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BITUMINOUS COAL DEPOSITS OF THE MATANUSKA COALFIELD, ALASKA: CENTRAL AND WESTERN PARTS, WISHBONE DISTRICT

By Robert S. Warfield

UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

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by

Robert S. Warfield[2]

SUMMARY AND CONCLUSIONS

The Federal Bureau of Mines and U.S. Geological Survey conducted exploratory investigations and geologic mapping in the Wishbone Hill district of the Matanuska coalfield almost continuously from 1942 through 1958. These investigations delineated reserves of high-volatile bituminous coal necessary to supply the rapidly expanding military and civilian requirements in the Anchorage area. This report describes the program conducted by the Bureau of Mines from 1949 through 1958, and briefly summarizes previous investigations, the results of which have already been published.

The coal-bearing structure on both the north and south limbs of the prominent Wishbone Hill syncline was explored by 8,719 feet of churn drilling and 25,460 feet of diamond-core drilling. A total of 33 holes were drilled ranging in depth from 60 to 2,114 feet. To supplement the drilling operations, bulldozer and dragline trenching were undertaken at key locations; about 25,000 cubic yards of dragline trench were excavated in the vicinity of the old Premier mine.

The investigation proved existence of the Jonesville coal group in the vicinity of the Buffalo mine, provided additional information regarding the nature of the synclinal structure (including a more accurate location of the axis), and determined the character and quality of the coal over a much larger area than previously explored. Because of the additional drill-hole data, coal reserve estimates in the vicinity of the Buffalo, Baxter, and Premier mines were increased and some reserves previously classed as "inferred" were reclassified as "indicated".

The intergraded coal-bearing formations of the Wishbone Hill district have been subjected to faulting and folding in varying degrees of intensity. Extreme variations of bedding characteristics are prevalent within relatively short distances. The resultant complex geology makes correlation of drilling results extremely difficult, and markedly limits the extent to which data gained

[1] Work on manuscript completed November 1960.

[2] Mining engineer, Alaska Office of Mineral Resources, Bureau of Mines, Juneau, Alaska.

from any given point of observation may be projected. Therefore, the investigations have not definitely delineated or correlated the coal measures in much of the area investigated. Complete delineation of the coal-bearing formations would require close drilling both normal and parallel to the strike, but such a program would be very expensive. The investigations conducted by the Bureau of Mines and Geological Survey are believed to have been extensive enough to serve as an adequate guide for private exploration and development.

INTRODUCTION

The Federal Government's relationship to the coal industry in Alaska is unique in that it is both the landlord and the principal customer of the coal producer. As the exclusive owner of all coal lands in Alaska, the Government has a direct economic interest in determining the extent, quality, and character of coal deposits as related to conservation practices, utilization, return from leasing royalties, and good safety practices. Army and Air Force installations in the vicinity of Anchorage and Fairbanks use coal as the principal fuel to produce the large amount of heat and power necessary to keep these bases constantly alert; therefore, the Government also has a major strategic interest in the development of adequate reserves.

To assure an adequate and reliable supply of coal for military installations in the Anchorage area, the Department of the Interior conducted a seasonal, comprehensive program from 1942 through 1958 of field investigations of the Wishbone Hill district of the Matanuska coalfield. This program included extensive geological studies by the Geological Survey, supplemented by trenching, diamond-core drilling, churn drilling, and beneficiation investigations by the Bureau of Mines. Much of the work completed before 1952 has already been described in publications by the Bureau of Mines[3-5] and the Geological Survey[6]. This report presents the results of work conducted by the Bureau for the period from 1949 through 1958.

ACKNOWLEDGMENTS

Cooperation, appraisal, and general assistance by the many interested and active members of the Alaskan Branch of the U.S. Geological Survey is greatly appreciated. Special recognition is extended to Farrell F. Barnes of the Geological Survey for his guidance and assistance throughout the entire investigation. Drill-core samples of coal were analyzed by the Bureau of Mines Coal Analysis Section, Pittsburgh, Pa., under the direction of R. F. Abernethy,

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[3] Apell, G. A., Moose Creek District of Matanuska Coal Fields, Alaska: Bureau of Mines Rept. of Investigations 3784, 1944, 36 pp.

[4] Jolley, Theodore R., Toenges, Albert L., and Turnbull, Louis A., Bituminous-Coal Deposits in the Vicinity of Eska, Matanuska Valley Coal Field, Alaska: Bureau of Mines Rept. of Investigations 4838, 1952, 87 pp.

[5] Geer, M. R., and Yancey, H. F., Washability Characteristics and Washing of Coals From the Matanuska Field of Alaska: Bureau of Mines Rept. of Investigations 3840, 1946, 17 pp.

[6] Barnes, Farrell F., and Payne, Thomas G., The Wisbone Hill District, Matanuska Coal Field, Alaska: Geol. Survey Bull. 1016, 1956, 88 pp.

Chief, and by the Bureau of Mines Coal Analysis Laboratory, Anchorage, Alaska, Kenneth A. Johnson, coal technologist. Officials of the Evan Jones Coal Co. and the Pioneer Mining Co. assisted the work by extending every courtesy and by the occasional loan of equipment or materials.

Bureau of Mines field investigations conducted during 1948 and 1949 were under the supervision of Theodore R. Jolley;[7] from 1950 through 1956 work was conducted under the supervision of Robert R. May;[8] after 1957 the project was supervised by the author.

LOCATION AND ACCESSIBILITY

The Wishbone Hill district of the Matanuska coalfield is in the valley of the Matanuska River in south-central Alaska (fig. 1), about 45-airline miles northeast of Anchorage. The district occupies an area about 8 miles long by 2-1/2 miles wide that extends northeastward along the north side of Matanuska Valley from the crossing of Moose Creek by Glenn Highway to Knob Creek (fig. 2).

The Wishbone Hill district is served by a spur of the Alaska Railroad which is routed from Matanuska (a station on the main line) by way of Palmer (the business center of the Matanuska Valley agricultural area) to Eska and Jonesville where coal mines and washeries are located. The district is also accessible by all-weather branch roads off the asphalt-paved Glenn Highway. This highway (open to all-year travel) is an interconnecting link of the Alaska Highway system serving Anchorage at its southwestern terminus, Palmer, and the Matanuska Valley along its route, and connecting with the Richardson Highway at its northeastern terminus. (See figs. 1 and 2.) Since 1942, when heavy floods along Moose Creek destroyed railroad tracks of an adjacent branch spur, production from mines in the western part of the district must be truck-hauled, either to destination or to a railroad loading point located near the mouth of Moose Creek.

TOPOGRAPHY

Wishbone Hill, from which the district derives its name, is a prominent topographic feature of the lower Matanuska Valley; it forms a conglomerate-capped ridge that extends from the Premier mine on Moose Creek northeastward about 6 miles to Eska Creek. The escarpment that forms the ridge gradually rises from a height of 125 feet above Moose Creek near the Premier mine to about 400 feet above the creek opposite the Wishbone Hill mine. The hill reaches its maximum altitude of 2,300 feet in the vicinity of Jonesville. Within the outer escarpments, lines of hogback ridges, and ledges reflect the southwestward-plunging nature of the synclinal structure.

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[7] Mining health and safety engineer, Bureau of Mines, Denver, Colorado; former Bureau of Mines mining engineer, Bituminous Coal-Mining Section, Pittsburgh, Pa.

[8] Former Bureau of Mines solid fuels mining engineer, Alaska district, Anchorage, Alaska.

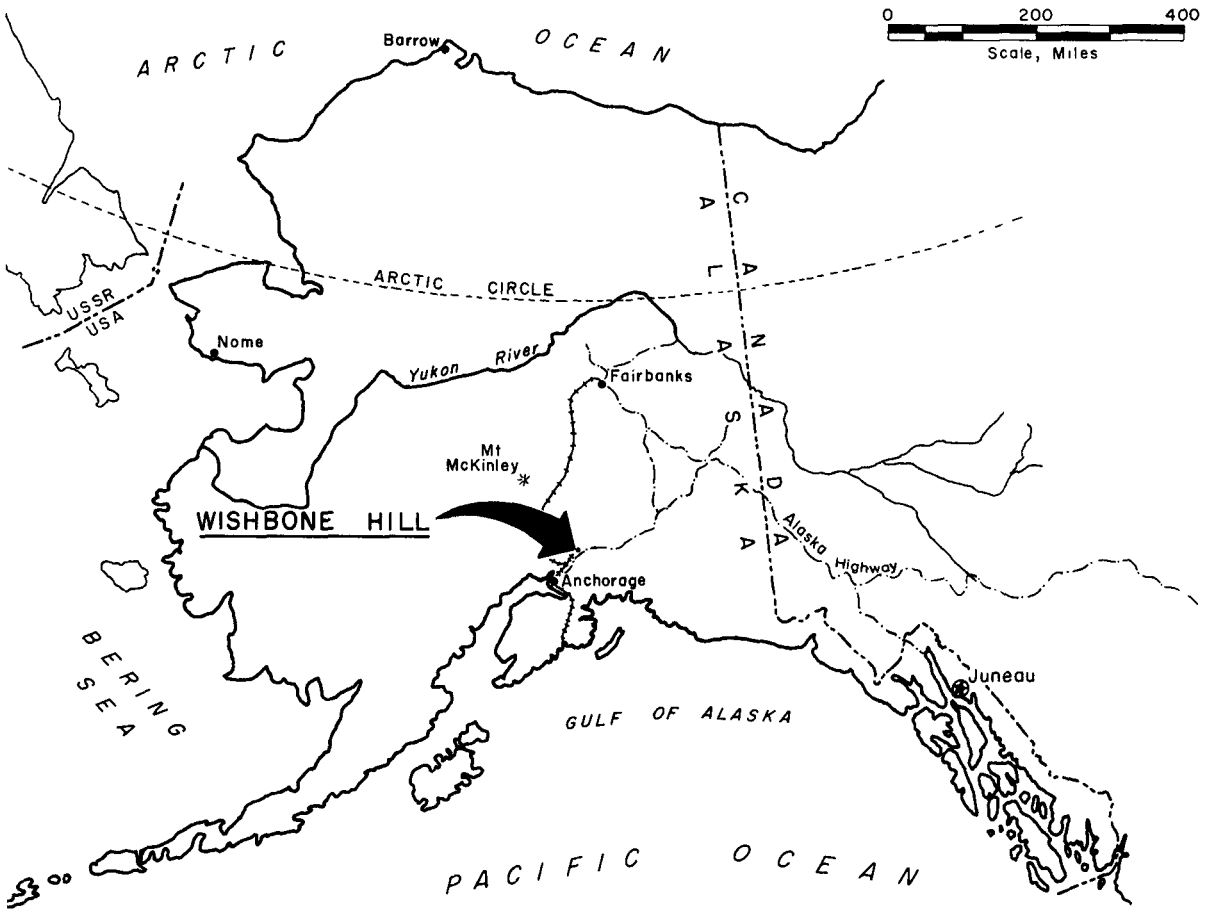

FIGURE 1. - Index Map of Alaska.

Wishbone Hill is bounded by several geographical features; on the north it is separated from the Talkeetna Mountains by a broad valley drained by tributaries of Eska and Moose Creeks; on the east by Eska Creek; on the west by Moose Creek, and on the south by a knob and kettle zone of glacial debris (some of the depressions contain lakes). The zone of glacial debris extends 1-1/2 to 2 miles southward to the Matanuska River and beyond to the rugged Chugach Mountain front.

Wishbone Hill is drained principally by Moose and Eska Creeks and/or their small tributaries; the exception is the southern slope that drains into the knob and kettle zone of glacial debris with no surface outlets. Both Moose and Eska Creeks head in the Talkeetna Mountain range and are subject to destructive flash floods during periods of heavy rainfall.

CLIMATE

The Wishbone Hill district, although near tidewater, has a climate more like that of Interior Alaska than that of typical Alaska coastal regions of the same latitude. Although annual total precipitation is light, averaging nearly 20 inches; concentration of rainfall during late summer months may hamper stripping operations because much of the material immediately over the coalbeds has a clayey nature that becomes extremely slippery when wet.

