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(Subject to correction and revision)

WAR MINERALS REPORT

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

B. R. 7847 | Coal | May 1944

PROPOSED COAL MINING
Point Barrow Area, Northern Alaska

References:

1. Vilhjalmur Stefansson, My Life Among the Eskimo, New York, 1913.

2. Ernest de K. Leffingwell, The Canning River Region, Northern Alaska: Department of the Interior, Geological Survey Professional Paper 109, 1919.

3. Philip S. Smith, and J. B. Mertie, Jr., Geology and Mineral Resources of Northwestern Alaska: Department of the Interior, Geological Survey Bulletin 815, 1930.

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2. Report on population and resources of Alaska: Eleventh Census, 1890, 1893.

3. Maurice L. Sharp, Chief Coal Sampler and Analyst, the Alaska Railroad, Anchorage, Alaska.

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5. Letter from Leon Vincent, Point Barrow, Alaska, to General Superintendent, Office of Indian Affairs, Juneau, Alaska: Department of the Interior, March 6, 1944.

6. Letter from Leon Vincent, Point Barrow, Alaska to Norman Ebbley, Jr., Bureau of Mines, December 6, 1943.

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SUMMARY

During the winter of 1942-43 an acute shortage of fuel was experienced by the native population at Barrow, Alaska. As an indirect result of 2 years of exceptionally poor whale and walrus hunting the natives were left little time to obtain supplies of drift wood, local coal, and "pitch" (petroleum residue). The shortage became so severe during the spring months of 1943 as to create a serious problem of survival for many native families.

This unfortunate situation was brought to the attention of Governor Ernest Gruening in May 1943 while on an inspection trip along the west Arctic coast. Through Governor Gruening's efforts a Bureau of Mines engineer made a trip to Barrow late that month to investigate reported local coal occurrences which might be utilized to alleviate the

*This war minerals report has been prepared for the engineers and consultants of the Bureau of Mines for their technical review and criticism, and to keep them informed of the progress of the Bureau of Mines war minerals program. It is not to be made available to others, as the data are subject to correction and revision. The final report, when issued, will be distributed on a limited basis to officials of the Federal war agencies, the owners or operators of the properties described therein, and to certain others with specific concern in the production of minerals vital to the prosecution of the war.

fuel shortage. Prior to this investigation it was understood that several minable deposits of coal were located along the coast near enough to Barrow so that the natives, with proper training, could mine and transport the coal with their small boats.

The Bureau of Mines examination determined that the above program was not feasible for 2 reasons: (1) lack of suitable coal deposits along the coast close to Barrow, (2) the peculiar idiosyncrasies and natural necessities of the Arctic slope Eskimos precluded an operation depending upon large scale native labor during the short open-water whaling season.

The investigation disclosed 3 occurrences of coal, 60 to 80 miles from Barrow, which can be readily mined by hydraulic stripping and open pit mining methods. Transportation of the coal could best be accomplished by tractors and sleighs during the winter months. The Bureau of Mines has suggested a mining program and agreed to furnish an engineer to the Office of Indian Affairs for the first season's operation. The program entails mining and transporting 1,500 tons of coal each year at an estimated cost of $13.50 a ton. The capital investment for equipment and freight, plus the first season's operating expenses is chargeable to the coal mining program, estimated to be $65,000. The office of Indian Affairs can save this amount in a 6 year period by using local coal in the Government hospital and school in place of coal and fuel oil purchased in the United States.

In conjunction with the actual coal mining operation to allay the fuel shortage at Barrow, the Bureau of Mines engineer would be able to drill and sample various coal beds in the area, also obtaining pertinent information on the underlying structure. The drilling could

be carried on from April to late June and from September to the middle of November, without interfering with the progress of the coal project.

The program herein proposed will not only be of immediate concrete assistance to the Barrow Eskimo population, but it will be a step forward in solving the problem of how and when the apparently unlimited mineral resources of Arctic Alaska can be commercially utilized.

The cost to the Bureau of Mines for the proposed program, which includes engineering supervision on the coal mining project as well as additional exploratory churh-drilling in the Point Barrow area, is $15,000.

Following the initial investigation by the Bureau of Mines engineer, recommendations were submitted June 8, 1943, briefly outlining a proposed mining and transportation program, essentially identical to the one elaborated upon in this report. Through lack of time and available appropriation, the proposals were not carried out in their entirety. Consequently, in an effort to alleviate the critical fuel shortage, certain items of equipment, being the only ones available, were hastily procured and shipped on the one boat a year to Barrow.

During the past winter a limited amount of underground mining at the Meade River deposit was attempted; the sacked coal to be freighted to Barrow by tractor and "go-devils". This present operation is described at length in this report but in no manner supersedes or alters the program as herein proposed.

INTRODUCTION

Stefansson,[1] and other Arctic explorers, have written interesting histories of the early day natives and living conditions on the

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1/ Vilhjalmur Stefansson, My Life Among the Eskimo, New York, 1913.

north Arctic coast. During the early days of the whaling industry along the Arctic coast the Eskimo population was spread out quite uniformly from Point Barrow east to Herschel Island. Small settlements made up of from 5 to 10 families inhabited various districts such as Dease Inlet, the Colville River delta, Beachy Point, Barter Island, and other points along the north Arctic coast. In addition, the inland Eskimos were numerous on every large river flowing north into the Arctic.

This condition was ideal for the natives from the standpoint of livelihood as no particular area was thus over-hunted or over-fished. The barren-ground caribou were scattered in thousands north of the Brooks Range from the international boundary to the west Arctic coast. Fish and game birds were abundant and the Eskimos had little difficulty in obtaining the food and clothing necessary for existence. The coast natives, thus spread out, were also able to obtain sufficient drift wood, found in abundance from the Mackenzie delta to Point Barrow, to keep their small sod huts comfortably warm. Inland the natives gathered willows for fuel and also burned coal which is found outcropping along the banks of almost every large river on the Arctic slope.

With the coming of the white man the natives obtained guns and ammunition and it was not many years before they, having little knowledge or inherent desire for conservation, drove the caribou out of the country. While this change was transpiring Government hospitals, schools, and missionary activities were gradually making their appearance in the larger communities such as Barrow, Point Lay, Herschel Island, and Aklavik on the Mackenzie River. The diminution of game combined with the natural

interest in the advantages offered by civilization had a tendency to congregate the natives at Barrow and these other towns. Many families went east into the Mackenzie delta country in Canada where the fishing was better and the climate less severe.

Thus in 1910 the population in the area between Point Barrow and Demarcation Point (the 141st Meridian) probably reached an all time low; the census taker counting only 65 Eskimos of all ages.2/ Since 1910 the situation has changed very little; the natives staying in the populated communities where they are experiencing increasing difficulties in obtaining food and fuel.

The immediate area around any particular community can supply only a limited amount of food, clothing and fuel. The Eskimos are equipped to range for these necessities only within a certain radius of the community. When the population becomes too large, the restricted area fails to supply sufficient food and fuel for the inhabitants and they are forced to augment the local supply with food and fuel brought by boat from the United States. Because of very high freight charges the produce shipped from the south is extremely costly and it is difficult for the average native, who has little or no opportunity to earn money, to buy any/of these supplies. quantity

In ordinary years the Eskimos at Barrow are fortunate enough to kill 2 or 3 whales each season, in which event the community not only has a sufficiency of meat, but also the sale of the whale bone gives them purchasing power to buy additional food and fuel. The whales are usually obtained in the spring or fall as they migrate past Point Barrow, and the

2/Ernest de K. Leffingwell, The Canning River Region, Northern Alaska: Department of the Interior, Geological Survey Professional Paper 109, 1919, p. 67

natives, if successful in procuring a supply of this meat, are then free to rustle for drift wood, coal, or other fuel during the short open-water season. If unsuccessful in obtaining whales, the natives are then forced to hunt for walrus, ugruk (bearded-seal), or other sources of meat and fish during the open-water period, thus, it basically is simply a question of the lesser of two evils, and they are more interested in keeping their stomachs full than in keeping warm.

Within the last few years there has been a slight but noticeable trend among the natives to revert to their former method of living. While on a petroleum reconnaissance trip on the Arctic slope during August and September of 1943, the writer had an opportunity to visit the various localities inhabited by families of natives, and kept a record of the number of people at each place. A total of 113 Eskimos of all ages were counted in 12 separate localities; this number being spread from Point Barrow to Demarcation Point. The country included represents an area of approximately 100,000 square miles. It is an interesting fact that all of these natives, living away from Barrow and other populated communities, were apparently well fed and healthy. The caribou are again ranging the Arctic slope in appreciable numbers and the rivers and lakes are stocked with an abundance of fish.

The condition existing during the spring of 1943 at Barrow, which resulted in the investigation by the Bureau of Mines of the coal occurrences in the Barrow area, was an indirect result of 2 years of poor whaling. The poor hunting luck, which still remained acute, has prevented the natives

from spending the necessary time to obtain supplies of fuel.

The Bureau of Mines engineer 3/ left Fairbanks May 27, 1943 and returned June 4. A second coal examination in the Barrow area was made in conjunction with a petroleum reconnaissance expedition during September of 1943 by the same engineer. Certain deposits which during the spring examination had been covered by high water and snow, were investigated at this time.

