of the underlying Birch Creek schist.

Using the above data, structure contours were drawn on the base of the coal-bearing formation (pl. 10). These contours show that the coal field is an oval basin whose major axis trends north-northwest. A subsidiary northward-trending anticline and syncline are indicated in the northern part of the coal field. Dips in the coal-bearing formation are locally as high as 30 degrees, and at one locality a coal bed, disturbed by hillside creep or a fault zone, dips 75° N. Generally, however, the beds dip 5 to 10 degrees inward toward the center of the basin.

A fault of small displacement cuts the coal-bearing formation in the basin of Little Gold Creek (pl. 10). The fault has been traced for a little more than a mile along a fork of Little Gold Creek, and its maximum displacement is about 100 to 150 feet. The fault apparently dies out to the west, for no evidence of it was seen in the bluff west of Little Gold Creek; to the east it passes into Birch Creek schist.

The northerly trend of the major structures in the Jarvis Creek coal field is in marked discordance with the general trend of Tertiary folds and faults in the neighboring parts of the Alaska Range, where the general trend of these structures is easterly, parallel to the trend of the range as a whole. This discordance can be explained by assuming that the northward-trending structures in the Jarvis Creek coal field were produced during a period of deformation that preceded the deposition of the Nenana gravel. Evidence for this period of deformation has been found by the senior author in the western part of the Nenana coal field (Wahrhaftig, 1951, p. 182–183). The basin of the Jarvis Creek coal field, with its major axis trending northward, could then be explained as the result of downfolding along a northward-trending axis before deposition of the Nenana gravel, followed by downfolding along an eastward-trending axis after the deposition of the Nenana gravel. Such a double period of folding, producing an unconformity between the coal-bearing formation and the Nenana gravel, would explain why no coal-bearing formation is present at the base of the Nenana west of the Delta River (Capps, 1912, pl. 2) or at the base of Nenana east of Jarvis Creek (Moffit, 1942, pl. 3, p. 131–134), although nearly 2,000 feet of coal-bearing formation is present in the Jarvis Creek coal field.

COAL DEPOSITS

DISTRIBUTION

Thin discontinuous beds of coal are present throughout the entire thickness of the coal-bearing formation of Jarvis Creek coal field. At least one coal bed is present in nearly every exposure. Thirty coal beds 1 to 7 feet thick are exposed in measured sections 3 and 4 and 14 beds in sections 15 and 17. These sections include only part of the entire thickness of the coal-bearing formation. Coal beds more than 2½ feet thick, the minimum thickness regarded as minable in this field, are rare; and most coal beds are lenticular and grade laterally into sections containing bone and clay. The lower stratigraphic unit contains only one coal bed thick and continuous enough to be regarded as minable coal. The greater part of the coal reserves are at the base of the middle stratigraphic unit in the zone containing beds B and C (pl. 11). The remainder of the middle stratigraphic unit has few coal beds, and only one of these has been considered minable. The upper stratigraphic unit has many small lenticular coal beds but only a few of minable thickness. As can be seen from plate 11, measured sections 1, 3, 4, and 7, these coal beds are also lenticular and interfinger for short distances with sections of bone and clay. Consequently, the reserves of minable coal in this field are small, considering the extent of the coal-bearing formation and the total amount of coal in the stratigraphic column.

CHARACTER OF THE COAL

Analyses of coal from the Jarvis Creek coal field are given in table 1. On the basis of proximate analyses, most of the coal in this field is classified as subbituminous C, according to the classification of the American Society for Testing Materials (Cooper, 1946, p. 20–22). The coal is black, has a dark-brown streak, and is generally dull in luster. The thicker coal beds contain many bony partings and commonly grade into bony coal at the top and base. Most of the thin beds tend to be bony throughout.

The samples represented by the analyses were all taken from outcrops, which must be considered in drawing conclusions from the analyses as to variations in rank of the coal within the field. Because

TABLE 1.—*Analyses of coal from the Jarvis Creek coal field, Alaska*

[Sample C–71481 collected by C. A. Hickcox, 1946, analyzed by H. M. Cooper, U. S. Bureau of Mines. Samples 11008, 11009, and 11010 collected by Van Alstine and Black, 1944, analyzed by M. L. Sharp, The Alaska Railroad. Thicknesses given are those reported by collectors]