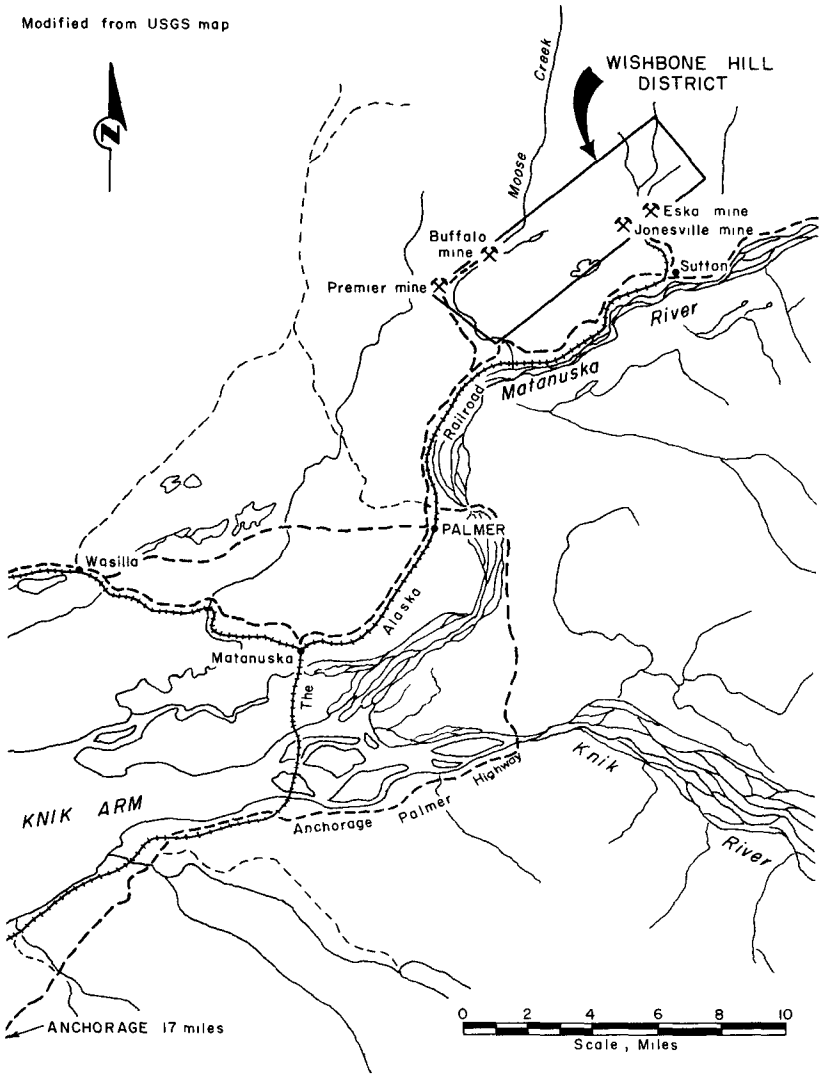

FIGURE 2. - Location Map Wishbone Hill District.

Temperature variations between winter and summer are extreme. Summer temperatures are frequently in the 80° F. range whereas winter temperatures are often in the minus 30° F. range. Sustained periods of weather may be below 0° F. during the winter months and often are accompanied by strong winds. Although surface mining is conducted continuously, the best outdoor working season is from mid-May to mid-October.

VEGETATION

Although annual total precipitation is light, the rate of growth and density of some vegetation is comparable to areas with a much more humid climate. Seasonal plants, such as devil's-club, grass, and farm produce grow rapidly and to prodigious sizes, whereas tree growth (with the exception of cottonwood) is markedly retarded from lack of moisture and/or the severe winters. Some factors contributing to rapid summer growth of vegetation are long hours of daylight, comparatively low mean temperature with subsequent small loss of moisture due to evaporation, and the greater proportion of the precipitation during summer months.

Tree growth includes spruce, cottonwood, alder, and birch; the spruce trees seldom gain diameters of more than 1-1/2 to 2 feet, but some cottonwood trees grow to 3 or 4 feet in diameter. Although large areas of Wishbone Hill are devoid of trees, they are covered with a dense growth of native grass and fireweed that may attain a height of 6 feet or more. Other small growth includes highbush cranberry, lowbush or bog cranberry, wild raspberry, salmonberry, blueberry, wild rose, and devil's-club.

The larger spruce trees are suitable for mine timber. However, very little is cut locally; instead, it is imported from the agricultural portions of the Matanuska Valley where it has become a byproduct of farmland clearing.

HISTORY

The history of coal mining in the Wishbone Hill district has been discussed in several Department of the Interior publications. However, a brief summary of early developments in the district follows:

Doherty Mine

Commercial coal mining in the Wishbone Hill district began in 1916 when the Chickaloon branch of the Alaska Engineering Commission Railroad (later the Alaska Railroad) was completed as far as Moose Creek. At this time the Doherty Coal Mining Co. opened a mine on Moose Creek about three-fourths of a mile from the mouth of the creek and adjacent to the present crossing of Moose Creek and Glenn Highway, but the operation was short-lived. After an idle period of 10 years, the mine was reopened in 1928 by the Pioneer Mining Co. The coal had some coking properties and reportedly was utilized for blacksmithing purposes. This operation was also short lived. During the most recent activity in 1953 the Pioneer Coal and Coke Co. mined a few tons of coal from a 3-1/2-foot seam that underlies the old Pioneer workings.

Baxter Mine

The Baxter mine in the western part of the district on Moose Creek was opened in 1917. Production in small amounts from the so-called big bed (an 11-foot seam) was sporadic during 1917-18 and 1921-25. Production was sledded to a branch line of the Alaska Railroad at the mouth of Moose Creek until 1923, when a narrow-gauge spur was completed up Moose Creek as far as the Baxter mine. Because of lack of capital and faulted condition of the coalbed, the mine was abandoned in 1925; all the workings are now completely inaccessible. Some of the old workings may have fed air to a crop fire that burned for several years in the vicinity of the caved Baxter portal; the Bureau of Mines extinguished the fire in 1953 by using compacted fill methods.

Eska Mine

The Eska mine No. 1 in the eastern part of the district on Eska Creek was opened in 1917, and initial coal production was sledded several miles to the Chickaloon branch of the railroad. Later in the year the Eska mine was purchased by the Alaskan Engineering Commission, and a rail spur from the Chickaloon branch to the mine was completed. The Alaskan Engineering Commission developed and maintained the Eska No. 2 and its predecessor, the Eska No. 1, so that the railroad would be assured of reliable and adequate source of coal. From 1917 to 1946 the mine was kept in a standby condition, except when private operators could not supply railroad requirements, or during an emergency (World War II). In 1942 the mine was modernized by adding new equipment and facilities, including a Baum-type jig washery. The Eska mine

closed in 1946 and remains idle to date. To maintain the underground workings in a standby condition is no longer necessary since the Alaska Railroad has converted to almost exclusive use of diesel-powered locomotives. However, with the exception of the washery and subsidiary facilities, the property is still held in reserve. The washery, powerhouse, and coalbins were purchased by Mark Coal Co. in 1956.

Evan Jones Mine

The Evan Jones mine in the eastern part of the district opened in 1920 but did not begin productive mining until 1921 upon completion of a railroad spur connecting it with the Eska spur. The mine quickly became the major producer of the district and remains so to date. In 1959 about two-thirds of its total production was obtained by stripping methods.

Until 1950 all production was obtained by underground mining methods as described in Report of Investigations 4838.[9] In 1950 stripping operations were started at outcrop level adjacent to the underground workings. Initial production obtained by this method was transported to the washery by an underground chute extending some 1,100 feet downdip (gravity flow) to the main haulage level and then by rail along the main haulage to the tipple. In 1953 a road was completed to the strip pit and the raw coal is now truck-hauled to the washery at Jonesville.

A modern heavy-media washery was purchased and installed in 1949 to replace the manually controlled Forester-type jig. Operational problems with the new plant caused an extended period of idleness; a full-scale production schedule was not attained until 1952. Meanwhile, production continued as usual through the old jig washery. The new plant has now completely replaced the old jig washery, and it has a production capacity of about 1,000 tons of cleaned coal per 18- or 20-hour day, using magnetite as the heavy media.

Rawson Mine

The Rawson mine on Moose Creek was opened in late 1921. Small amounts of coal were produced during various years through 1938. The property has been inactive since 1938.

Premier Mine

In 1922 development work was started at the Premier mine on beds east of Moose Creek, and was continued in 1923, but with a shift of operations to beds on the west side of Moose Creek. The development work continued and the mine became a major producer of the district for several years. In 1926 the narrow-gauge railroad was replaced with standard-gauge track as far up Moose Creek as the Premier mine. In late 1933 the lower workings were accidentally flooded causing immediate closure. The property remained idle until World War II. In 1942 and 1943 a small amount of coal was produced by extracting pillars that remained above water level.

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[9] Work cited in footnote 4, p. 2.

The most recent activity in the Premier mine area has been by the Pioneer Mining Co., which produced coal during 1953-55 from an underground operation located between the old Premier and Baxter workings on the west side of Moose Creek. The Pioneer Mining Co. also produced coal during 1955-57 from limited stripping operations conducted at the outcrop level above the underground workings. Coal from the stripping operation was cleaned in a manually controlled jig-type washery. In October 1958 production of coal from the underground workings recommenced on a small scale.

Matanuska Center Mine

The Matanuska Center mine in the western part of the district on Moose Creek began production in 1925 following extension of the narrow-gauge railroad to its operation and in 1926 the mine became one of the major producers of the district. Thereafter, production was sporadic until closure in 1929. The Matanuska Center mine is presently referred to as the Howard and Jesson. When the property may have changed ownership is not known and no record of production as the Howard and Jesson mine exists.

Wishbone Hill Mine

The Wishbone Hill mine adjacent to the Rawson mine on Moose Creek opened in 1932 and produced a small amount of coal. Operation as the Wishbone Hill mine continued to early 1934. After a period of closure, the property was taken over by the New Black Diamond Coal Co. late in 1934, and a small amount of coal was produced. There is no record of any production after 1934.

Buffalo Mine

Prospecting and development work at the site of the Buffalo mine on Moose Creek began in 1939. Mining on a production basis with the aid of the U.S. Army during World War II commenced in 1942 and continued until late 1945. In September of 1942 heavy floods along Moose Creek damaged the railroad beyond repair, forcing both the Buffalo and Premier mines to resort to hauling the coal by truck.

In 1952 the Buffalo mine was reopened under new management and with the aid of a Reconstruction Finance Corp. loan. Underground workings were drained and rehabilitated, ventilation was provided, and a new surface plant was under construction when all work was suspended early in 1953. The property has since remained idle.

Knob Creek Coal Co.

In 1947 work of a prospecting nature was started by the Knob Creek Coal Co. in the extreme eastern part of the district near Knob Creek. This work consisted of two short entries; the first was driven a distance of 130 feet without reaching coal; the second was driven a distance of 100 feet on coal and was discontinued at a fault in 1950.

In 1953 the property was acquired by the Mrak Coal Co.; some underground prospecting and development continued to 1955, but production by stripping methods was begun during the summer of 1953 and has since replaced all underground mining. Early production, both from underground and stripping operations, was cleaned by the Evan Jones washery. In mid-1955 the company built and operated its own small Forrester-type jig washery. The Eska washery (equipped with a Baum-type jig), powerplant, and coalbins, subsequently obtained from the Alaska Railroad, replaced the smaller plant in August 1956.

PRODUCTION

The following table showing total production by years from the Wishbone Hill district is partially duplicated from Geological Survey Bulletin 1016.[10] Production figures for 1916-52 are from the bulletin; figures for 1953-59 were compiled from records kept by the Alaska Office of Mineral Resources, Bureau of Mines, Juneau, Alaska.

TABLE 1. - Coal production from the Wishbone Hill district through 1959

Year	Number of mines	Short tons
1916-1934	7	918,561
1935	2	48,819
1936	3	60,998
1937	3	49,789
1938	3	52,490
1939	2	51,084
1940	1	64,566
1941	2	110,732
1942	4	138,527
1943	4	173,909
1944	3	210,243
1945	3	166,744
1946	2	164,873
1947	1	171,799
1948	2	147,436
1949	3	180,042
1950	3	153,010
1951	2	177,867
1952	3	243,234
1953	4	286,465
1954	3	227,788
1955	3	257,548
1956	3	269,067
1957	2	237,114
1958	3	279,927
1959	3	251,266

[10] Work cited in footnote 6 (p. 2), p. 81.

The utilization of coal from the Wishbone Hill district has changed considerably over the years. Until World War II, a large percentage of production was consumed by the Alaska Railroad; during and since World War II, the Alaska Railroad has converted almost entirely to diesel locomotives. The increased demand and present use of coal has been brought about by construction of large military establishments in the Anchorage area with resultant increased coal requirements for the generation of electricity and for heating purposes. The Anchorage area presently has three coal-steam power-generating plants - two military and one private.