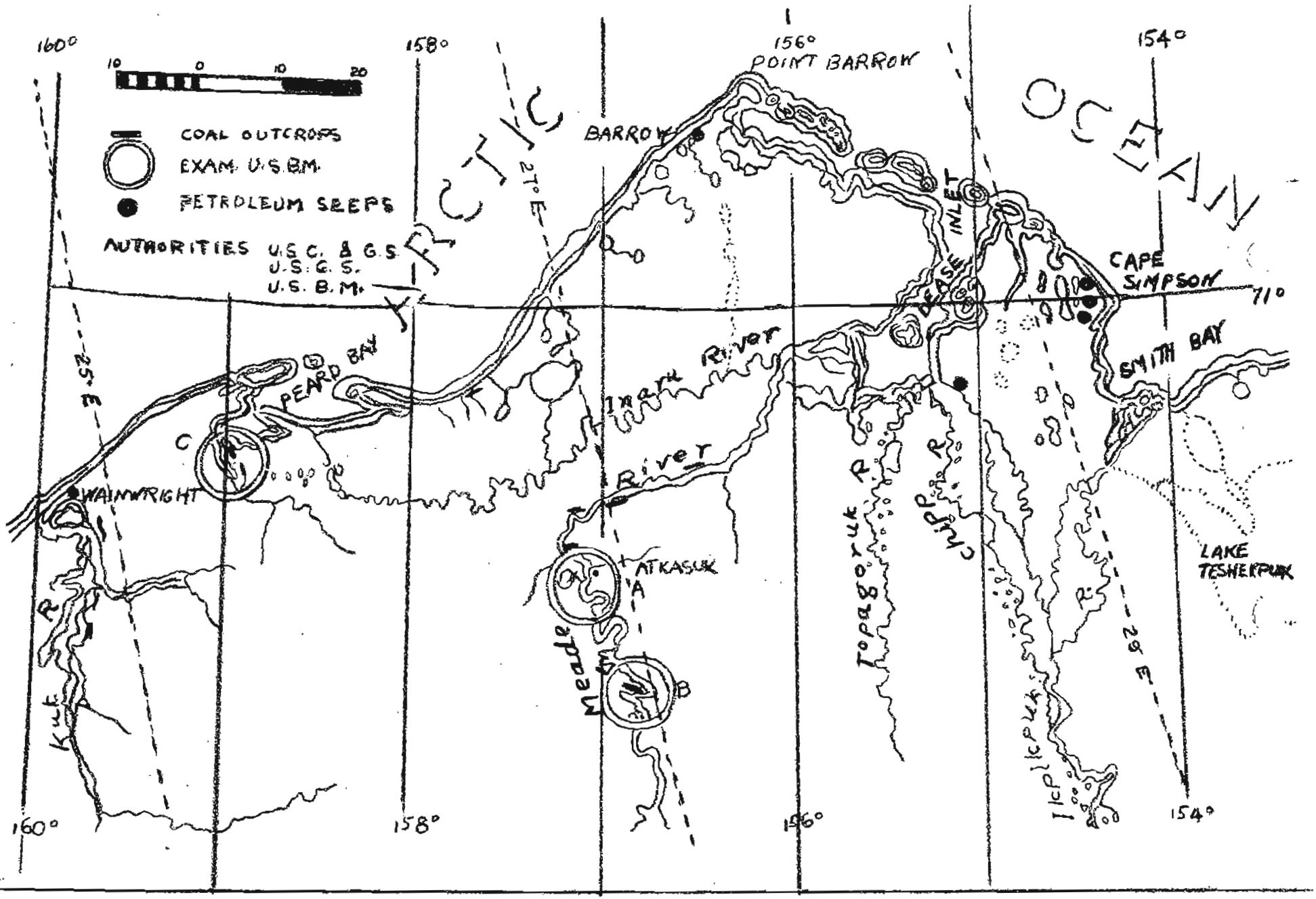
LOCATION AND ACCESSIBILITY

The area pertinent to this report, with boundaries limited by feasible freighting distances from Barrow, extends east from Wainwright on the west Arctic coast at longitude 160° west to Smith Bay at longitude 154° west. The area encompassed by these meridians, and extending south from Point Barrow to latitude 70° north, contains about 10,000 square miles, the entire portion of which is the flat terrain of the Arctic coastal plain. A map of the Point Barrow area is shown in figure 1.

No regular scheduled mode of transportation into the area is maintained and the only means of communication is the Army Signal Corp radio station at Barrow. For the last few years, or since the expiration of the whaling industry, only one boat a year arrives at Barrow, usually during the early part of September. The Wien Alaske Airlines of Fairbanks and Nome, maintains an unscheduled plane service to Barrow, averaging about one trip a month. Any air transportation along the coast east from Barrow or inland on the Arctic slope must be on a charter basis.

The opening of navigation along the Arctic coast generally occurs during

3/ Norman Ebbley, Jr., Mining Engineer.


160°
158°
156°
154°
10 0 10 20
COAL OUTCROPS
EXAM. U.S.BM.
PETROLEUM SEEPS
AUTHORITIES U.S.C. & G.S.
U.S.G.S.
U.S.B.M.
ARCTIC
OCEAN
BARROW
POINT BARROW
ELSON INLET
CAPE SIMPSON
71°
SMITH BAY
PEARD BAY
Inaru River
Meade River
WAINWRIGHT
ATKASUK
Topagoruk R.
Chipp R.
LAKE TESHEKPUK
Kuk R.
Ikpikpuk R.
152° E.
28° E.
C
A
B

the last of July and it is not safe for a ship to remain in the Point Barrow vicinity after the first of September.

In general, east-west travel inland on the Arctic slope is difficult during the summer and fall months. Numerous large, north-flowing streams segment the entire Arctic plain and form a hazard which prevents any extensive trips on foot, except near the Alpine province where the streams are small. No timber is available for rafts or for fuel. North-south travel, on the other hand, can be easily accomplished by utilizing canoes and following the rivers. In addition to the difficulty caused by rivers, travel on foot is made slow and tedious by the marshy condition of the tundra, and because of the many large lakes which in some places form an impassible maze. Travel along the east coast may be safely done in small boats during the months of August and September while the ice pack is away from the shore. Sufficient protection is afforded by offshore reefs to permit travel even by canoe, providing close watch is kept for storms.

Transportation by dog team, snowmobile or tractor is feasible from November to early in June. Air travel has proven its value in Alaska. In northern Alaska, particularly, airplanes provide the most practical transportation.

Flying conditions are best during March, April, May and June, and sometimes during October. However, the coast is generally foggy and clear days are exceptional. Gasoline and oil for the planes is a problem, and gasoline caches must be established throughout the area before any extensive flying program is started. At present Barrow is the only place on the north Arctic coast where aviation gasoline is available.

Freight on supplies shipped by steamer to Barrow from the United States amounts to about $50 a ton. Air freight on supplies, flown on charter basis from Fairbanks to Barrow, would amount to from $1,200/a ton, to $2,000 depending upon the size of plane used. Passenger fare from Nome or Fairbanks to Barrow is $300 a round trip.

PHYSICAL FEATURES AND CLIMATE 4/

Topographically, the Arctic slope is divided into 3 separate provinces. Although these main divisions grade into each other, the general line of demarcation can be fairly well established. The different provinces trend east and west, paralleling the general line of the Arctic coast and of the Brooks range. The most northern, the Arctic coastal plain province, which included the area covered by this report, is a gently sloping plain extending along the coast, the southern boundary being approximately coincident with the seventieth parallel. The next division is the Arctic plateau province. It extends south to the Brooks Range and in places comes within about 15 miles of the Arctic coast. Ground elevations range from only a few feet above sea level near the coastal plain to about 3,500 feet near the Alpine province. The most southerly province is the mountainous highland called the Brooks Range. This province is about 150 miles wide and separates the Arctic slope from central Alaska. It extends from the west Arctic Ocean to the Canadian boundary. The altitude of the peaks probably average between 6,000 and 7,000 feet, although a few are as high as 9,000 feet. Several low passes, running generally north and south, such as the Chandler and Anaktuvuk passes, permit easy traverse through the Brooks Range.

4/ Norman Ebbley, Jr., and Henry R. Joesting, Report of Investigation of petroleum Seepages, Arctic Slope Area, Alaska; Department of the Interior, Bureau of Mines report, 1943.

The Arctic slope climate is severe, based on temperate zone standards. Temperatures are prevailingly low; from December to March the mean temperature is -15° to -20° F., while during the summer months from May to September it is from 20° to 40° F. Temperatures commonly drop to -50° F. in the winter and to 26° F. in July and August.

Precipitation in the Arctic slope area is very low, seldom averaging more than 5 or 6 inches annually. Along the coast the snow fall is light while in the mountains it is somewhat heavier and 3 or 4 feet of snow usually accumulates during the winter.

Probably the greatest handicap to outside work is the constant driving wind which never seems to subside. Velocities of 100 miles an hour have been recorded at Barrow, with yearly averages as high as 14 miles an hour. Hourly averages during heavy blows are commonly as high as 60 to 70 miles an hour. Foggy weather is the rule rather than the exception. This condition seriously handicaps air transportation. The frequent fogs, especially along the coastal plain, combined with sub-freezing temperatures are flying conditions which invariably cause icing of the plane, a hazard even to local flying.