Laboratory No.	Location	Condition [1]	Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Heating value, Btu	Thickness of coal sampled	
									Feet	Inches
C–71481	Measured section 5, beds B and C.	A	21.9	35.1	32.8	10.2	0.3	8,100	13	5
		B	8.1	41.3	38.6	12.0	.3	9,540		
		C	-------	44.9	42.1	13.0	.3	10,370		
		D	-------	51.7	48.3	-------	.4	11,920		
11008	One of coal beds exposed near measured sections 15, 16, and 17. Exact bed unknown.	A	23.0	39.8	24.1	13.1	1.4	7,815	5	6
		B	14.3	44.3	26.8	14.6	1.6	8,705		
		C	-------	51.7	31.3	17.0	1.8	10,150		
		D	-------	62.3	37.7	-------	2.2	12,230		
11009	Measured section 10, bed C.	A	20.0	43.4	25.8	10.8	.4	8,645	6	3
		B	12.9	47.4	27.9	11.8	.4	9,420		
		C	-------	54.2	32.3	13.5	.5	10,805		
		D	-------	62.7	37.3	-------	.7	12,490		
11010	Measured section 10, bed B.	A	20.6	38.9	35.3	5.2	.4	9,415	4	10
		B	12.3	42.9	39.0	5.8	.4	10,405		
		C	-------	49.1	44.4	6.5	.5	11,855		
		D	-------	52.4	47.6	-------	.5	12,690		

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

of the deep weathering of the coal exposures, it was difficult to get fresh, unweathered coal samples, and the prevalence of cracks and joints in the coal made it impossible to exclude all foreign material.

COAL RESERVES

Coal reserves were calculated according to the rules recently adopted by the Geological Survey (Averitt and Berryhill, 1950, p. 8–11). The reserves were divided into two classes according to the reliability of the basic data: (1) Indicated coal, for which outcrop data spaced closer than 1 mile apart exist and for which continuity of the coal between outcrops can be assumed with reasonable assurance; and (2) inferred coal, for which outcrop data are spaced more than 1 mile apart or for which the evidence for continuity between outcrops is less strong. The reserves were further subdivided on the basis of average thickness into coal in beds between 2½ and 5 feet thick and coal in beds more than 5 feet thick. The areas underlain by coal in the various categories for each bed are shown on plate 12, and reserve figures are given in table 2. All coal in the indicated and inferred categories has less than 1,000 feet of overburden. The reserves in these two categories are intended to be reserves that would be used as a basis for engineering consideration of the mining possibilities in the field. Nearly all of the coal will have to be recovered by underground mining. The coal beds, outcropping as they do along the base of high bluffs into which they dip, are not favorably disposed for open pit mining. Possibly 100,000 to 300,000 tons of coal are available to open pit mining along the outcrop of beds B and C between measured sections 5 and 8 and in the vicinity of sections 9 and 10 (pls. 10 and 12).

An estimate was also made of the probable amount of minable coal which the field might contain and which might be raised to the category of inferred, indicated, or measured coal through trenching, diamond drilling, or underground exploration. Although the authors feel confident that the field contains the calculated amount of coal in beds more than 2½ feet thick, they are unable to assign the reserves to any particular bed or horizon within the coal field. The calculations were made by assuming that a major part of the coal field (shown by the stippled pattern on pl. 12) is probably underlain by 10 feet of minable coal and that a smaller area north of Sargent Creek is underlain by 4 feet of minable coal. (See pl. 12.) On this basis, 60 million tons of coal, in addition to the reserves shown on table 2, is inferred to exist in the major area of the coal field and 4 million tons in the northern part of the coalfield. Between one-half and two-thirds of this coal is probably overlain by less than 1,000 feet of overburden and the remainder by 1,000 to 1,500 feet of overburden.

TABLE 2.—*Coal reserves, Jarvis Creek coal field*

Designation of bed	Outcrop section	Thickness at outcrop (feet)	Distance between outcrops (feet)	Average thickness between outcrops (feet)	Area underlain by coal of a given class (acres)	Coal reserves by classes (millions of short tons): Indicated, More than 5 feet thick	Indicated, Less than 5 feet thick	Inferred, More than 5 feet thick	Inferred, Less than 5 feet thick
A	11 12	6.9 7(?)	2,400	5.0	100			0.9	
B	8 5	8.0 2.4	4,500	7.0 3.5	57 57	0.6	 0.4		
C	4 5 8	4.3 5.7 7.1	5,750 4,500	4.5 6.0	210 410	 4.5			1.6
F	17 15 14	2.3 3.0 2.8	900 200	2.6	18		.1		
G	3 ridge above 5 7 15 16	2.2 3.0(?) 4.9 5.6 3.0	4,000 4,500 4,500 4,250	3.0	850				4.5
I	1 3	3.3 2.9	1,800	3.0	23		.12		
J	1 3	3.0 6.7	1,800	4.0	23		.16		
	19	4.4		4.4	100				.5
Total						5.1	0.8	0.9	6.6
						5.9		7.5	

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