GEOLOGY

The geology of the Wishbone Hill district has been discussed in various Department of the Interior publications. The most recent comprehensive publication is Geological Survey Bulletin 1016 by Barnes and Payne, which incorporates data obtained from Bureau of Mines diamond drilling through 1952; other publications concerning specific areas within the Wishbone Hill district are Bureau of Mines Reports of Investigations 3784 and 4838. These publications contain detailed interpretations of geology and structure of the Wishbone Hill district.

The following description of the general geology of the district is briefly summarized from various publications supplemented by data from subsequent investigations by the Bureau of Mines.

The Wishbone Hill district is bounded on the north and south by parallel zones of major faulting. These zones of major faulting border the Matanuska Valley and separate the Tertiary and Cretaceous rocks of the valley from the older intrusive and metamorphic rocks of the mountains on either side. The district is composed of moderately deformed clastic rocks of Tertiary age; the Matanuska formation of upper Cretaceous age presumably underlies the district, but no exposures have been located.

The Tertiary system of the Wishbone Hill district is comprised of three nonmarine formations known in descending order as the Tsadaka, Eska Conglomerate, and Chickaloon formations. The Tsadaka formation (sometimes referred to locally as the Upper Eska Conglomerate) consists of several hundred feet of boulder to cobble conglomerate with many sandstone and siltstone lenses; the formation lies with distinct angular unconformity on the Eska Conglomerate and/or the Chickaloon formation.

The boulders and cobbles of the Tsadaka formation (predominately granite and diorite in a matrix of granitic debris) are distinctive as compared to the Eska Conglomerate (predominately pebbles to cobbles of fine-grained igneous and metamorphic rocks such as chert, vein quartz, and jasper in a sandy matrix). Barnes and Payne[11] report the Tsadaka formation to be poorly indurated. This may be true on the outcrop, but not necessarily so below the weathering zone. In several instances of penetration of the Tsadaka formation by Bureau of Mines core drilling, the material stood well in open holes and no trouble was experienced with loosening cobbles.

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[11] Barnes, Farrell F., and Payne, Thomas G., The Wishbone Hill District, Matanuska Coal Field, Alaska: Geol. Survey Bull. 1016, 1956, 88 pp.

The Eska Conglomerate (named the Wishbone formation by Barnes and Payne) consists predominately of pebbles, cobbles, and a few boulders in a sandy matrix; it also includes many sandstone lenses and a few lenses of the finer clastics. The amount of finer clastics increases towards the base of the conglomerate and blends imperceptibly into the underlying Chickaloon formation. This creates what has been termed the transition zone between the Eska Conglomerate and Chickaloon formations.

The Eska Conglomerate forms the dominant surface feature of the Wishbone Hill area clearly reflecting its gently southwestward-plunging synclinal structure. Its outcrop area includes most of Wishbone Hill, and its escarpments may be observed from a distance of several miles. The Eska Conglomerate has a maximum measured thickness of at least 1,850 feet.

The Chickaloon formation is comprised of 3,000 to 5,000 feet of interbedded sandstone, siltstone, claystone, and many coalbeds. The minable coalbeds in general are confined to the upper 1,400 feet of the Chickaloon formation; they also are confined to three rather well-defined and persistent groups of coalbeds that are separated by comparatively thick strata containing little or no coal. The individual groups of coalbeds are known in descending order as the Jonesville, Premier, and Eska. Barnes and Payne introduce a fourth group of coalbeds (the Burning Bed group) that is believed to underlie the Eska coal group. An isolated bed occurring between the Premier and Eska coal groups has been identified at several localities in the district. This bed, called the Midway, is considered to be of minable thickness only in the vicinity of the Buffalo mine (table 4).

Within a given group of coalbeds, the thickness of individual beds may vary within relatively short distances, or the beds may be comparatively clean at one locality and extremely dirty at another. The distance between beds and between groups of beds also varies. The thinning out or intergrading of an individual coalbed within relatively short distances is believed to be due primarily to the deltaic origin of the deposits, but also may be due in part to distortion incident to folding and faulting. The extreme variations in the physical characteristics of the coalbeds, together with the complex structure, lack of markers, and scarcity of outcrops, makes correlation of individual beds very difficult; however, in general, with the aid of drilling, trenching, and mining, the identification of a particular group or series of beds over reasonable distances is possible.

The dominant structural feature of the Wishbone Hill district is the prominent, gently plunging, southwestward-trending syncline to which both the Eska Conglomerate and underlying coal-bearing Chickaloon formation conform. The overlying later Tsadaka formation lies unconformably on the Eska or Chickaloon formation and has been only moderately disturbed structurally. The exposed length of the synclinal structure between the Premier mine on Moose Creek and the Eska mine on Eska Creek is about 7 miles. The syncline has been

divided into segments by several major transverse faults (figs. 3 and 6, pocket) and locally modified by minor folding and faulting. The syncline is roughly canoe shaped with the closed end of the canoe outlined by the old Premier mine workings.

Glacial deposits, consiting of a poorly sorted mixture of clay, sand, gravel, and boulders cover most of the Wishbone Hill district to depths ranging from a few inches to more than 100 feet. These deposits have the greatest thickness southward from the south base of Wishbone Hill, forming a typical knob and kettle topography that offers no surface clue to the underlying bedrock structure or to the location of the coal-bearing formations.

WORK BY THE BUREAU OF MINES

Investigations Before 1949

Investigations by the Bureau of Mines in the Wishbone Hill district were undertaken as a result of World War II, which caused increased demands for coal far exceeding prewar requirements. As a stimulus to mine development and production, a diamond-drilling and trenching program designed to extend the known area of minable coal deposits and prove additional tonnage along Moose Creek was initiated in November of 1942 and was continued (with interruptions) until December 1944. During this time, 11 drill holes and several trenches were completed; the location of the drill holes are shown on figure 6. These investigations are described in Report of Investigations 3784.[12] Simultaneously with diamond drilling in this area, the Buffalo mine began production, which helped to alleviate coal shortages during the following war years.

In 1945 drilling operations were shifted to the eastern part of the district where the Bureau of Mines undertook to find additional reserves on the north limb of the syncline that could be mined from the Eska 2 mine. To this end, three diamond-drill holes were completed which are located west of the Eska 2 mine portal in the NW1/4 sec. 16, T. 19 N., R. 3 E. (See figure 3.) Drilling operations stopped in 1946, but in 1947-48 nine diamond-drill holes located in the extreme northeastern part of the district were completed. These drill holes are in the same general area as the old Knob Creek workings and the present Mrak Coal Co. strip operations. The results of the drilling accomplished in this phase of the exploration program are published in Report of Investigations 4838.[13]

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[12] Apell, G. A., Moose Creek District of Matanuska Coal Fields, Alaska: Bureau of Mines Rept. of Investigations 3784, 1944, 36 pp.

[13] Jolley, Theodore R., Toenges, Albert L., and Turnbull, Louis A., Bituminous-Coal Deposits in the Vicinity of Eska, Matanuska Valley Coal Field, Alaska: Bureau of Mines Rept. of Investigations 4838, 1952, 87 pp.

Central Part of Wishbone Hill District

The central part of the Wishbone Hill district includes both the north and south limbs of the syncline in the area lying westward from the Jonesville fault to the Range line (fig. 3). Most of the active workings of the Evan Jones mine (both underground and strip operations) are on the north limb of the syncline in this area.

In late 1948 Bureau of Mines exploratory drilling operations were shifted to the central part of the district for the purpose of determining, if possible, the attitude, position, and quality of the coal measures on the south limb of the syncline. Because of the heavy cover, little was known of the location or production potential of the coal-bearing formations of the south limb. Exploration in this area included 14 drill holes (number WH-1 to WH-14) aggregating 6,297 feet of churn drilling and 12,377 feet of diamond-core drilling. All these holes, except WH-14, were drilled under contract. Incidental to the drilling, in order to gain access to the various drill-hole locations, about 6 miles of bulldozer-excavated one-lane roads were built (also mostly by contract).

The locations of the drill holes, collar elevations, and principal formations encountered are given in table 2, and described individually in the following paragraphs.

Drill Holes WH-1 Through WH-8

During late 1948 and 1949 eight diamond-drill holes designated DDH-WH-1 through DDH-WH-8, and ranging in depth from 411 to 1,358 feet were completed (see fig. 3 for plan location). Although coalbeds of minable thickness were intersected in each of the drill holes, the results of this phase of the drilling program were, in general, disappointing. Correlation of individual beds or groups of beds between holes, or with south limb coalbeds exposed in old workings of the Evan Jones mine could not be made with any degree of certainty.

Barnes and Payne[14] have tentatively assigned the diamond-drill hole coal intersections to the various coal groups (Jonesville, Premier, and/or Eska) on the basis of stratigraphic evidence as shown in figure 4, section A-A. However, since the individual drill-hole sections show such marked disparity between each other, the continuity of any one coal group over a significant strike length is very doubtful. For this reason, no additional minable reserves were added as a result of this phase of the drilling program.

The marked disparity of the coal intersections in this group of drill holes probably is due to contortion and dislocation of the formations because of locally intense folding and faulting. The distortion appears to be particularly intense at the toe of the escarpment near the extremity of the south limb where the conglomerate cover is relatively thin. Downdip from the toe of the escarpment, the formations appear to be less disturbed, as was indicated by subsequent downdip drilling through the thicker conglomerate capping where correlative

[14] Work cited in footnote 11, p. 10.

coal-bearing formation were found and by the underground workings of the Evan Jones mine. These workings are beneath the thick conglomerate capping on the north limb of the syncline where coal is produced from beds that are relatively undisturbed except for major transverse faulting. Descriptive logs and results of analyses are given in the appendix.

Drill Holes WH-9 Through WH-13

Because of the erratic conditions found in the drill holes along the south edge of the conglomerate, investigators decided in 1950 to move drilling operations northward onto the conglomerate mass of Wishbone Hill proper to determine if such unfavorable conditions extended downdip toward the synclinal axis. If improved conditions were indicated by deeper drilling, the position of the synclinal axis and the depth, attitude, and character of the coalbeds in its vicinity would be determined as an aid to possible future mining operations. The discovery of an area where the coal was comparatively flat-lying, such as might be expected near the synclinal axis, was particularly desirable for deep development and mechanized mining.

Churn drilling was used to penetrate the conglomerate capping; core drilling was then continued from the bottom of the churn-drilled holes into the coal-bearing formations. During 1950-52 four drill holes (WH-9, 10, 11, and 12) were completed. Their churn-drilled depth ranged from 1,151 to 1,293 feet, and their total depth ranged from 2,100 to 2,114 feet. A fifth hole, DDH-WH-13, was churn drilled through Eska Conglomerate to a depth of 1,305 feet in 1952 and core drilled to a total depth of 1,707 feet in 1953. At 1,707 feet, the tools became stuck in soft-caving Chickaloon formations and were broken off. After the failure of repeated efforts to remove the stuck section of tools, the hole was abandoned. The locations of the five vertical holes drilled during this period are shown on figure 3. Holes 9, 10, and 11 are located on the south limb of the syncline; hole 12 is believed to be located at or very near the synclinal axis, and hole 13 was planned to intersect beds on the north limb of the syncline.

The results of this series of holes were considerably more promising than the previous series drilled along the south limb extremity. All the holes, with the exception of DDH-WH-13, which was abandoned short of any coal measures, intersected coalbeds of minable thickness. The intersected beds are believed correlative. Investigators believe that drill holes 10, 11, and 12 intersected the Jonesville group and all holes (with the exception of 13) have intersected the Premier group. The Jonesville group was absent in hole 9; the interval of the hole that should have included this group contained only short intervals of coaly claystone and longer intervals containing many coaly streaks and fragments. The core recovered from this section of hole showed a high degree of shearing. Therefore, the Jonesville group probably was eliminated by a local minor fault. Apparently only hole 11 reached the Eska coal group, which here consisted of several thin nonminable coalbeds. Sections B-B and C-C (fig. 4) show an interpretation of data obtained from this series of drill holes. Because no positive individual bed correlation would be made, coal intersections are shown as a group of beds. Descriptive logs and results of analyses are contained in the appendix.