Although climatic conditions are unfavorable, it is entirely possible for people properly dressed to attend to their regular duties, and only during the worst blizzards is travel impossible.

LABOR AND LIVING CONDITIONS

The native population at Barrow constitutes the only source of labor in the Point Barrow district. Although the natives at Barrow and immediate vicinity probably number from 400 to 500, very few of these are available at any one time because of their hunting activities. As previously discussed, food is the Eskimos' prime concern, the procuring of which occupies

the largest part of his time.

There are no living accommodations at Barrow other than those kindly offered by the few local white families in their homes, or in the Government hospital. There are no restaurants or stores where food can be purchased, other than at the native cooperative store which carries a limited supply of such essentials as flour, sugar, salt, and dried fruits. The white residents and the more prosperous natives buy yearly supplies of food stuffs from the United States, this material arriving on the one boat a year.

The advent of the white man has, in reality, resulted in less favorable living conditions for the Eskimo. The dwellings originally used in the Point Barrow area, consisted of wooden frames covered with a thick blanket of sod which insulated the houses so completely that they were entirely cold-proof. The entrances, always open, were long, narrow alleyways, constructed in the same manner as the main building. For ventilation, an open hole in the roof permitted a current of air to circulate at all times. These dwellings could be kept from 60 to 90 degrees F. throughout the coldest winter by burning 2 or 3 seal oil lamps.

The appearance of the white man's commodious frame buildings, even though ill-adapted to the Arctic, changed the natives ideas and they began building the best imitations they could of the dwelling of the foreigners; unfortunately without the costly thick cork and celotex inner walls the white man could afford. The new flimsy frame structures admitted the cold so readily that the seal oil lamps no longer sufficed, and even iron stoves in which drift wood and coal could be burned were not adequate to keep the dwellings comfortable.

Drift wood, which until 40 years ago had been abundant in seemingly

inexhaustible quantities along the Arctic coast, soon disappeared and is now practically non-existent in the Point Barrow vicinity. As a result of the lack of fuel, ventilation has been necessarily curtailed until the present Eskimo house is tightly sealed against fresh air.

Now instead of the former comfortable, well-ventilated, frame and sod houses, the natives live in overcrowded, frost-coated, unventilated frame buildings which are undoubtedly responsible for the increased death rate due to pulmonary and respiratory infections and other diseases that breed in filth and foul air.

In general, the clothes used throughout central Alaska can be safely worn during the summer months on the Arctic slope. The addition of a heavy cloth parka is advisable to serve as a wind break. Shoepacks or native waterproof boots and heavy underwear are necessary. During the winter months it is advisable to wear the usual native clothes; that is, fur inside against the skin, with a separate garment with the fur outside and fur cap and boots. A well built tent is advisable to have throughout the summer as a protection from the wind, but during the winter the traveler should carry the materials to construct an Eskimo tent, consisting of a framework of about 20 light, curved willow sticks lashed into a hemispherical form and covered with 2 thicknesses of light cloth, the margins of which are packed with snow. The low, rounded form, double lashed, enables this tent to withstand the most violent wind; the 2 thicknesses of cloth with the enclosed air space resulting in excellent insulation. Any standard cold weather sleeping bag is sufficient for summer use. The native-made reindeer or caribou bags are needed during the winter months.

For field trips and for camp use the quality of the food purchased should be the best obtainable and condensed as much as possible; not requir-

ing a great amount of preparing and cooking. The field rations "C", "K", and the "Mountain" rations, put up for the United States Army are excellent for this type of work. Game, other than ducks and fish, is scarce and a field party should not plan on "living off the country" even in a small degree. However, in the Arctic plateau country there are quite a number of caribou, and moose are found along the upper Colville from the Anaktuvuk to the Killik Rivers. Mountain sheep are plentiful in the Alpine province. Berries in general are scarce, although in the fall wild cranberries are abundant throughout the Colville River valley.

The fuel situation is always a problem. Along the coastline, other than in the vicinity of Point Barrow, sufficient drift wood can be obtained for most purposes. However, from the coast inland for a distance of 30 to 70 miles there is no suitable fuel to be found unless camp is made in the vicinity of a coal outcrop. On the Arctic coastal plain the willows are as small as a pencil, do not grow much higher than 12 inches and are very scarce. A type of small, yellow moss can usually be gathered, and diligent search for an hour or so will generally reward the traveler with a sufficient amount to pile around his coffee pot so that the water will at least get warm.

Large willows, as high as 15 feet, are found along the upper Colville, and along the smaller streams throughout the plateau country. Numerous coal seams outcrop along the river banks in the plateau area, and any permanent camp should be established near one of these deposits so that the coal can be used for fuel. However, in this country the field equipment for any party should include a small gas stove or primus burner.

The present native wage scale at Barrow, established by the Government agencies, is about $5.00 a day. However, many of the Barrow and west coast Eskimos have gone to other parts of Alaska and are now working on war jobs at

much higher wages, so it may be necessary after the war to adjust the Barrow wage scale to conform to other parts of Alaska. The price of food is exceptionally high, averaging about 100 percent higher in cost at Barrow than in the United States.

HISTORY AND REFERENCES

Coal occurrences in northwestern Alaska which are found within the area covered in this report have been described by Smith and Mertie. 5/

> "Along the coast between the Utukok and Kuk Rivers coal is esposed in the bluffs southwest of Kilimantavi. Numerous coal beds were seen at intervals along the Kuk River and its tributaries, the Kaolak and Avalik Rivers. Several beds of coal were recognized on the Kukroak River and at nearby points on Peard Bay between Wainwright and Barrow. Coal beds were also recognized at a number of places on the Meade River as far upstream as was reached by the Paige party in 1923. On the Ikpikpuk River coal beds were seen at many places upstream from the Price River and also up its tributary, the Kigalik River, and coal float was found on the bars on Maybe Creek in such quantity as to suggest that coal beds probably occur in that valley also."

The same report specifically describes the coal occurrences in the Wainwright, Peard Bay, Meade River, and Ikpikpuk regions and should be consulted for detailed information on the deposits.

GEOLOGY

Information concerning the geology of northern Alaska is contained in several publications of the Federal Geological Survey. 6/ These have been freely drawn on in preparing this summary. Somewhat less than half of northern Alaska has been covered by reconnaissance methods, in which areal geologic mapping was necessarily the primary concern. Except in a general way, therefore, little stratigraphic and structural information is available.

5/ Philip S. Smith and J. B. Mertie, Jr., Geology and Mineral Resources of Northwestern Alaska, Department of the Interior, Geological Survey, Bulletin 815, 1930, p. 297.

6/ Work cited in footnote 2, page 5 and footnote 5. Reference to earlier work are given in these publications.

The oldest, most highly indurated and structurally complex rocks are found in the Brooks Range, and they become progressively younger, less indurated and structurally simpler to the north in the Arctic plateau and Arctic coastal plain. In general the formations dip north and thus progressively younger rocks are exposed north from the Brooks Range.

In the Brooks Range the rocks are pre-Cambrian or early Paleozoic to Jurassic and are for the most part metamorphosed and complexly folded and faulted. In the Arctic plateau the rocks are mainly Cretaceous and are in general moderately well indurated. To the south near the mountains the rocks are close-folded and considerably faulted while farther north the structure becomes simpler and the rocks dip gently north, with occasional reversals in dip to form broad, open folds. In the Arctic coastal plain, the area under consideration in this report, the rocks are upper Cretaceous, Tertiary, and Quaternary. According to the relatively few exposures, the upper Cretaceous and Tertiary rocks in the coastal plain are poorly consolidated and in general dip north at a low angle. The Quaternary formations which form the surface cover are unconsolidated and flat-lying.

Upper Cretaceous rocks outcrop in a wide belt along the northern part of the Arctic plateau and in the adjoining southern part of the coastal plain and probably underlie the unconsolidated coastal plain deposits at shallow depths. They are also found along the Arctic coast in Peard Bay, southwest of Barrow. They have not been recognized east of the Colville River, but it is possible that closer correlation will prove that upper Cretaceous rocks exist here also. Where it has been recognized, the formation is dominantly shale and sandstone of both marine and terrigenous origin. Coal and carbonaceous shale is found in the terrigenous members. Because they contain abundant carbonaceous material these rocks are also considered to be a likely source of petroleum. However,

nothing definite is known concerning the existence or stratigraphic position of source horizons or of horizons suitable for the accumulation of petroleum. No complete measurements of the thickness of the upper Cretaceous formations are available, but estimates place it at between 10,000 and 15,000 feet. A number of broad, open anticlines have been observed where the formation is exposed in river valleys in the plateau region.

Tertiary deposits are found near the mouth of the Colville River and in the Canning River region to the east. In the former area they are flat-lying, gray, calcareous silts and fine sands, with a thickness of about 100 feet, while in the Canning River region they are mainly soft shale dipping northeast at fairly steep angles with a thickness of 200 feet or more. Tertiary rocks may also underlie the unconsolidated surface deposits in parts of the coastal plain.

Covering most of the coastal plain are relatively thin, shallow-water, marine sands, and silts of Pleistocene age. These deposits are modified locally by rivers. Pleistocene morainal deposits left by retreating glaciers are found in parts of the plateau region, especially in the larger valleys.