TABLE 2. - Summary of drill-hole data, central part of Wishbone Hill district

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
WH-1....	165 ft. N., 305 ft. E. of W. 1/4 cor. sec. 20 (vertical)	835			0	44	Overburden.
					44	127	Eska Conglomerate.
					127	271	Chickaloon.
					271	352	COAL (Jonesville group).
					352	612	Chickaloon.
					612	695	COAL (Premier group).
					695	852	Chickaloon.
					852	863	COAL (Eska group).
					863	1004	Chickaloon.
WH-2....	810 ft. N., 1,890 ft. E. of W. 1/4 cor. sec. 20 (vertical)	740			0	40	Overburden.
					40	757	Chickaloon.
WH-3....	825 Ft. S., 1,665 ft. W. of E. 1/4 cor. sec. 19 (vertical)	785			0	67	Overburden.
					67	165	Chickaloon.
					165	173	COAL (Jonesville group).
					173	352	Chickaloon.
					352	536	COAL (Premier group).
					536	1358	Chickaloon.
WH-4....	305 ft. S., 680 ft. W. of E. 1/4 cor. sec. 19 (vertical)	842			0	56	Overburden.
					56	132	Eska Conglomerate.
					132	370	Chickaloon.
					370	533	COAL (Premier group).
					533	998	Chickaloon.
WH-5....	470 ft. N., 1,130 ft. E. of W. 1/4 cor. sec. 20 (vertical)	872			0	106	Overburden.
					106	339	Chickaloon.
					339	435	COAL (Premier group).
					435	736	Chickaloon.

TABLE 2. - Summary of drill-hole data, central part of Wishbone Hill district (Con.)

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
WH-6....	1,005 ft. N., 1,625 ft. E. of W. 1/4 cor. sec. 20 (vertical)	857			0	45	Overburden.
					45	312	Chickaloon.
					312	387	COAL (Premier group).
					387	411	Chickaloon.
WH-7....	770 ft. N., 2,270 ft. E. of S. 1/4 cor. sec. 19 (vertical)	834			0	35	Overburden.
					35	258	Eska Conglomerate.
					258	579	Chickaloon.
					579	612	COAL (Premier group).
					612	869	Chickaloon.
					869	959	COAL (Eska group).
					959	963	Chickaloon.
WH-8....	1,195 ft. N., 690 ft. W. of S. 1/4 cor. sec. 19 (vertical)	833			0	21	Overburden
					21	419	Eska Conglomerate.
					419	438	Chickaloon.
					438	524	COAL (Premier group).
					524	887	Chickaloon.
WH-9....	1,005 ft. S., 905 ft. W. of NE. cor. sec. 19 (vertical)	1,240	0	4			Overburden.
			4	1,225			Eska Conglomerate.
			1,225	1,257			Chickaloon.
					1,257	1,671	Do.
					1,671	1,895	COAL (Premier group).
					1,895	2,104	Chickaloon.
WH-10...	555 ft. N., 3,380 ft. E. of E. 1/4 cor. sec. 19 (vertical)	1,032	0	11			Overburden.
			11	1,151			Eska Conglomerate.
					1,151	1,459	Do.
					1,459	1,652	Chickaloon.
					1,652	1,705	COAL (Jonesville group).
					1,705	1,801	Chickaloon.

TABLE 2. - Summary of drill-hole data, central part of Wishbone Hill district (Con.)

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
WH-10 (con.)..					1,801	1,973	COAL (Premier group).
					1,973	2,110	Chickaloon.
WH-11....	735 ft. N., 1,500 ft. W. of E. 1/4 cor. sec. 19 (vertical)	1,197	0	3			Overburden.
			3	1,010			Eska Conglomerate.
			1,010	1,291			Chickaloon.
					1,291	1,371	Do.
					1,371	1,487	COAL (Jonesville group).
					1,487	1,624	Chickaloon.
					1,624	1,863	COAL (Premier group).
					1,863	1,977	Chickaloon.
					1,977	1,997	COAL (Eska group).
					1,997	2,100	Chickaloon.
WH-12....	875 ft. S., 2,630 ft. W. of NE. cor. sec. 19 (vertical)	1,172	0	15			Overburden.
			15	1,293			Eska Conglomerate.
					1,293	1,692	Do.
					1,692	1,852	Chickaloon.
					1,852	1,911	COAL (Jonesville group).
					1,911	1,990	Chickaloon.
					1,990	2,114	COAL (Premier group).
WH-13....	1,190 ft. N., 1,125 ft. W. of SE. cor. sec. 18 (vertical)	1,646	0	1,305			Eska Conglomerate.
					1,305	1,556	Do.
					1,556	1,707	Chickaloon.
WH-14....	1,605 ft. S., 2,130 ft. E. of NW. cor. sec. 20 (horizontal), (Bearing N. 40°W.)	731			0	193	Evan Jones adit (drilled through casing).
					193	1,376	Chickaloon.
					1,376	1,425	Eska Conglomerate.

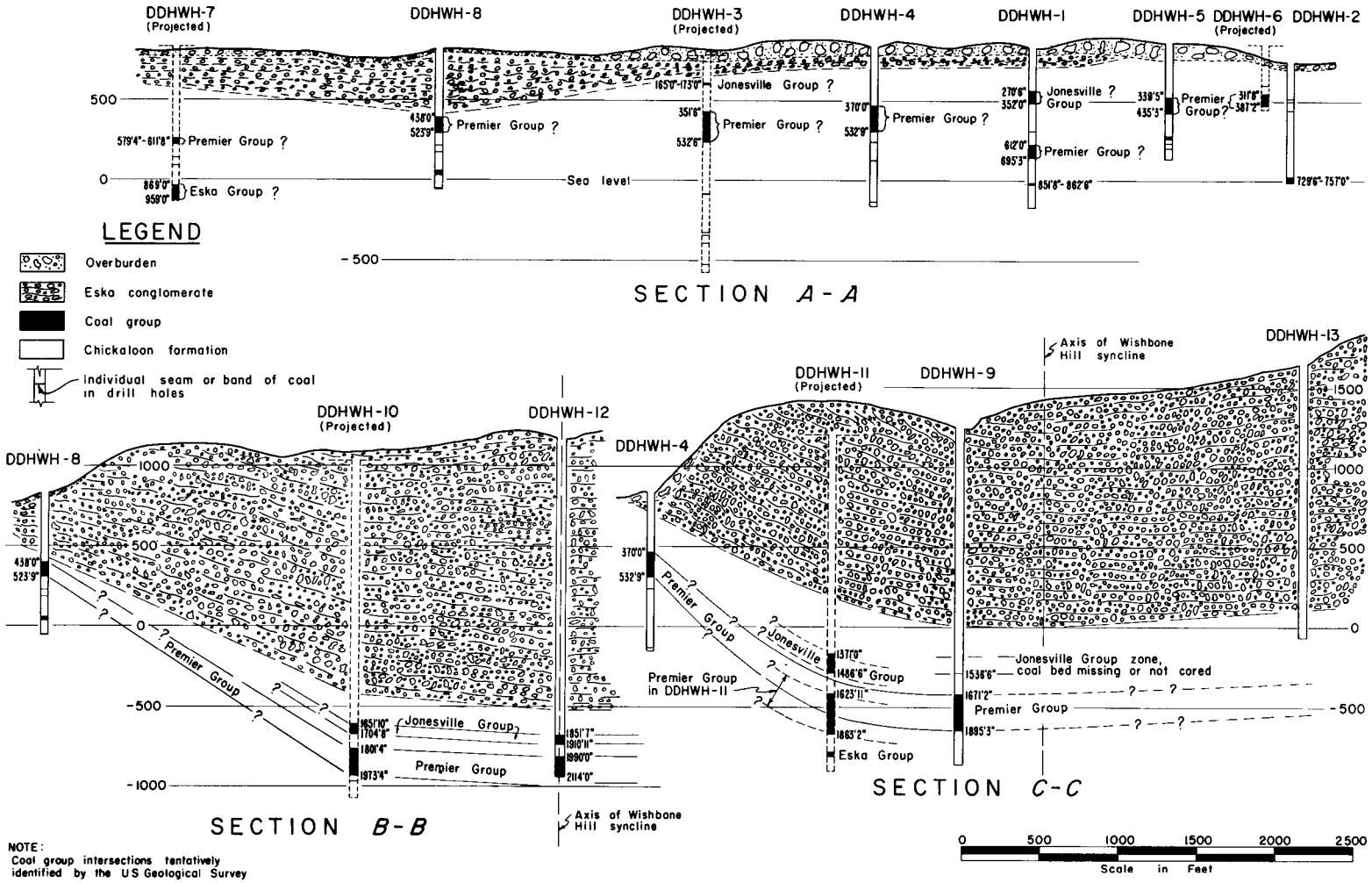

FIGURE 4. - Sections A-A, B-B, and C-C, Drill Holes WH-1 Through WH-13.

Drill Hole WH-14

In addition to the five vertical holes drilled from the higher slopes of Wishbone Hill, a horizontal hole was drilled in 1952 to obtain data on the position, attitude, and quality of coal seams believed to underlie the conglomerate escarpment immediately west of Jonesville. The location best suited was the face of a short adit previously driven by the Evan Jones Coal Co. The short adit intersected a coal seam believed to correlate as one of the upper members of the Premier coal group, but the correlation was not positive, and the position, attitude, and quality of the overlying Jonesville group in this area was not known; the horizontal hole was drilled to obtain this information.

To accomplish the drilling with available equipment, a surface gasoline-engine-driven drill was set up at the portal of the short adit, and the drill rods from portal to face were operated in casing supported by sprags across the adit. For measuring purposes, the casing head at the portal was considered the hole collar.

The results of this drilling were very disappointing; the hole, designated DDH-WH-14 (fig. 3), was drilled to 1,425 feet and bottomed in Eska Conglomerate without having encountered a single coal measure.

The difficult drilling conditions encountered in the hole (such as abundance of mud, a strong waterflow, and swelling ground) and the apparent repetition of certain strata as noted in the core indicated extensive movement along at least two strong faults. This movement may have removed the Jonesville group of coal measures from the section penetrated by the drill hole. A large fault intersected at 1,110 feet is possibly the Jonesville fault, along which major displacements have been measured where exposed in mine workings to the north. Figure 5 shows hole number DDH-WH-14 in section; the section was devised by the Geological Survey as the most plausible of several possible geological interpretations to best fit the available information. The detailed log of the core is given in the appendix.

Western Part of Wishbone Hill District

The western part of the Wishbone Hill district includes both the north and south limbs of the syncline in the area extending westward from the Range line to the Premier mine (fig. 6). Prominent topographic features are the valley of Moose Creek and the Eska Conglomerate escarpment that longitudinally border the north limb of the syncline in this area. Mining activity within the area has been confined to a narrow strip along or near Moose Creek where many coal outcrops occur. With the exception of the Premier mine, all production has been from the north limb of the syncline. Until the Bureau of Mines did subsurface exploration, no attempt had been made to locate the position of south limb outcrop within this area.

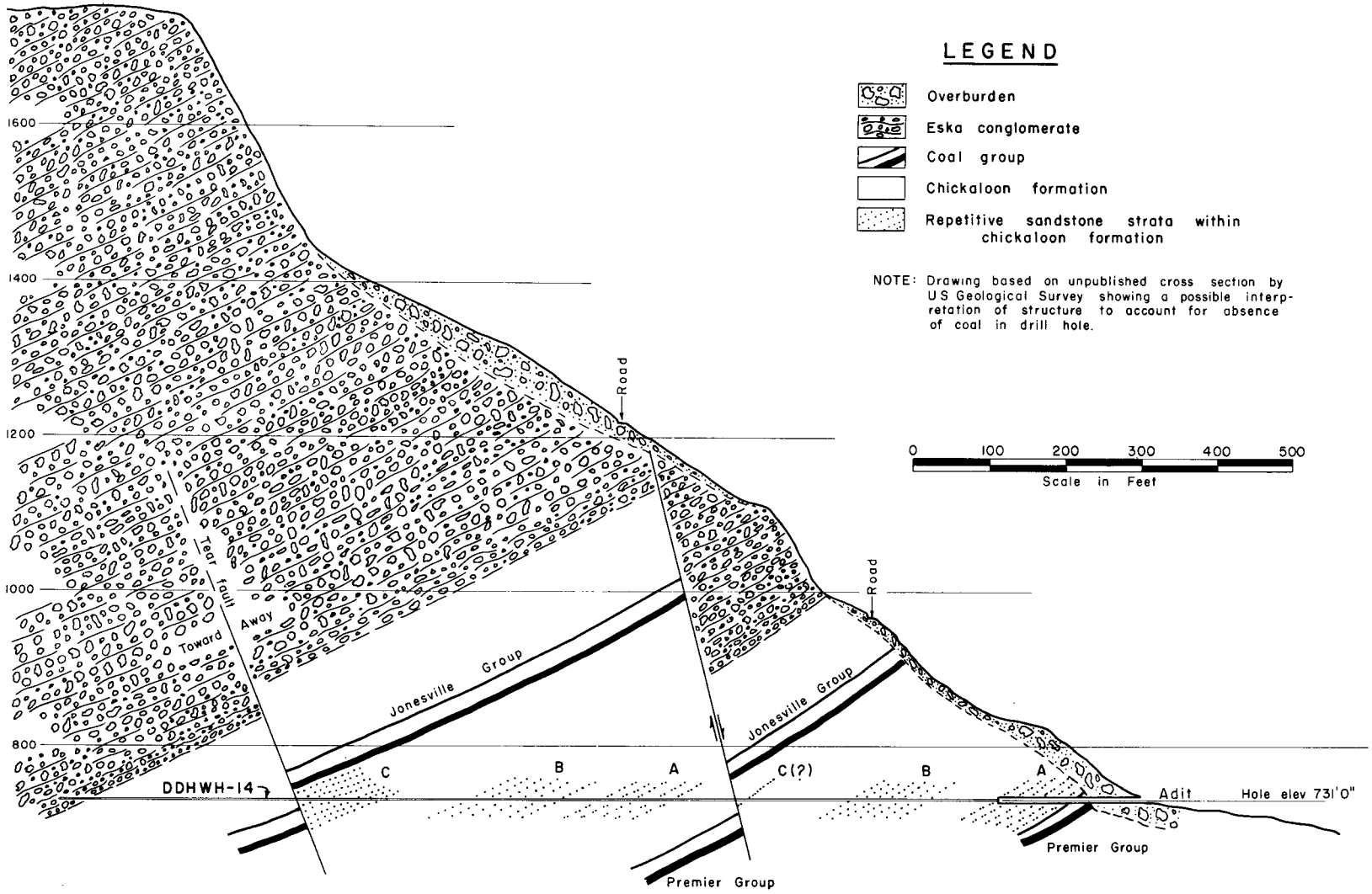

FIGURE 5. - Section Through Drill Hole WH-14.

Subsurface exploration in this part of the district included 2,422 feet of churn drilling, 13,083 feet of diamond-core drilling, and about 25,000 cubic yards of dragline trench excavation. To reach the various drill-hole locations, about 8 miles of bulldozer-excavated roads were built. All the dragline trenching and a substantial part of the access road construction and drilling was completed under contract. Typical contract terms are given in the appendix.

Exploratory drilling was undertaken on both the north and south limbs of the syncline in several contiguous areas that are divided by major transverse faults. In addition to transverse faulting, part of the area has been subjected to a thrust fault, designated the Moose Creek fault, which dips about 40° SE. and has a surface strike trace along Moose Creek just below the base of the Eska Conglomerate (fig. 6). The segment between the Buffalo and Baxter transverse faults that contains the Buffalo mine and a section of drill holes made by the Bureau of Mines apparently were not affected by the Moose Creek fault.

Drill-hole data are summarized in table 3. Exploration by both trenching and drilling is described in detail, and the results are interpreted by area and method.

North Limb

Earlier reconnaissance core drilling in the western part of the district by the Bureau of Mines[15] and surface geologic interpretation by the Geological Survey[16] indicated that a part of the district adjacent to Moose Creek might contain a large block of relatively undisturbed coal. If this could be proved, the known minable coal reserves within the Wishbone Hill district would be considerably increased. Investigators believed that a block of ground lying between the Buffalo and Baxter faults was most likely to contain the largest unit of relatively undisturbed minable coal reserves. A section of diamond-drill holes was planned to accomplish proof of existence, continuity, attitude, and position. The section is located between the Baxter and Buffalo faults and oriented approximately normal to the synclinal strike. This series of drill holes would complement the earlier reconnaissance drilling.

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[15] Apell, G. A., Moose Creek District of Matanuska Coal Fields, Alaska: Bureau of Mines Rept. of Investigations 3784, 1944, 36 pp.
Jolley, Theodore R., Toenges, Albert L., and Turnbull, Louis A., Bituminous-Coal Deposits in the Vicinity of Eska, Matanuska Valley Coal Field, Alaska: Bureau of Mines Rept. of Investigations 4838, 1952, 87 pp.
Geer, M. R., and Yancey, H. F., Washability Characteristics and Washing of Coals From the Matanuska Field of Alaska: Bureau of Mines Rept of Investigations 3840, 1946, 17 pp.

[16] Barnes, Farrell F., and Payne, Thomas G., The Wishbone Hill District, Matanuska Coal Field, Alaska: Geol. Survey Bull. 1016, 1956, 88 pp.

TABLE 3. - Summary of drill-hole data, western part of Wishbone Hill district

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
MC-1....	1,675 ft. N., 1,043 ft. E. of SW. cor. sec. 23 (vertical)	1,063			0	19	Overburden.
					19	46	Chickaloon.
					46	256	COAL (Jonesville group).
					256	691	Chickaloon.
					691	838	COAL (Premier group).
					838	932	Chickaloon.
MC-2....	1,560 ft. N., 1,180 ft. E. of SW. cor. sec. 23 (vertical)	1,084			0	13	Overburden.
					13	349	Chickaloon.
					349	547	COAL (Jonesville group).
					547	936	Chickaloon.
					936	1,367	COAL (Premier group).
					1,367	1,405	Chickaloon.
MC-3....	1,236 ft. N., 1,600 ft. E. of SW. cor. sec. 23 (vertical)	1,096	0	90			Overburden.
					90	106	Overburden.
					106	399	Eska Conglomerate.
					399	760	Chickaloon.
					760	945	COAL (Jonesville group).
					945	958	Chickaloon.
MC-4....	921 ft. N., 1,964 ft. E. of SW. cor. sec. 23 (vertical)	1,100	0	110			Overburden.
			110	135			Tsadaka Conglomerate.
			135	221			Eska Conglomerate.
					221	544	Do.
					544	773	Chickaloon.
					773	941	COAL (Jonesville group).
					941	1,012	Chickaloon.
MC-5....	635 ft. N., 2,384 ft. E. of SW. cor. sec. 23 (vertical)	1,107	0	139			Overburden.
			139	180			Eska Conglomerate.
					180	864	Do.
					864	922	Chickaloon.

TABLE 3. - Summary of drill-hole data, western part of Wishbone Hill district (Con.)

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
MC-6....	322 ft. N., 2,773 ft. E. of SW. cor. sec. 23 (vertical)	1,150	0	117			Overburden and Tsadaka Conglomerate.
					117	206	Tsadaka Conglomerate.
					206	1,176	Eska Conglomerate.
					1,176	1,202	Chickaloon.
MC-7....	252 ft. S., 3,550 ft. E. of NW. cor. sec. 26 (vertical)	1,150			0	5	Overburden.
					5	244	Tsadaka Conglomerate.
					244	980	Eska Conglomerate.
					980	1,210	Chickaloon.
					1,210	1,571	Eska Conglomerate.
					1,571	2,017	Chickaloon.
P-1.....	126 ft. N., 944 ft. E. of E. 1/4 cor. sec. 27 (-45°), (Bearing S. 39° E.)	899			0	14	Overburden.
					14	141	Eska Conglomerate.
					141	247	Chickaloon.
					247	490	COAL (Jonesville group).
					490	682	Chickaloon.
					682	823	COAL (Premier group).
					823	837	Chickaloon.
MC-8....	2,163 ft. N., 2,595 ft. W. of SE. cor. sec. 26 (vertical)	874	0	21			Overburden.
			21	198			Eska Conglomerate.
					198	425	Do.
					425	472	Chickaloon.
					472	560	COAL (Jonesville group).
					560	982	Chickaloon.
MC-9....	1,950 ft. N., 2,310 ft. W. of SE. cor. sec. 26 (vertical)	800	0	108			Overburden.
			108	172			Eska Conglomerate.
			172	265			Chickaloon.

TABLE 3. - Summary of drill-hole data, western part of Wishbone Hill district (Con.)

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
MC-9 (con.)..					265	429	Chickaloon.
					429	594	COAL (Premier group).
					594	911	Chickaloon.
MC-10....	1,570 ft. N., 1,921 ft. W. of SE. cor. sec. 26 (vertical)	738	0	60			Overburden.
					60	803	Chickaloon.
MC-11....	357 ft. S., 1,665 ft. E. of NW. cor. sec. 35 (vertical)	766	0	160			Overburden.
			160	234			Chickaloon.
MC-12....	16 ft. N., 2,678 ft. W. of SE. cor. sec. 27 (vertical)	855	0	55			Overburden.
			55	180			Chickaloon.
MC-13....	886 ft. N., 3,486 ft. W. of SE. cor. sec. 27 (vertical)	863	0	160			Overburden.
MC-14....	1,192 ft. N., 3,869 ft. W. of SE. cor. sec. 27 (vertical)	847	0	110			Overburden.
			110	149			Tsadaka Conglomerate.
					149	239	Do.
					239	648	Chickaloon.
MC-15....	1,528 ft. N., 4,260 ft. W. of SE. cor. sec. 27 (vertical)	849	0	56			Overburden.
			56	165			Tsadaka Conglomerate?
			165	170			COAL (Premier group?).
					170	263	COAL (Premier group?).
					263	1,046	Chickaloon.
MC-16....	24 ft. S., 1,260 ft. E. of SW. cor. sec. 26 (vertical)	794	0	180			Overburden.
			180	232			Tsadaka Conglomerate.
					232	599	Chickaloon.
MC-17....	2,000 ft. N., 4,597 ft. W. of SE. cor. sec. 27 (vertical)	892	0	67			Overburden.
			67	91			Chickaloon.

TABLE 3. - Summary of drill-hole data, western part of Wishbone Hill district (Con.)

Drill hole No.	Location	Collar elevation	Churn drilling		Core drilling		Principal formations intersected
			From, feet	To, feet	From, feet	To, feet	
MC-18...	2,990 ft. N., 360 ft. W. of SE. cor. sec. 26 (vertical)	785	0	73			Overburden.
			73	75			Do.
					75	80	Do.
					80	347	COAL (Premier group).
					347	566	Chickaloon.

Drill Holes MC-1 through MC-7

During 1953 and 1954, seven diamond-drill holes (designated DDH-MC-1 through DDH-MC-7) were completed (see fig. 6 for plan locations). Drill holes MC-1 and MC-2 were drilled through both the Jonesville and Premier coal groups; the Jonesville coal group had not previously been shown to exist in this area. Coalbeds of economic importance are present in each coal group and in both drill holes. Drill holes MC-3 and MC-4 were discontinued at or very near the base of the Jonesville coal group. Either a minor fold or fault occurs between holes MC-3 and MC-4, but the deformation is probably not of a magnitude to impede mining (fig. 7, section D-D). Because of the increased depth to the coal measures toward the synclinal axis and the resultant increase in cost, holes MC-5 and MC-6 were drilled only to the base of the Eska Conglomerate to establish the continuity of the structure and to locate, if possible, the approximate position of the synclinal axis rather than to obtain additional samples of the coals.

On the basis of data obtained from the previous holes, hole MC-7 was subsequently located on the projected position of the axis and was drilled to a depth of 1,109 feet, a depth believed to lie below the conglomerate base. As originally planned, drill hole MC-7 was to be continued through both the Jonesville and Premier coal groups. However, for various reasons, drill hole MC-7 was discontinued at a depth short of any coal measures. In 1958, because of correlation difficulties experienced in subsequent drill holes, the original plan was renewed by continuing drill hole MC-7 to a total depth of 2,017 feet. The results of the continued drilling were very disappointing. At 1,210 feet the hole reentered Eska Conglomerate and continued in this formation to a depth of 1,571 feet. From 1,571 feet to bottom, the hole penetrated typical sediments of the Chickaloon formation but did not encounter coal of economic importance. Although the evidence is not conclusive, either from observation of drill core or drilling characteristics, investigators believe that drill hole MC-7 encountered a major fault, probably the Buffalo fault. The Buffalo fault is essentially a tear fault along which the west side has moved southward. To account for the intersection of the Buffalo fault by drill hole MC-7, the fault