OCCURRENCE OF DEPOSITS

Meade River Occurrences

On May 29, 1943, a trip by plane was made from Barrow to the Meade River. It was found that the coal seam, located approximately 10 miles south of the "big bend", reported by the natives to be the largest along that part of the Meade River, was under high water. This proved to be true, also of the coal bed located at the "big bend". Upon continuing south, a distance of approximately 25 miles above the "big bend", a coal bed was found exposed in the river bank above the water level. The location of this coal deposit is shown

(11.3.6) 157°05'W 70°18'N

on figure 1 by the letter "B". A section through the exposed coal is shown in figure 2.

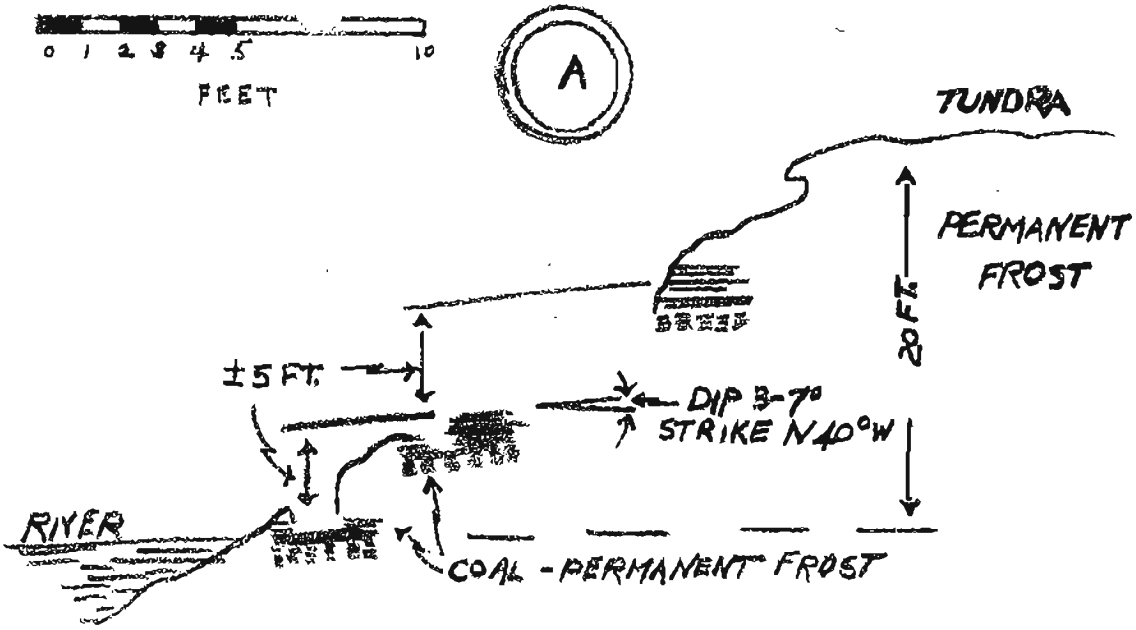
The full thickness of the bed was not determined because of frozen ground, but in 2 cuts, 35 feet apart, excavated into the coal bed, the exposed thickness was 40 inches.. The length of the coal bed along the strike could not be determined because the bank had been badly sloughed and the muck subsequently frozen. The term "muck" as used in Alaska refers to decayed organic matter, silt and clay. This coal bed strikes east-west and dips from 6 to 9 degrees to the south. Four samples, E 1 to E 4, inclusive, were cut from the 2 exposures. For analysis refer to Table 1.

U.S.G.S. B-1

On September 10, 1943, a trip by plane was again made to the Meade River. No difficulty was experienced this time by high water and the coal deposit 10 miles south of the "big bend" was exposed for 1,000 feet in strike along the river bank. This deposit is approximately 70 miles south 15° west from Barrow, and is near an old Eskimo camp called Atkasuk. Although the river bank was badly sloughed, the natives had exposed the coal in numerous places by shallow excavations into the bank. The location of this coal occurrence is shown in figure 1 by the letter "A". A section through the exposed coal is shown in figure 2.

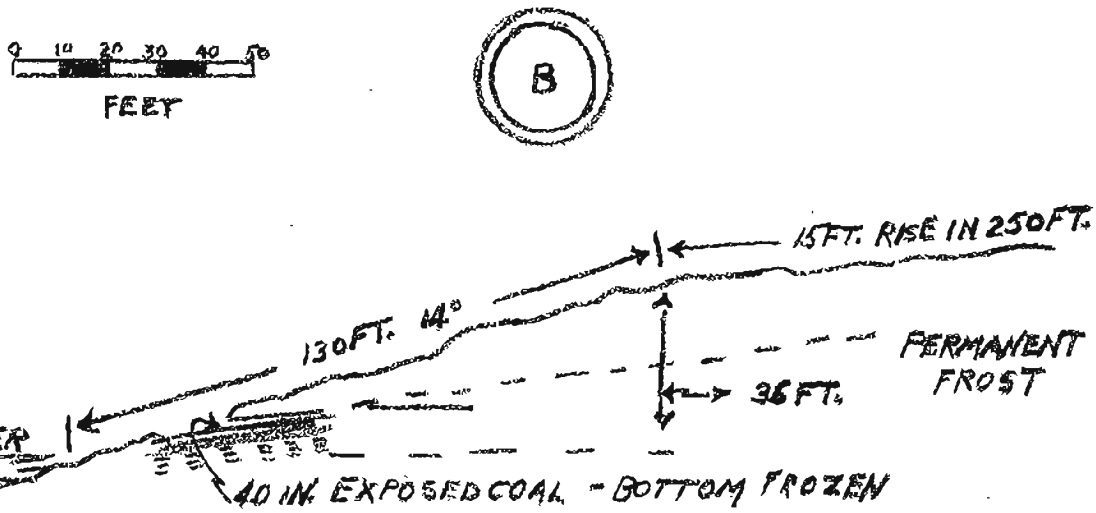
(9.3.8.5) 157°25'W 70°28'N

The actual thickness of the bed or beds was not determined, although a thickness of from 5 to 10 feet is apparent in several places. As illustrated in figure 2, the lowest cut near the water level was still in solid coal, while another excavation exposing clean coal on the bank directly above might indicate a thickness of over 10 feet. It could not be determined if the exposures represented a single solid bed of coal or whether the intervening footage consisted of bone, shale, or intermixed coaly material. The beds strike north



THIS COAL IS TRACEABLE FOR 1000 FEET ALONG THE RIVER BANK. SKETCH MADE AT LOW WATER STAGE - SEPT.

COAL SEAM NEAR BIG BEND - SECTION-VIEW S.E.



THIS COAL IS TRACEABLE FOR 500 FEET ALONG THE RIVER BANK. SKETCH MADE AT HIGH WATER STAGE - JUNE

COAL SEAM 25 MI. SOUTH OF BIG BEND - SECTION VIEW WEST

FIG. 2

40° west and dip 3° to 7° north-easterly. A sample, marked No. 3, Table 1, was cut from a 5-foot vertical face of frozen coal in one of the deeper excavations.

An Eskimo family has a summer camp at this location and have mined several hundred sacks of coal which will be transported to Barrow during the winter.

(13,0,0,1) 159°00'W 71°04'N

Peard Bay Occurrence

After examining the Meade River coal deposit in September, the trip was continued by air 60 miles westerly to Peard Bay where the coal occurrence on the east shore of the bay was sampled. This deposit is exposed for 1,200 feet along a low bank and has a strike of north 40° west, which corresponds to the shore of the bay. The bed had been opened in numerous places earlier in the fall by Eskimos who obtained 1,300 sacks of coal which had been transported by small boats to Barrow during the early part of September. The method used by the natives to mine the coal is to expose a large number of faces which are allowed to thaw a few inches, after which the thawed coal is picked down and sacked. By working a great number of faces in rotation, a large amount of coal may be obtained in this manner. Seasonal high-water, snow, and ice slough the low bank, covering the coal outcrop.

The location of this coal deposit is indicated on figure 1 by the letter "C". A sketch map illustrating a plan and elevation is shown on figure 3. The deposit is located about 80 miles southwest along the coast from Barrow.

A few exposed faces show a thickness of more than 8 feet of clean coal, with the base still unexposed. A study of the plan and elevation views, shown in figure 3, indicate a possible stratigraphic thickness of over 20 feet. A sample marked No. 4, Table 1, was cut from a 6-foot vertical face of frozen

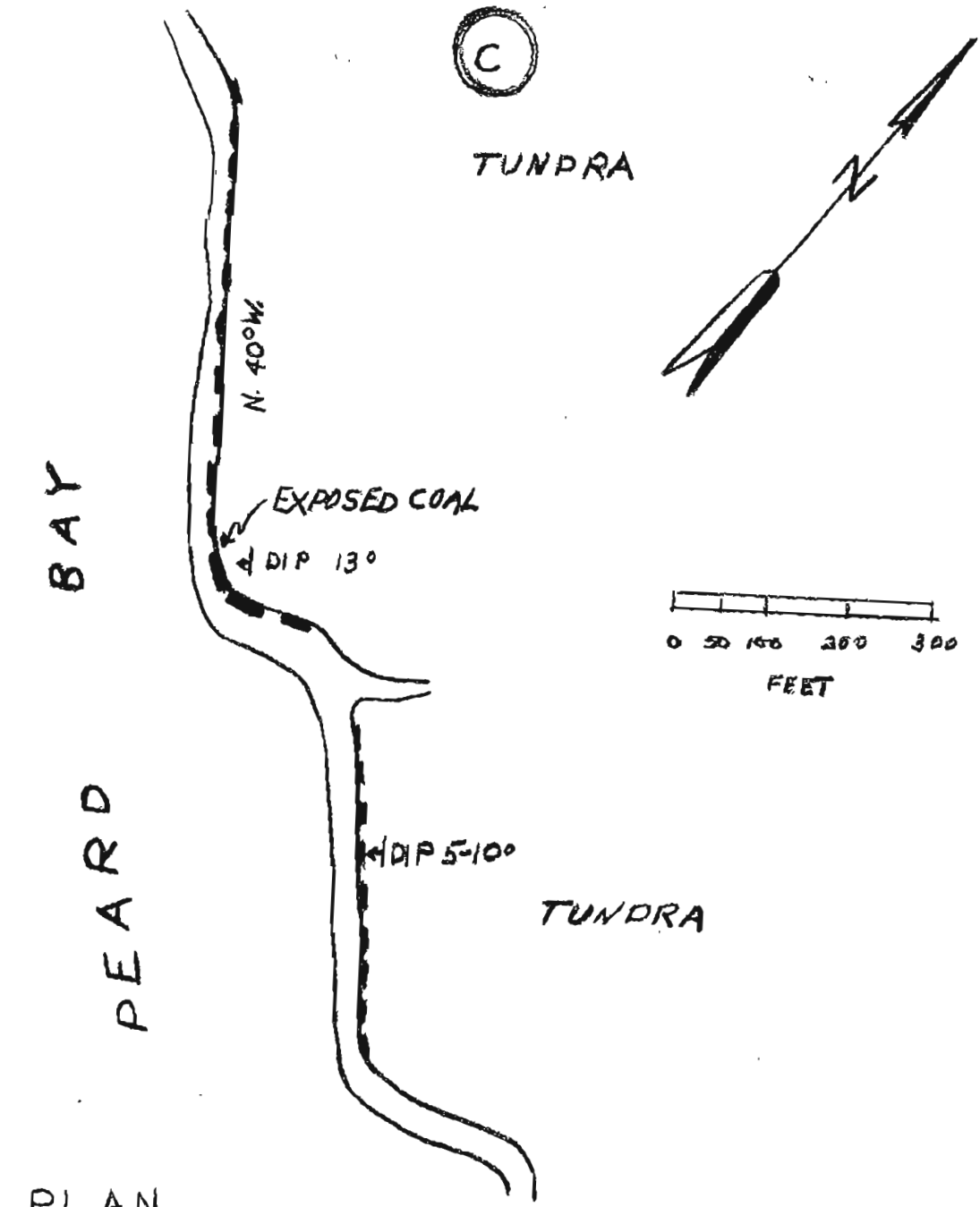

C
TUNDRA
N
N. 40° W.
BAY
EXPOSED COAL
DIP 13°
0 50 100 200 300
FEET
PEARD
DIP 5-10°
TUNDRA
PLAN
ELEVATION (LOOKING N. 40° W.
20-25 FT. HIGH
BAY
COAL
PROBABLE THICKNESS 20 TO 30 FT.

FIG. 3

coal.

SAMPLING AND ANALYSIS

All samples were obtained by cutting channels normal to the coal bed. Care was exercised at all times to obtain a clean representative sample of the deposit. However, the exigencies of Arctic slope travel forbade handling the samples in the accepted manner, it being necessary in these particular cases to use sample sacks instead of coal cans. As the coal beds were frozen, the coal contained a large percentage of water in the form of ice and some of this moisture evaporated enroute to the laboratory. On the other hand, the samples as cut should be fairly representative of the entire bed as the frozen condition protects the coal from normal weathering.

A description of the samples with the analysis on Table 1 follows: 7/

Description of Samples

Sample No.	Location
E 1	Vertical channel cut 40 inches long, 12 inches wide, 2 inches deep, normal to the bed, on west side of prospect cut in coal deposit 25 miles south of the "big bend" on the Meade River, approximately 80 miles south of Barrow, Alaska. May 29, 1943. Position "B" in figure 1 and figure 2.
E 2	Same as E 1, only channel was cut on east side of excavation.
E 3	Vertical channel cut 40 inches long, 12 inches wide, 2 inches deep, normal to the bed, on west side of prospect cut 35 feet west of above cut. Apparently same coal bed. May 29, 1943.
E 4	Same as E 3 only channel was cut on east side of excavation.
E 7	Grab sample collected from several sacks of coal stored at Barrow, Alaska, rumored to be taken from deposit

7/ Maurice L. Sharp, Chief Coal Sampler and Analyst, The Alaska Railroad, Anchorage, Alaska.

Description of Samples (Cont'd)

Sample No.	Location
	located at the "big bend" on the Meade River. Bed reported to be 5 feet thick. This sample of coal somewhat weathered as the coal was mined during the fall of 1942.
E 8	Same as E 7.
E 9	Sample obtained from the Point Lay school teacher. Coal reported mined from deposit 25 miles up the Kukpawruk River south of Point Lay. The bed is reported to be from 10 to 20 feet thick.
	- - - - - - - - - - - - - - - - - -
1	This sample of coal was cut from a 2-foot thick bed of clean coal which outcrops in a cut-bank on the north side of the Colville River about 15 miles below the mouth of the Killik River. A 20-foot zone of coal is exposed, containing several 2 to 3-foot ribs of high grade clean coal, the remainder being bone, shale, or intermixed coaly material. The coal appears to be of bituminous grade. This coal is reported by the Eskimos as being the best coal along the Colville River. The coal seams strike east and west and dip 45° to the south. The vertical exposure is about 30 feet in height, along the outcrop. September 1943.
2	Coal sample cut from a low grade seam 15 feet thick, footwall not exposed, on the north bank of a small left-limit pup of the East Fork of the Kupawruk River, in the White Mountains area. This region is located about 100 miles east of the lower section of the Colville River. Two exposures about 500 feet apart.
3	Meade River near "big bend". Coal sample cut from plus 10-foot bed. Sample described under Meade River occurrences. Location is shown in figure 1 by the letter "A". A section through the exposed coal is shown in figure 2. September 10, 1943.
4	Peard Bay 80 miles southwest of Barrow, Alaska. Sample described under Peard Bay occurrence. Location is shown on figure 1 by the letter "C". A plan and elevation is shown on figure 3. September 10, 1943.

TABLE 1

Analysis of Coal Occurrences in Northwestern Alaska

(Report on Coal Analysis Samples E 1 to E 9-Trip-June, 1943)

Sample No.	Air Dry Loss Percent	Percent: Proximate Analysis: Moisture: Air Dried	Moisture: As received	Volatile Matter: Air Dried	Volatile Matter: As received	Volatile Matter: Moisture Free	Volatile Matter: Moisture and Ash Free	Fixed Carbon: Air Dried	Fixed Carbon: As received	Fixed Carbon: Moisture free	Fixed Carbon: Moisture and Ash Free	Ash: Air Dried	Ash: As received	Ash: Moisture Free	Ultimate Analysis: Sulphur: Air Dried	Sulphur: Moisture and Ash Free	British Thermal Units: Air Dried	BTU: As received	BTU: Moisture Free	BTU: Moisture and Ash Free
E 1	8.4	8.7	16.4	35.2	32.2	38.5	45.2	42.7	39.1	46.8	54.8	13.4	12.3	14.7	0.5	0.5	10265	9400	11240	13190
		(Classification: Subbituminous "B" - NAa)																		
E 2	8.0	8.7	16.1	36.3	33.4	39.8	44.2	45.9	42.2	50.3	55.8	9.0	8.3	9.9	0.5	0.5	10945	10070	12005	13325
		(Classification: Subbituminous "B" - NAa)																		
E 3	8.4	7.6	15.4	34.3	31.3	37.0	43.5	44.3	40.6	48.0	56.5	13.9	12.7	15.0	0.5	0.5	10585	9695	11460	13485
		(Classification: Subbituminous "B" - NAa)																		
E 4	8.8	6.3	14.5	34.8	31.7	37.1	44.0	44.1	40.3	47.1	56.0	14.8	13.5	15.8	0.8	0.7	10410	9495	11110	13190
		(Classification: Subbituminous "B" - NAa)																		
E 7	10.0	7.5	16.8	38.6	34.7	41.7	42.9	51.4	46.2	55.5	57.1	2.5	2.3	2.8	0.6	0.5	12140	10925	13130	13505
		(Classification: Subbituminous "B" - NAa)																		
E 8	9.6	8.3	17.1	38.7	35.0	42.2	43.4	50.5	45.6	55.0	56.6	2.5	2.3	2.8	0.6	0.5	11980	10830	13080	13440
		(Classification: Subbituminous "B" - NAa)																		
E 9	2.0	0.7	2.7	34.2	33.5	34.4	36.3	60.1	58.9	60.5	63.7	5.0	4.9	5.1	0.1	0.1	13[illegible]5	13235	[illegible]05	14320
		(Classification: (High volatile) "B" Bituminous-Cp																		
REPORT of Coal Analysis Samples 1 to 4 (Trip - September 1943) - Sample locations and descriptions on previous page.																				
1	4.4	4.6	8.8	35.2	33.7	36.9	37.9	57.7	55.1	60.4	62.1	2.5	2.4	2.7	0.7	0.7	12370	11825	12960	13315
		(Classification: Subbituminous "A" NAa)																		
2	13.6	13.1	24.9	40.9	35.4	37.2	49.2	42.3	36.5	48.5	50.8	3.7	3.2	4.3	0.3	0.3	9905	8555	11395	11900
		(Classification: Subbituminous "C" NAa)																		
3	7.2	8.6	15.2	37.6	34.9	41.1	42.6	50.8	47.1	55.6	57.4	3.0	2.8	3.3	0.5	0.5	11575	10740	12660	13100
		(Classification: Subbituminous "B" NAa)																		
4	9.2	11.2	19.4	37.2	33.8	41.9	46.2	43.5	39.4	48.9	53.8	8.1	7.4	9.2	0.4	0.4	10210	9270	11505	12660
		(Classification: Subbituminous "C" NAa)																		

Point Barrow

Coal.