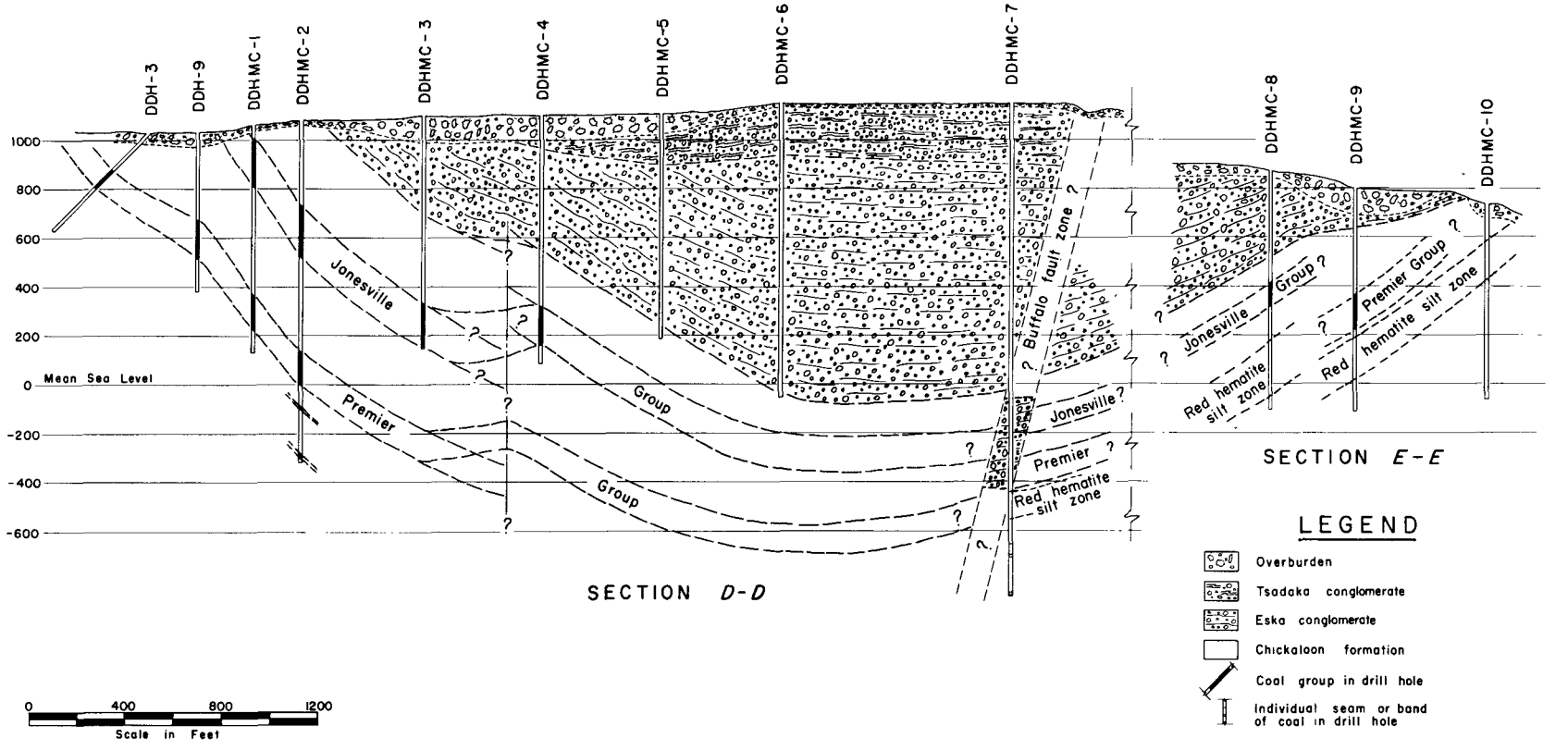

FIGURE 7. - Sections D-D and E-E, Drill Holes MC-1 Through MC-10.

either varies slightly from vertical and/or the drill hole with increasing depth assumed a slight angle from vertical. To explain the absence of the Jonesville and Premier coal groups as related to intersection of the Buffalo fault, the writer favors an explanation involving displacement of a relatively small independent segment of Eska conglomerate within the Buffalo fault zone. The conglomerate segment was displaced at the time of main movement along the Buffalo fault, both horizontally and vertically, to a position corresponding to the drill-hole interval of 1,210 to 1,571 feet. The segment of conglomerate thus occupies a stratigraphic position that normally should have contained the Jonesville and Premier coal groups (see fig. 7, section D-D).

Drill Hole P-1

Simultaneously with contract core drilling in the Buffalo mine area, Bureau of Mines equipment and personnel were employed to core drill in an area east of the old Premier mine and on the opposite side of the prominent Premier fault (see fig. 6). Several coal seams had been found in this area, but because the amount of displacement along the Premier fault was unknown and the lack of any marker beds, these coalbeds could not be correlated with any of the known coal groups of the Wishbone Hill district. If these coalbeds could be identified and their stratigraphic position established, the development of future mining operations in the area might be decidedly influenced, and if an overlying coal group exists, the economically recoverable reserves within this potential block would be considerably increased. Accordingly, the best estimate possible of the Premier fault displacement was used to locate a proposed drill hole (P-1) that should intersect any overlying coal group and produce data indicative of the synclinal structure on the north side of the Premier fault.

In an attempt to reach bedrock before drilling, the bulldozer reached coal. Additional trenching was then undertaken to correlate the newly uncovered coalbeds. Overlying Eska Conglomerate was ultimately uncovered, thus making fairly certain the assignment of these coalbeds to the Jonesville group; attitudes indicated the beds were on the north limb of the syncline. However, bulldozer trenching to determine the structure to the east of the exposure became impractical because of the depth of glacial overburden. Therefore, drill hole P-1 finally was collared from the location shown on fig. 6.

Drill hole P-1 was core drilled at an angle of minus 45° on a bearing of S. 39° E. to a total depth of 837 feet. It intersected the contact of the Eska Conglomerate and the Chickaloon formation and coalbeds of both the Jonesville and Premier groups. The angle of bedding intercepted indicated that the coalbeds have a 5° to 15° dip, which further indicated a decided broadening of the synclinal trough in comparison to the old Premier workings. The hole is shown in section on figure 8; a detailed log and coal analyses are given in the appendix.

Dragline Trenching: Vicinity of Old Premier Mine Workings

Although additional bulldozer trenching in the vicinity of the old Premier mine had proved impractical, researchers believed that probably a dragline capable of digging to depths of 30 feet could be effectively utilized. Therefore, in 1955 trenching was begun to trace the synclinal structure from the known position of north limb outcrop across the syncline to the unknown position of south limb outcrop.

Trench No. 1 commenced about 600 feet southwest of the collar of drill hole P-1 and progressed eastward approximately parallel to the projected trace of the Premier fault. Minable beds of the Jonesville coal group at a very steep attitude were cut in the western part of the trench, and the overlying sediments of the Upper Chickaloon formation were exposed eastward to a position near the contact of the Eska Conglomerate and Chickaloon formations. The trench was then continued eastward at intervals for observation of the predominant attitudes of the interbedded lenticular sandstone contained in the conglomerate (see fig. 6).

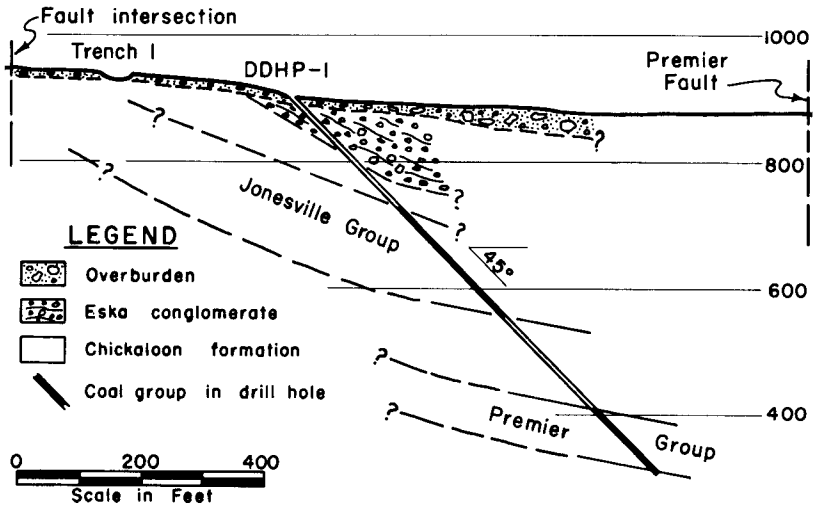

FIGURE 8. - Section Through Drill Hole P-1.

Eska Conglomerate bedrock was reached at intervals to a distance of about 3,500 feet from the beginning of trench No. 1. The most eastward bedrock obtained, in trench No. 1-E at a distance of about 4,300 feet, showed Tsadaka formation; three attempts eastward of trench No. 1-E failed to reach bedrock. Although the position of the south limb coal outcrop was not determined, average dips (though very erratic) and the synclinal width over which Eska Conglomerate was uncovered indicated a comparatively broad synclinal structure.

Two subsidiary trenches, No. 2 and No. 3 (see fig. 6), were located about 500 feet and 1,300 feet, respectively, northeast of trench No. 1 to cross the projected strike of the north limb of the Jonesville coal group. Trench No. 2 apparently cut the Jonesville coal group, but at a position that can only be accounted for by the presence of a transverse fault between trenches No. 1 and No. 2. Subsequent strip mining of the Jonesville coal group has proven the existence and position of the fault (see fig. 6). Trench No. 3 traversed beds of medium-grained sandstone at rather flat attitude (15° to 20°) but failed to intersect any coal measures. The area in which trench No. 3 is located probably has been affected by the Moose Creek thrust fault.

South Limb

During 1956 and 1957 a series of drill holes planned to augment earlier drilling and trenching in the southwestern part of the Wishbone Hill district was begun to locate the south limb outcrop position and establish the stratigraphic continuity of the major coal groups (Jonesville and Premier) in each of the several blocks caused by the Buffalo, Baxter, and Premier transverse faults. Over much of this section of the district, the capping of Eska or Tsadaka conglomerates submerges under areas of moderate to heavy glacial cover. Therefore, churn drilling was used to penetrate the bouldery glacial overburden and was continued into bedrock to determine, if possible, the identity of the formation from the churn-drill cuttings. Where the churn-drill cuttings indicated the presence of favorable formations, core drilling was used to explore the underlying strata.

Drill Holes MC-8 Through MC-10

Drill holes MC-8, 9, and 10 are located within the same fault block as drill holes MC-1 through 7 (see fig. 6). These holes were drilled to complete a section across the entire width of the syncline. Because of difficult access and the proximity of the Buffalo fault, the line of section for these later holes was offset about 2,600 feet southwest.

A single coal group of economic importance was intersected in both drill holes MC-8 and MC-9, but positive correlation was not possible. Stratigraphic evidence, such as distance of the coal groups below the Eska Conglomerate, thickness of coal groups, appearance, and arrangement of coalbeds within each coal group, and stratigraphic position of a zone containing a red hematite and/or limonite silt strongly indicate intersection of the Jonesville coal group by drill hole MC-8 and intersection of the Premier coal group by drill hole MC-9 as illustrated in figure 7, section E-E. However, evidence of the structural complexity necessary to account for absence of a major coal group from each of the drill holes is lacking, and no satisfactory explanation has been devised. Loss of drilling fluid and heavy ground at about 775 feet hole depth in MC-8 indicated a strong fault intersection that may have eliminated the Premier coal group from the drilled section in this hole. A more plausible interpretation of the failure to intersect two coal groups in holes MC-8 and MC-9, but one supported by less conclusive stratigraphic evidence, is that the two groups were blended at the time of deposition. If this interpretation is correct, a normal fault between the drill holes would account for the structural discordance.

Drill hole MC-10 penetrated typical Chickaloon formation sediments to a total depth of 802 feet without intersecting any coal measures of economic importance. By projecting hole MC-9 dip angles, MC-10 should have intersected at shallow depth the same coal group as that intersected in MC-9. However, this was not true; the dip angles intersected in MC-10 had steepened considerably. Therefore, investigators believe that the coal group outcrops under the moraine some distance short of drill hole MC-10. Drill hole MC-10 intersected several coal measures of noneconomic importance which may be members of the Eska and Burning Bed coal groups (fig. 7, section E-E).

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Drill holes MC-8, 9, and 10 each intersected a zone of Chickaloon formation containing iron minerals that give a conspicuous red color to a stratigraphic interval of approximately 60 feet. The zone probably is located just below the Premier coal group and appears to be correlative between drill holes. A sample, representative of most of the zone, was submitted for petrographic and chemical analyses and was classified as an illite shale containing acid-soluble iron in the amount of 6.9 percent (principally in the form of either limonite or hematite). As a result of these analyses and because similar appearing zones were encountered in other drill holes, a more detailed study was initiated. Selected samples from several holes were submitted for a detailed correlation study[17] by means of micropaleontology and sedimentary petrography techniques. Because of timelag between actual core recovery and collection of these later samples, samples had to be selected from hard, more durable bands within the reddish-colored zone. (Drill cores, other than coal sections, were laid out in unprotected core gardens adjacent to the drill hole and thus were subject to weathering. The shale portion of the zone weathers to an indistinguishable mass not suitable for representative sampling). The samples selected for special study contained acid-soluble iron (siderite) in amounts ranging from 23.2 to 29.8 percent. The results of the study follow:

> Through this study it was found that no microfossils, heavy minerals, or other prominent correlation features are present in the four submitted samples. Consequently, it was not possible to establish a definite age relationship between these materials. The samples, however, are all mineralogically and megascopically similar consisting primarily of illite with varying amounts of siderite and chlorite. In addition, the composition of the siderite seems to be essentially the same in all four samples. This is reflected both by a similarity of differential thermal curves and the consistency of indices of refraction of the siderite. Normally, variations in the substitution ratio of magnesium, manganese, and calcium to iron would be expected in siderite derived from different deposits. Therefore, it is strongly indicated that the materials are at least very closely associated, and there is a good possibility that they could have been deposited contemporaneously.