Proposed Mining Lands.

U.S. Bureau Mines.

ESTIMATED COAL RESERVES

In the Point Barrow area few of the known coal beds have been measured accurately. This is due in large part, not to the absence of coal occurrences but rather to the lack of exposures and of time in which to thoroughly explore the separate deposits. The 3 occurrences described in this report are the only ones examined, but there are numerous beds reported along the Meade River and others along the coast between Barrow and Peard Bay. However, these other known beds are small and are not suitable for mining. As the structure in the Point Barrow area consists of broad gentle folds, the coal beds are flat-lying with low dips, a condition unlikely to form outcrops except where modified by rivers.

For this reason it is very likely that numerous unexposed beds occur in the area. It is quite evident that a drilling program would have an excellent opportunity of locating minable beds much nearer Barrow than the occurrences herein described.

Table 2 summarized the probable dimensions of the 3 beds described:

TABLE 2

Estimated Coal Reserves*

Deposit	Probable Average Thickness - Feet	Probable Strike Length - Feet	Assumed Slope Length-Feet**	Cubic Feet
A	10	1,000	225	2,250,000
B	4	500(assumed)	300	600,000
C	15	1,200	100	1,800,000

$\frac{4,650,000}{25}$ = 186,000 tons of coal or enough coal to supply Barrow for 100 years.

* All dimensions are estimated and should be verified by churn-drilling.
** The slope length determined by inclination of beds with relation to the thickness of the overburden.

PRESENT OPERATIONS

In ordinary years when the Barrow Eskimos were fortunate enough to kill 2 or 3 whales each season, everyone benefited as their communistic society functioned in such a manner that all received a portion sufficient for their needs.

Generally, in addition to being able to gather an appreciable supply of drift wood, the natives dug from 2,000 to 4,000 sacks of petroleum residue each year from the oil seepages at Cape Simpson and transported this material to Barrow for fuel. Although extremely sticky and disagreeable to handle, this material is far superior to coal from the standpoint of bulk, weight, and heating quality. As an average, about 1,000 sacks of local coal were mined along the Meade River and Peard Bay, and this combined with the drift wood, pitch (petroleum residue), and whale blubber, sufficed to keep the Barrow native population warm.

However, when for the first time in over 60 years the Barrow Eskimos failed to obtain any whales during 1942 and 1943, the food situation became critical and there was little time to gather fuel. Consequently, during the summer of 1943, only 600 sacks of pitch were brought into Barrow while 400 more, remaining sacked at Cape Simpson, could not be transported because of lack of boats and labor. In addition, 1,300 sacks of coal were mined at Peard Bay and brought to Barrow by small boats. This combined material, representing about 100 tons of fuel, is only a small portion of the amount needed to meet the annual consumption at Barrow.

In a letter written December 6, 1943, Mr. Leon S. Vincent, Barrow school teacher and representative of the Office of Indian Affairs, states:

> "The coal shortage is beginning to be felt again this fall, as in past years. C.A.A. wages have so increased the buying power of the people here that the summer supply of coal and pitch is all gone already."

Immediately after the initial investigation of the coal resources of the Point Barrow vicinity in May 1943 recommendations were submitted June 8, briefly outlining a tentative mining and transportation program designed to supply Barrow with local coal at moderate price.[8/]

The original plans were designed to bring relief to the native population by mid-winter of 1943-44. It was proposed to transport by plane during June the necessary equipment to explore and strip the coal bed at the "big bend" on the Meade River. This material would consist of a small churn-drill, a pumping unit with accessories for hydraulic stripping, and limited amounts of fuel oil, gasoline, and other supplies.

The heavy freighting equipment, which would be shipped on the one boat a year to Barrow, would consist of 2 new medium-heavy tractors with dozers and hoists, 6 heavy duty freighting sleighs, a cork-lined wanigan, and fuel oil and miscellaneous supplies necessary for an operation of this nature. An endeavor was made to pattern the proposed operation on an economically stable basis assuming that the U.S.I.O. owned hospital and school would use local coal, thus making a saving sufficient to retire the capital investment in a 6-year period. It was estimated that an operation of this magnitude, which planned on mining and transporting 1,500 tons of coal a year to Barrow, could be successfully maintained by selling the coal at a price of about $10.00 a ton in Barrow.

Through an acute lack of time and available funds the proposals, which were essentially the same as set forth in this report, were not

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8/Norman Ebbley, Jr., Preliminary letter report, "Point Barrow Coal Investigation", Bureau of Mines, June 8, 1943.

strictly adherred to. It proved impossible to obtain certain items of equipment in the limited time allowed before the boat sailed for Barrow. Consequently, as a last resort, the equipment list was changed to conform with available material. The equipment shipped to Barrow is not adequate to successfully carry out the program as outlined in the report. A portion of this equipment is worn out, a portion is the wrong type for the work contemplated, while other items essential to the success of a low cost program are entirely missing.

An inventory of the material landed at Barrow in September 1943 is as follows:9/

1 RD 7 Caterpillar tractor with hydraulic-operated blade. Shows little wear and is apparently in excellent shape. No cab curtains, heater, or hoist.

1 RD 6 Caterpillar tractor (3 cylinder job) very old and very badly worn in all parts. No cab, lights, or hoist. Equipped with hydraulic blade. Track completely worn out and adjustment entirely taken up. Starting engine clutch worn out, with second and reverse gears howling.

1 D 4400 Caterpillar Diesel pumping unit on steel bed. 10 x 8 DeLaval pump. Both new.

1 Hydraulic giant with nozzle and 3 lengths of pipe.

300 pounds of 3/4 inch chain.

200 feet of used 3/4 inch cable.

4 Go-devils. Runners shaped at Nome and assembled at Barrow. Steel shoeing, well braced and bolted.

Lumber and planking for 1 bunker at the Meade River and 1 at Barrow.

Lumber and shiplap for a garage at Barrow and a light shelter at the Meade River.

Plywood and Insulite for a wanigan. Bobsled and stove donated by the Barrow Mission.

9/ Leon Vincent, written communication.

2 Wheelbarrows.

6 each of miners picks, shovels, and mauls.

4 Coal drills with hand type braces.

2000 pounds of dynamite, 40 percent, with primers, fuse and crimpers.

300 Drums Diesel oil.

4 Drums Diesel lube oil (S.A.E. 10).

2 Drums automotive lube oil (S.A.E. 10).

2 Drums gear oil (S.A.E. 90).

4 Small drums roller grease.

Miscellaneous nails and building paper.

The following items have already been purchased or assured:

Replacement of track, rollers, sprockets for RD 6.

Set of socket wrenches.

2 Firepots.

Lights and generator for RD 6.

A letter from Mr. Vincent written March 6, 1944, states in part:

"A dogteam has just returned from the Meade, bringing word that our first load (about 30 tons) will be ready for us when we get there. They report also that the opening of the mine was a serious business. Frozen muck had slid down over the coal, and it had to be picked and shoveled away by hand before the actual mining could be begun. Then, soon after the vein was opened, the first severe winter blow drifted that bank of the Meade 30 feet deep. It was necessary to tunnel nearly 200 feet out to the surface of the river.

"At the present time, I have five men digging. They are pooling their efforts and doing well. They each average about 15 sacks a day. The tunnel is 6 feet high in solid coal of good quality and the men are in out of the weather. Several more men are planning to go to the mine immediately.

"It was only yesterday that the C.A.A. finished their project here. They have kept the best of our men busy all of this time, and so much money has been in the village that it was hard to get people to go inland.

"Sleds, wanigan, and tractor are ready for the trip. I am only awaiting the coming of Wien from Point Lay where he has been with our mail for over 30 days. Thanks to the cooperation of the C.A.A. mechanic and the prompt and accurate shipment of parts through Mr. Rood's Nome office, the tractors are functioning without trouble. We do not expect any trouble from the D 7 which we will take into the Meade.

"The fuel shortage is acute this winter. People have stayed in the village in great number to work for wages instead of scattering to trap. Long spells of contrary winds have closed the leads so that no seals could be caught. Thanks to Dr. Sienfelt we have been able to purchase surplus coal from the hospital for sale during this period when we are nearly ready to deliver Meade coal.

"It seems entirely feasible now to haul enough coal this spring to last the village until we are able to again haul this late fall."

From the above it would appear the fuel shortage can be alleviated, at least for the rest of this season. However, the cost a ton landed at Barrow will necessarily be high if underground mining methods are continued.

With the present system of mining and with available transportation facilities it would be difficult to supply Barrow with much over 300 to 400 tons of coal each winter, and this would be at a relatively high cost considering the capital investment, interest and amortization.

The equipment now at Barrow is sufficient if only enough coal is contemplated to take care of the native population. However, to put the operation on a low-cost basis, it will be necessary to follow the proposals as outlined in the initial and in this coal report, converting the hospital and school to local coal, thereby raising the consumption to a point where the project will be economically stable.

PROPOSALS AND ESTIMATES

Proposed Method of Mining

The 3 coal occurrences described in this report have physical

conditions ideal for hydraulic stripping and open-pit mining. In all 3 instances the coal beds outcrop in a low bank, dip towards the water, and have very little overburden. The overburden is comprised mainly of frozen muck, with little or no sandstone or slate overlying the coal. Unless the beds experience sudden local reversals in dip, which is unlikely, all 3 deposits would outcrop back in the tundra relatively short distances from the water.

The shallow depth of frozen muck overburden, the lack of a consolidated sandstone or slate hanging-wall, and the lack of available timber in the area, all preclude an underground mining operation. The most logical mining method would be to strip the tundra with a bulldozer and then sluice off the frozen muck with water under pressure, leaving the coal exposed for an open-pit operation. A pump and hydraulic giant used during the months of June, July, and August would be the most effective medium of thawing and removing the frozen overburden. The coal once exposed to the air should thaw rapidly. It may eventually prove advisable to strip a year ahead so that the coal will have sufficient time to thaw. It is quite likely stock-piling can be accomplished with a bulldozer. A churn drill should be used to determine the best location for stripping operations.

Other factors favorable to the proposed program are: the terrain is ideal for winter tractor and sled freighting, being generally flat and having many chains of lakes which could be used; the slope of the coal beds are such that the overburden could be readily sluiced into the river or bay; the tractors and sleighs could be used to haul approximately 300 tons of ice, which is used in Barrow for water purposes, from a lake about 3 miles away; the churn drill could be used to drill for a possible local water supply at Barrow, and to prospect for coal

near Barrow where indications in the form of coal dust have been observed on the edges of small lakes. The presence of high water in the spring, which would cover the lower portions of the coal beds, would not in any manner interfere with the mining program.

Proposed Schedule of Operations

As the element of time is very important to the ultimate success of the project, it would be necessary to transport the material used in the initial testing and the remainder of the stripping equipment by plane from Fairbanks to the Meade River. A small churn drill would be used to obtain information relative to the thickness of the coal beds, the depth and composition of the overburden, as well as other pertinent information needed to locate the most logical place to strip for a mining operation.

1. The churn drill, hydraulic pipe, and miscellaneous supplies necessary for the stripping operation would be flown from Fairbanks to the location of the coal deposit 10 miles south of the "big bend" on the Meade River. This equipment must be disassembled so that it will fit into a plane and should be landed at the Meade River by the last of May so that a ski-plane can be used on one of the numerous nearby lakes. The pump, fuel, and additional supplies for the stripping operation can be brought to the Meade River from Barrow by tractor.

2. Test drilling would begin immediately to determine the thickness of the coal bed and the logical area to strip. Native labor from Barrow would be used for this work under the supervision of the Bureau of Mines engineer. Only a few holes would be required and those could probably be drilled without the use of casing.

3. After drilling and the best location decided upon, surface tundra would be stripped by bulldozer and hydraulic sluicing operations

begun. If the bed proved to average 5 feet in thickness it would then be necessary to strip an area 100 feet square to insure the mining of 1,500 tons of coal. It is essential that the stripping operations be accomplished during the months of June, July, and August, to take advantage of the warm weather.

4. After removal of the frozen overburden, which will probably average from 8 to 10 feet in thickness, the coal bed should thaw rapidly. If the coal proves to be too hard to be effectively mined and stock-piled by bulldozing, it will then be necessary to hand drill and blast so that bulldozing can be accomplished. It is believed advisable to stock-pile the coal so that the present large water content, in the form of ice, will have an opportunity to thaw and drain, thus preventing re-freezing when the cold weather returns. While the stripping operation is in progress the drill could be transported to other areas worthy of investigation.

5. After the ground has frozen sufficiently to permit overland tractor freighting, the coal can then be bulldozed into the box-type bodies on the sleighs and hauled to Barrow. A complete round trip could be made in 4 days time, hauling 70 tons of coal each trip using 2 tractors and 6 sleighs. About 3 months would be required to transport 1,500 tons of coal to Barrow from the deposit located 10 miles south of the "big bend" of the Meade River.

It would be necessary to fly the following equipment to the Meade River to expedite operations 1, 2, and 3 under "Proposed Schedule of Operations":

200 Feet of 20-gauge asphalted hydraulic pipe as follows:

6, 10 foot lengths of 10-inch pipe
6, 10 foot lengths of 9-inch pipe
6, 10 foot lengths of 8-inch pipe
1, 10 foot length reducer 10 to 9-inch
1, 10 foot length reducer 9 to 8-inch
1 reducer 8-inch to intake size of giant
1 adapter from pump to 10-inch pipe

This pipe can be telescoped into 7 pieces for transporting by plane. This last 2 items would have to be checked for size to correspond with the equipment now at Barrow.

Pipe averages $1.00 a foot - Total with adapters.....$225 - 900 pounds

1 used Fairbanks or Airplane placer drill with 4-inch light weight string of tools, 10 feet of 4-inch casing - Total.....$1500 - 2,000 pounds

Camp supplies and miscellaneous tools, etc..... $275 - 1,100 pounds
$2000 4,000 pounds

Air freight on 4,000 pounds.....$3000

Totall.....$5000

Although the above additions to the equipment now at Barrow would insure inexpensive mining costs, transportation costs would still remain high, using only one tractor and "go-devils" for freighting. No other additions to the equipment now at Barrow are required to assure a substantial fuel supply for the natives. However, as previously pointed out, a small coal production will mean a high unit cost, and unless the hospital and school are converted to using local coal, which would assure a consumption of from 1,200 to 1,500 tons a year, the operation will be far from economical.

The unfortunate purchase of certain worn out and ill adapted items will result in a higher unit cost than originally estimated.

However, it is still thought advisable to augment the equipment now at Barrow with certain items which would permit the handling of 1,500 tons of coal a season.

The RD 6 tractor, from its description, is hardly suitable for extensive heavy duty, cross-country hauling. It is suggested that another used RD 7, without bulldozer blade but equipped with a hoist, enclosed cab, lights, and with an entire new track assembly be shipped to replace the worn out RD 6. It is always advisable to standardize on equipment so that a minimum of repair parts are required. The "go-devils" now in use are not adapted to continuous cross-country freighting as their rigid construction is impractical for heavy duty work for great distances over frozen terrain. It would be advisable to obtain 6 heavy freighting sleighs, as these sleighs are built especially for this type of work and have proven highly successful in Alaska. Although not absolutely essential, an acetylene cutting torch unit and a 200-ampere electric arc welder would be advantageous to have at Barrow.

Additional equipment needed to assure the supply of 1,500 tons of coal a year at Barrow is listed as follows:

		Price FOB Seattle	Weight, Pounds
1	used RD 7 Caterpillar tractor in Al condition, equipped with hoist, cab, lights, and entire new track assembly	$6,000	28,630
6	Sweets No. 6 heavy sleighs (or equal) at $700 each	4,200	21,540

	Price FOB Seattle	Weight, Pounds
Sleigh extras:		
Pull chain assembly $300 each	$1,800	4,470
Spread pole gangers	42	60
No extra rechaining or side-ironing for these sleighs as they have a capacity of from 15 to 25 tons each, depending upon the work. Six-foot track width.		
6 Sleigh beds and boxes $400 each to be constructed in Seattle	2,400	18,000
	$14,442	72,700
Boat freight on 72,700 pounds (Seattle to Barrow)	1,818	
Total.....	$16,260	

Total additional equipment plus freight:

By air from Fairbanks to Meade River-	$ 5,000
By boat from Seattle to Barrow -	16,260
	$21,260

Labor Costs First Season

Mining and transporting 1,500 tons of coal to Barrow does not include the operation of the churn drill during the summer and fall months on additional general coal exploratory work, nor does it include engineering and supervision cost chargeable to the Bureau of Mines.

1 Foreman - (tractor driver) - mechanic (10 months)	$5,000
4 Native laborers, (aver.) $5.00 a day, (8 months)	4,800
	$9,800

Cost Summary (First season 1,500 tons of coal delivered to Barrow from Meade River.)

Transportation of all material and supplies now at Barrow	5,323
Cost of equipment now at Barrow (includes all labor, office, etc.)	18,866
Cost of supplies now at Barrow (Usable Diesel oil, etc.)	1,725
Cost of additional equipment and supplies to insure mining and transportation of 1,500 tons of coal a year (Includes transportation-see above).	21,260

	9,800
Labor first season, total	3,026
Miscellaneous air freight and passenger extra . . .	$60,000
Miscellaneous additional for contingencies, 8 percent	4,800
	$64,800
Capital investment plus cost of first season operation chargeable to the coal mining and transportation program, estimated.	$65,000

Following Seasons (1500 tons of coal each year)	Cost Each Year
Equipment repairs, average for 10 years	$ 2,000*
Equipment depreciation, 10 years	4,000**
Labor 7 months, 4 natives, 1 mechanic-supervisor	7,000
Cost of Diesel, lub. oil, grease, anti-freeze, etc.	5,000
Miscellaneous contingencies, additional	2,000
	$20,000

(for 1500 tons) or $13.33 a ton of coal at Barrow.