Even though this study does not offer conclusive evidence on which to base correlation, the results are probably sufficient for use as an aid in assigning the coal intersections to a coal group and/or in determining the position of hole intersection stratigraphically with the Chickaloon formation.

Drill Holes MC-11 and MC-16

Drill holes MC-11 and MC-16 are located within the projected boundaries of the Baxter and Premier faults. They were planned to locate the south limb of the syncline within this major fault block (see fig. 6 for plan location). Drill hole MC-11 was churn drilled to a depth of 234 feet, 160 feet of which was logged as variable glacial overburden; the remainder of the hole intersected typical sandstone and claystone of the Chickaloon formation. No core drilling was done in this hole.

[17] Conducted by Hess, Harold D., supervising geologist, Bureau of Mines, Albany, Oreg.

Diamond-drill hole MC-16 is located approximately 500 feet toward the synclinal axis from drill hole MC-11. Hole MC-16 intersected five minor coal horizons, all of which were narrow and not considered important economically. Although no correlative marker beds were intersected to definitely establish stratigraphic relationship, the narrow coalbeds encountered in this hole probably are members of the Eska and/or Burning Bed coal groups. Apparently hole MC-16 is located east of the moraine-covered outcrop of the productive Jonesville or Premier coal groups. Previous to core drilling, identification of churn-drill cuttings had indicated intersection of conglomerate from a depth of 180 to 231 feet. However, subsequent core drilling to a total depth of 599 feet disclosed no conglomerate of either the Eska or Tsadaka variety. Either identification of the churn-drill cuttings was wrong or any conglomerate penetrated was of the Tsadaka variety that unconformably overlies the Eska Conglomerate and/or the coal-bearing Chickaloon formation (fig. 9, section G-G).

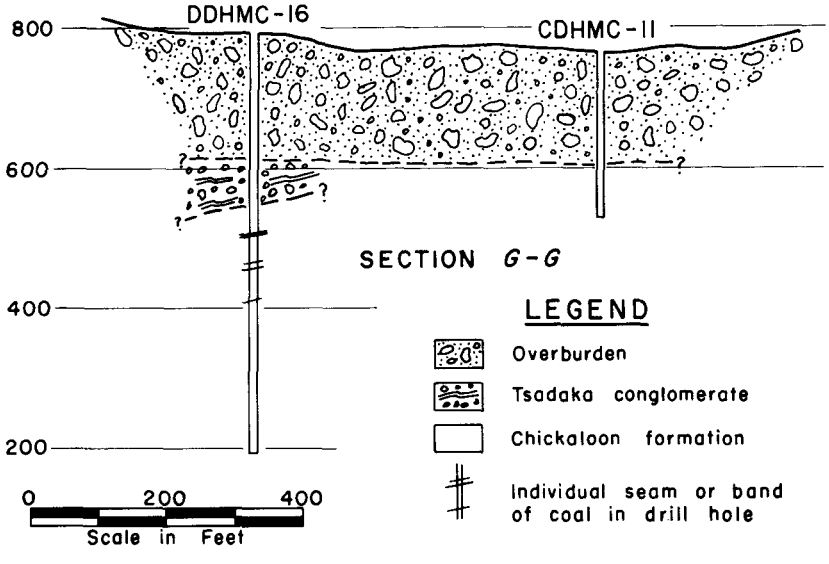

FIGURE 9. - Section G-G, Drill Holes MC-11 and MC-16.

Drill Holes MC-12 Through MC-15, and MC-17

Drill holes MC-12 through MC-15, and MC-17 were located along a section south of the Premier fault in an attempt to locate possible south limb extensions of beds worked in the Premier mine (see fig. 6 for plan location). Drill holes MC-12, 13, and 17 were churn drilled to depths of 180 feet, 160 feet, and 91 feet, respectively, with no following core drilling. Because of difficult drilling conditions encountered in the galcial overburden, hole MC-13 was abandoned before reaching bedrock. As identified from churn-drill cuttings, the bedrock in holes MC-12 and MC-17 indicated that these holes were unfavorably located for subsequent core drilling. Drill holes MC-15 and MC-14 were continued by core drilling to depths of 1,046 feet and 648 feet respectively, and in the order listed.

Drill hole MC-15 encountered several coal horizons, the uppermost of which was of considerable thickness; the coal horizons are well east of what was previously considered to be the limit of the south limb beds in this area. The other coal horizons encountered in the hole were comparatively narrow and not considered important. Because of the absence of a known correlative marker, the stratigraphic position of the uppermost coal horizon has not been definitely established; however, stratigraphic evidence observed in the core indicates that assignment to the Premier coal group is most logical. Bedding angles were steep

in the upper part of the hole and gradually flattened toward the bottom, indicating local folding. The extent of folding, however, or its relationship to coal measures contained in the old Premier mine workings has not been definitely determined. A possible solution is shown in figure 10, section F-F.

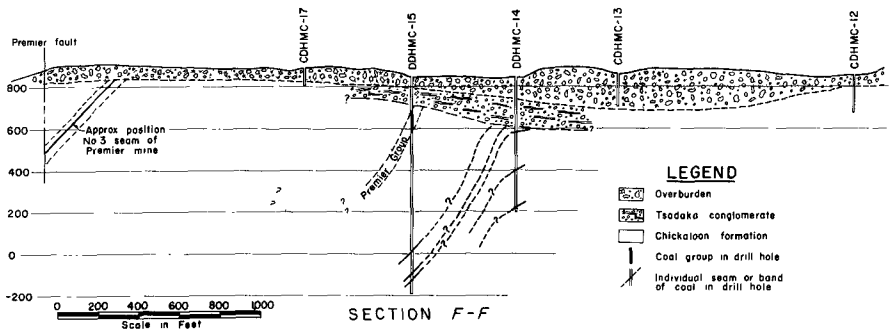

FIGURE 10. - Section F-F, Drill Holes MC-12 Through MC-15 and MC-17.

Drill hole MC-14 was continued by core drilling on the premise that bedding intersected in hole MC-15 was dipping toward hole MC-14. Evidently this premise was in error. Hole MC-14 encountered Tsadaka conglomerate in the upper part of the hole that lies unconformably on Chickaloon sediments. Three minor coal sections were found within the Chickaloon formation below the conglomerate. However, because of extreme lateral variation in bedding characteristics within a relatively short distance, definite correlation between holes MC-14 and MC-15 has not been determined. One possible correlative view is shown in figure 10, section F-F.

Drill Hole MC-18

Hole MC-18 was located to establish the position of coal measures on the south limb of the syncline within the major fault block bounded by the Buffalo fault to the west. The hole was located close to the toe of the Eska Conglomerate escarpment in order to intersect both the productive Jonesville and Premier coal groups. Coal was encountered from 80 to 347 feet. Although the hole was drilled to a depth of 566 feet, no other coal seams were encountered. The coal measures were tentatively identified as the Premier group; correlation was based, in part, on the presence of a section below the coalbeds containing a red hematite and/or limonite silt which is similar to sections intersected in holes MC-7, 8, 9, and 10. A section view of hole MC-18 is shown in figure 11; the descriptive log and analyses of core samples are given in the appendix.

Reserves

Estimates

The detailed estimates of reserves in the Wishbone Hill district published in Geological Survey Bulletin 1016 (previously cited) are based on knowledge gained from company mining operations, Geological Survey investigations, and

Bureau of Mines drilling and trenching. Estimates by the Geological Survey made in 1952 are considered applicable at this writing (1960), except for tonnage mined since 1952, and except for an area between the Buffalo and Baxter faults in the western part of the district. Core drilling since 1952 has added considerably to the knowledge of this particular area with a resultant increase in estimated reserves.

Drilling and trenching at other locations in the western part of the district add considerable knowledge to the several areas and give evidence of possible additional reserves of economic importance, but the evidence is not clear enough or complete enough to justify a recalculation of the reserves.

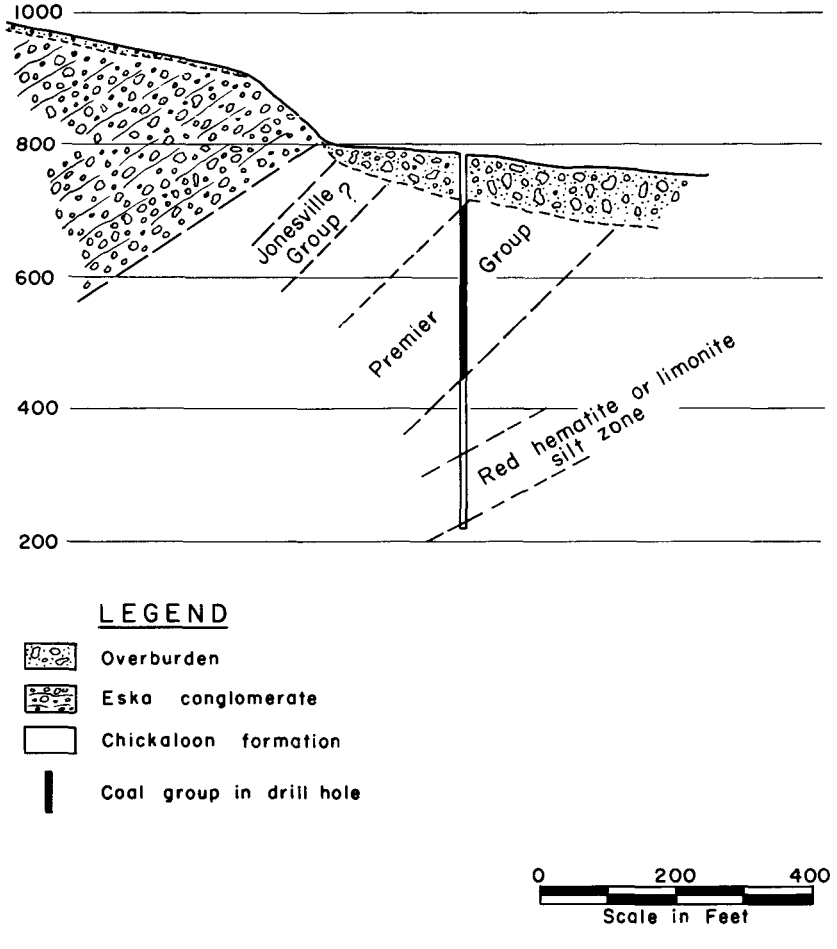

FIGURE 11. - Section Through Drill Hole MC-18.

The method of calculation and classification used herein to estimate new reserves conforms, in general, to the method used by the Geological Survey in Bulletin 1016 (previously cited). Because of wide variations in bed thickness (both laterally and downdip) within relatively short distances, correlation of individual beds is difficult; therfore, calculations were made for the Jonesville and Premier coal groups as a whole rather than by individual beds. No attempt was made to divide the beds into thickness categories (usually standard practice with Bureau of Mines estimates of coal reserves), but no reserves were calculated for beds containing less than a 14-inch thickness of clean coal. In several of the previously cited publications, reserves were estimated for beds underlying the Premier group. However, in the area considered, additional information on these beds is scant, the literature is somewhat

confusing, and no mine development or prospecting has been conducted; therefore, recalculation of reserves was not attempted.

The usual standards for the classification of reserves as measured, indicated, and inferred have been modified to fit the local conditions. Although a considerable tonnage in the immediate vicinity of the Buffalo mine is considered well enough outlined to be classed as measured reserves, this tonnage has been included with the indicated reserves to conform with the classification methods used for this area by the Geological Survey. The distinction between indicated and inferred reserves is based in part on the number and nature of the points of observations and in part on the judgment of the estimator; for estimation of indicated reserves, no group of coal seams was projected more than 3,000 feet from a point of observation and, for inferred reserves, no more than 4,000 feet from a point of observation. Using these criteria, reserves on the north limb were classed as indicated and those on the south limb as inferred.