* It should be noted that the operation of the equipment is for only about 4 months each season. In other words, a 10-year operation of this program is equivalent to only about 3-1/2 years steady operation.

** If $4,000 a year is maintained as a surplus accumulating at 3 percent interest, funds will be on hand at the end of a 10-year period for complete replacement of all equipment. This sum amounting to $47,000 represents a profit.

TABLE 3

Fuel Consumption at Barrow - Present and Probable

Users	Present Fuel Used (Tons) Year				Would probably use - Tons of local coal year	Remarks
	Outside Coal*	Outside Oil**	Local Coal	Local Pitch***		
Signal Corps (U.S. Army) Byron Ames	20				25	1 house
Hospital (U.S.I.O.) Dr. Edward Seinfeld	250 to 300	60			400	Nurses quarters use oil
Mission Fred Klerekoper	25	53			40	House and Church
School (U.S.I.O.) Leon Vincent		270			175 to 200	Would have to convert oil stoves to coal

Fuel Consumption at Barrow - Present and Probable (Continued)

Users	Present Fuel Used (Tons) Year				Would probably use - Tons of local coal year	Remarks
	Outside Coal*	Outside Oil**	Local Coal	Local Pitch***		
C.A.A. (Dept of Commerce) Merle Wittmeyer		240			150	Would have to convert oil stoves to coal
Natives and Others	15		60 to 75	300 to 4000 sacks (200 tons)	600 to 700	Would need coal stoves
					1400 to 1500 tons	

* Outside coal (United States)costs approximately $60 a ton landed at Barrow.

** A 55-gallon drum of fuel oil costs approximately $4.00 plus $12.50 freight, or a total of $16.50 a drum landed at Barrow.

*** The pitch (petroleum residue) costs the natives $1.50 a sack in Barrow, approximately 100 pounds to the sack. This material is hauled 60 miles by boat from Cape Simpson to Barrow.

If an abundance of fuel were available the natives would use considerably more than indicated by the above chart. The hospital and the natives are the two large users, which combined use about 1,100 tons a year.

TABLE 4

Indicated Saving Each Year to the Office of Indian Affairs by Using Local Coal

User	Present Fuel*	Cost	Would Use	Cost	Saving
Hospital (U.S.I.O.)	250-300 tons of outside coal	$16,500	400 tons of local coal**	$4,332	
	60 drums oil	900	60 drums oil	990	$11,168
School (U.S.I.O.)	270 drums oil	$4,455	175 tons local coal	2,333	
			60 drums oil	990	1,132
				Saving Each Year.....	$12,300

* Refer to Table 3 for costs.

** Local coal at $13.33 a ton.

In addition to the above, other agencies would save each year:

Mission	$1,000
Signal Corps	900
C.A.A.	1,900
Total.....	$3,800

Disregerding the saving other than to the U.S.I.O.:

Capital investment plus cost of first season operation, total.....$65,000

Saving each year to U.S.I.O. by using local coal at $13.33 a ton.....$12,300

The total investment of $65,000 plus interest at 6 percent can be retired in a 6-year period by the annual saving of $12,300. Thus, after 6 years there will be a saving of $12,300 a year plus interest, which can be considered as a theoretical profit.

Cost of Project to the Bureau of Mines (First Season Only)

Engineering, supervision, and office expense	$7,200
Native and other labor	2,000
Transportation, personnel and supplies	2,000
General supplies, tractor rental and miscellaneous	3,800
Total	$15,000

GENERAL DISCUSSION

A few points probably should be mentioned which may help explain the peculiar conditions existing that affect any program of transportation in the Point Barrow area.

Transportation of Coal by Whaleboat

1. The average number of days during the year when it is safe to use boats for freighting along the west coast is about 35 days.
2. The distance to Wainwright and even to Peard Bay is too great for the whaleboats to travel. The ice is either in too close, forming a hazard, or it is so far offshore that a dangerous sea makes travel difficult.

3. The pay load carried by a whaleboat is so small that only the owner of the boat and a few of the crew benefit. The boats are usually owned by men who are best able to finance the purchase of fuel and the poorer natives do not benefit. There are no boats available at Barrow that will carry more than 8 tons a trip and this by using 2 dories in tow.
4. It takes 3 days for a round trip to Peard Bay to load and unload. At this rate there are only enough boats if all were made available to handle about 400 tons during the season.
5. At the time of the year when boats can be used, the boats and crews are needed to hunt walrus. The natives would not give up this chance to obtain meat to haul coal.
6. If a large boat was purchased, it would require at least a boat of 50 tons capacity, making 17 trips a season, a round trip every 2 days. A boat of this size would cost from $35,000 to $40,000. There is no harbor or protection for a boat of this type and it would be necessary to run it up around Point Barrow (about 7 miles from Barrow) every time there was a storm. The coal would have to be handled by lighterage at both ends.

Mining and Transportation of Pitch

1. The distance to the petroleum seepages at Cape Simpson is 65 miles, a long trip for small boats which haul a small pay load.

2. The pitch should be cut and sacked during the one month when the natives are whaling. During 1943 none was cut on this account.
3. Sacks for the transportation of pitch are scarce; a sack is good for only one filling.
4. Constant mining of the pitch within the last few years has depleted the reserve of drier material, which was easier to handle than the fresher oil now remaining.

The idiosyncrasies of the Eskimos with their peculiar living conditions are such that it is difficult to say whether or not the proposed program is entirely practical from all viewpoints. There is little doubt but that the mining and transportation problems are relatively simple and comparatively inexpensive from an Alaskan standpoint. The economic phase, on the other hand, is an entirely different and unpredictable proposition. The natives are not in a position to pay more than a few dollars a ton for coal and a considerable percent probably could pay nothing. Nevertheless, they are in dire need of this fuel and with the past year of continued poor whaling, they are now in critical circumstances. With the rate of disease increasing in Barrow from year to year, it would seem advisable for the Government to either alleviate the fuel situation or move the Eskimos to southern Alaska. It appears to be a losing race to simply try to hospitalize the increasing number of sick.

During the winter all water in Barrow is obtained by melting ice, which takes fuel. When fuel is scarce fewer baths are taken and clothes are unwashed. The fuel problem is a constant mental drag to the native,

who as a fatalist considers this problem as almost unsurmountable. There are now many petty crimes, most of which are the theft of fuel. This condition could be greatly improved if there was more fuel available at a reasonable price.

The consensus of opinion of the white population at Barrow is that an adequate supply of fuel in itself would contribute more toward directly helping the native than any other consideration furnished by the Government, including even the school and the hospital. It is believed that the logical organization to control and operate the coal program would be the Native Cooperative store, under the supervision of the Office of Indian Affairs. The Cooperative store, which is in close contact with the natives, already has the organization necessary to handle the sale and the distribution of the coal. A trader would tend to operate towards his own advantage.

A Bureau of Mines representative would be required in Seattle to order the necessary equipment and to supervise the building of the freighting sleigh beds and boxes. A Bureau of Mines engineer must assemble the equipment at Fairbanks which will be transported to the Meade River by plane. This equipment should be landed at the coal deposit by the first of June.

CONCLUSION

The rock structure of the Point Barrow area consists of broad gentle folds, and the coal beds are flat-lying with low dips. This condition is unlikely to form outcrops except where modified by rivers. It is evident that numerous unexposed beds occur in the area much nearer to Barrow than the occurrences herein described. A churn drilling program would have an excellent opportunity of locating additional minable beds in the area.

The economic picture relative to coal occurrences in the Point Barrow area would be considerably improved if in future years the exploration, development and production of the Arctic slope oil reserves became a reality. Pioneering work in the form of general geologic reconnaissance by the Federal Geological Survey, combined with the recent discovery and sampling of petroleum seepages by the Bureau of Mines, has resulted in active exploratory drilling being undertaken at the present time by the Navy Department.

An additional market for coal products will probably be developed in the area after the war if the proposed and much discussed trans-Arctic air transportation service, which appears to be entirely logical, materializes. Another possibility which should be given serious consideration is the investigation of a possible briquetting industry, utilizing petroleum residue found in juxtaposition with coal in the Point Barrow area. The technology of using the petroleum residue as a binding medium would have to be perfected. This proposal would depend upon a cheap backhaul in ships returning to the United States after transporting supplies to the contemplated Arctic petroleum industry and trans-Polar air service.

As a matter of policy it is felt that the Bureau of Mines should consider this program more from a pioneering or ground-floor viewpoint and from its possible value to Arctic Alaska than from a purely dollar and cents proposition. In addition to the concrete assistance this program would give the Barrow Eskimo population, it is also concerned with a broader long range result. It is not so much concerned with the idea of establishing mineral reserves for this war, nor is it designed primarily to obtain information so that an inventory of national resources will be

available for some theoretical future needs, although this is an important factor, but such a program would be a step forward in solving the problem of how and when the apparently unlimited mineral resources of Arctic Alaska can be commercially utilized.