A summary of previous estimates made by the Geological Survey and revised estimates resulting from subsequent work by the Bureau of Mines is presented in table 4. Estimates by the Geological Survey were calculated for a more extensive area of the Wishbone Hill district than is covered by this report; only those estimates applicable to the area of coverage have been summarized in the table.

Character and Quality

The coal throughout the Wishbone Hill district is of the same general character and quality but varies considerably within and between individual beds, groups of beds, and areas. The rank is high-volatile B bituminous; however, an occasional analyses will indicate coal of high-volatile A bituminous rank. These coals are generally considered to be noncoking, but free swelling index and agglutinating index determinations performed on core samples from the central part of the district indicate that some of the coal may have poor to fair coking and caking properties.

The principal difference between coal seams lies in the ash content; some are relatively clean, some inherently dirty, and others are dirty because of thin high-ash partings.

The ash content of drill-core analyses (tables 5 and 6 in the appendix) range from a low of 1.5 percent to a high of 42.4 percent. A weighted average of this range plus the high-ash core rejected before analyses would probably roughly parallel the ash content of run-of-mine product currently entering the coal washeries of the district, where as much as 50 percent of tonnage entering the washery is rejected as waste. The high reject results from strip-mining methods that prevent selectivity. The quality of product from the washeries may be illustrated by the following contract specifications established for military procurement in fiscal year 1961.

Mine	Maximum Moist	Maximum Ash	Minimum B.t.u.
Evan Jones (Eastern and central part of district).....	8.5	12.5	12,500
Mrak Coal Co. (Eastern part of district).....	7.5	13.0	12,687

The washing characteristics of the coals from the Evan Jones and Mrak mines have been described by Geer and Yancey[18].

[18] Geer, M. R., and Yancey, H. F., Washability Characteristics and Washing of Coals From the Matanuska Field of Alaska: Bureau of Mines Rept of Investigations 3840, 1946, 17 pp.

TABLE 4. - Estimated coal reserves remaining in central and western parts of Wishbone Hill district

Coal group	Reserves (short tons)[1]			
	Geological Survey[2]		Bureau of Mines[3]	
	Indicated	Inferred	Indicated	Inferred
North limb between Jonesville fault and Township line (Above 860 level, Evan Jones mine)				
Jonesville group.....	2,500,000	--	--	--
Premier group.....	12,416,000	--	--	--
(Below 860 level, Evan Jones mine)				
Jonesville group.....	4,440,000	--	--	--
Do.....	--	5,280,000	--	--
Premier group.....	3,465,000	--	--	--
Do.....	--	26,570,000	--	--
South limb west of Jonesville within 1,000 feet of drill holes 9 to 12				
Jonesville group.....	2,365,000	--	--	--
Premier group.....	5,400,000	--	--	--
North limb between Township line and Buffalo fault				
Premier group.....	--	19,000,000	--	--
North limb between Buffalo and Baxter faults				
Jonesville group.....	--	--	7,700,000	--
Premier group.....	9,950,000	--	26,500,000	--
Midway bed.....	624,000	--	--	--
Eska group.....	272,000	--	--	--
Burning Bed group.....	368,000	--	--	--
South limb between Buffalo and Baxter faults				
Jonesville group.....	--	--	--	4,600,000
Premier group.....	--	--	--	4,600,000
South of Premier fault (Above 500 level, Premier mine)				
Premier group.....	370,000	--	--	--
(Below 500 level, Premier mine)				
Premier group.....	--	500,000	--	--

[1] 1 short ton = 25 cu. ft. in place.

[2] Barnes, Farrell F., and Payne, Thomas G., The Wishbone Hill District, Matanuska Coal Field, Alaska: Geol. Survey Bull. 1016, 1956, 88 pp., pp. 82 and 83.

[3] Bureau of Mines revised estimates are total for the given area and include Geological Survey estimates.

APPENDIX

The logs of drill holes are arranged in chronological order with respect to the part of the district where the drill holes were located; the sequence is WH-1 through WH-14, MC-1 through MC-7, P-1, and MC-8 through MC-18. Under the column headed "Remarks", the laboratory sample number is given for each coal intersection analyzed; in instances where a coal seam contained measurable partings that were rejected, or where more than one bed was analyzed in the same sample, subsequent intersections included in the sample are designated by a parenthesis mark.

Analyses of coal cores are given in tables 5 and 6; table 5 gives analyses obtained from the central part of the district and table 6, analyses from the western part of the district. Analyses are given in descending order of intersection within each drill hole.

Part of the core drilling, churn drilling, part of the bulldozer-excavated roads, and dragline trenching were accomplished by contract. As a guide to cost estimating for this type of exploration, several bid awards are quoted.

Logs of Drill Holes, Central Part of District

Log, Hole WH-1

Location: 165 feet N. and 305 feet E. of the W1/4 corner, sec. 20, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 835.4 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	44	0	Overburden, conglomerate slide rock.	44	0	
44	0	127	0	Coarse-grained Eska conglomerate.	83	0	
127	0	133	0	Medium-grained sandstone.	6	0	
133	0	150	0	Soft clay with claystone streaks, bottom of Eska conglomerate.	17	0	
150	0	159	0	Claystone.....	9	0	
159	0	200	0	Interbedded siltstone and arkose coarse-grained speckled sandstone.	41	0	
200	0	243	0	Coarse-grained arkose sandstone.	43	0	
243	0	262	0	Interbedded and crossbedded siltstone, fine- and medium-grained sandstone.	19	0	
262	0	265	0	Conglomeratic sandstone...	3	0	
265	0	268	0	Coarse-grained sandstone..	3	0	
268	0	270	6	Conglomeratic sandstone...	2	6	
270	6	271	6	Bony COAL with streaks of coaly claystone.	1	0	
271	6	272	0	Ironstone.....		6	
272	0	273	0	Bony COAL with streaks of coaly claystone.	1	0	Dip 30°.
273	0	275	6	Coaly claystone.....	2	6	Dip 20° to 30°.
275	6	285	0	Claystone with streaks of ironstone.	9	6	
285	0	287	0	Bony COAL with streaks of coaly claystone.	2	0	Slickensides.
287	0	287	6	Coaly claystone.....		6	
287	6	294	6	No core, clayey claystone.	7	0	
294	6	295	3	COAL.....		9	) D-22381.
295	3	295	4	Bone.....		1	
295	4	296	4	COAL.....	1	0	)
296	4	296	5	Bone.....		1	

Log, Hole WH-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
296	5	296	6	COAL.....		1	)
296	6	296	7	Bone.....		1	
296	7	296	10	COAL.....		3	)
296	10	297	0	Bone.....		2	
297	0	297	3	Coaly claystone.....		3	
297	3	298	10	Claystone.....	1	7	
298	10	299	2-½	COAL.....		4-½	) D-22382.
299	2-½	299	3	Bone.....		½	
299	3	299	6	COAL.....		3	)
299	6	299	7	Claystone.....		1	
299	7	300	0	COAL.....		5	)
300	0	300	1	Claystone.....		1	
300	1	301	11	COAL.....	1	10	)
301	11	318	0	Claystone with streaks of silty claystone.	16	1	
318	0	322	0	Fine-grained sandstone.....	4	0	
322	0	343	0	Siltstone with streaks of claystone and ironstone.	21	0	
343	0	343	3	Ironstone.....		3	
343	3	344	0	Coaly claystone.....		9	
344	0	345	0	Bony COAL.....	1	0	
345	0	351	0	Coaly claystone with thin streaks of coal.	6	0	Dip 45°.
351	0	351	3	Ironstone.....		3	
351	3	352	0	COAL.....		9	
352	0	400	0	Fine light-gray bentonitic sandstone with thin cross-bedded streaks of dark siltstone.	48	0	
400	0	418	0	Fine- to medium-grained sandstone.	18	0	
418	0	437	0	Bentonitic siltstone.....	19	0	
437	0	463	0	Interbedded and cross-bedded clayey siltstone, fine- and medium-grained sandstone.	26	0	
463	0	493	0	Siltstone with streaks of very fine-grained clayey sandstone and ironstone.	30	0	
493	0	508	0	Hard interbedded and cross-bedded fine-grained sandstone and siltstone.	15	0	
508	0	514	0	Silty claystone.....	6	0	
514	0	515	0	Medium-grained sandstone...	1	0	
515	0	518	0	Clayey shaly claystone.....	3	0	Soft.

Log, Hole WH-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
518	0	521	0	Claystone.....	3	0	Steep fractures.
521	0	522	9	Coaly shaly claystone.....	1	9	
522	9	525	0	Shaly claystone.....	2	3	Dip 70°.
525	0	527	9	Bony COAL.....	2	9	
527	9	528	3	Clayey claystone.....		6	Soft.
528	3	538	0	Silty claystone with streaks of ironstone.	9	9	Dip 45°.
538	0	541	0	Hard dense limestone and ironstone with calcite	3	0	
541	0	558	0	Claystone with streaks of ironstone and siltstone.	17	0	Dip 30°.
558	0	559	0	Hard medium-grained sandstone.	1	0	
559	0	586	0	Interbedded siltstone and very fine-grained sandstone with ironstone bands.	27	0	Do.
586	0	588	0	Claystone with coaly streaks.	2	0	
588	0	588	3	Bony COAL with calcite bands.		3	
588	3	592	0	Claystone.....	3	9	Dip 20° to 30°.
592	0	605	0	Hard dense interbedded siltstone and fine-grained sandstone with ironstone bands.	13	0	
605	0	606	6	Shaly claystone.....	1	6	
606	6	607	0	Slickensided claystone with calcite and clay bands.		6	
607	0	608	0	Ironstone.....	1	0	
608	0	612	0	Claystone.....	4	0	Dip 20° to 30°.
612	0	613	0	COAL with streaks of bone..	1	0	
613	0	614	4	Claystone.....	1	4	
614	4	615	1	COAL with thin bony streaks.		9	
615	1	615	4	Ironstone with coaly claystone streak.		3	
615	4	618	6	COAL.....	3	2	) D-22383.
618	6	626	11	Claystone with ironstone bands.	8	5	
626	11	631	0	COAL.....	4	1	) D-22384.
631	0	631	2	Bone.....		2	
631	2	632	2	Claystone.....	1	0	
632	2	632	4	COAL.....		2	
632	4	632	9	Ironstone.....		5	

Log, Hole WH-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
632	9	633	6	Bony COAL.....		9	
633	6	633	10	Ironstone.....		4	
633	10	634	0	Bony COAL.....		2	
634	0	635	2	Claystone with thin coal blebs.	1	2	
635	2	637	6	COAL.....	2	4	) D-22385.
637	6	637	8	Ironstone.....		2	
637	8	638	0	COAL.....		4	)
638	0	638	5	Claystone.....		5	
638	5	639	5	Coaly claystone.....	1	0	
639	5	640	9	Ironstone.....	1	4	
640	9	644	0	Claystone.....	3	3	
644	0	644	6	Ironstone.....		6	
644	6	648	8	COAL.....	4	2	) D-22386.
648	8	649	0	Ironstone and claystone....		4	
649	0	650	0	Claystone.....	1	0	
650	0	650	2	COAL.....		2	
650	2	654	0	Claystone.....	3	10	
654	0	654	6	Bony COAL.....		6	
654	6	659	0	Claystone.....	4	6	
659	0	662	0	Ironstone.....	3	0	
662	0	666	0	Claystone.....	4	0	
666	0	672	0	Interbedded and crossbedded fine- and medium-grained sandstone.	6	0	
672	0	688	0	Interbedded siltstone and silty claystone with carbonized plant fragments.	16	0	Dip 10° to 30°.
688	0	689	0	Coaly claystone.....	1	0	
689	0	691	7	Claystone.....	2	7	
691	7	692	10	COAL with thin bony streaks.	1	3	) D-22387.
692	10	693	10	Claystone and coaly claystone.	1	0	
693	10	695	3	COAL with thin bony streaks and calcite veinlets.	1	5	)
695	3	695	4	Coaly claystone.....		1	
695	4	698	0	Hard dense siltstone.....	2	8	
698	0	708	0	Interbedded and crossbedded siltstone, clayey claystone, ironstone and sandstone.	10	0	
708	0	726	0	Siltstone with clayey streaks.	18	0	

Log, Hole WH-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
726	0	731	0	Claystone with a few coaly streaks.	5	0	
731	0	763	0	Very fine-grained sandstone with thin clayey streaks.	32	0	
763	0	769	0	Fine-grained sandstone.....	6	0	
769	0	805	0	Medium- to coarse-grained gray sandstone with dark speckles.	36	0	
805	0	810	0	Gray-white coarse-grained conglomeratic sandstone.	5	0	
810	0	817	0	Interbedded and crossbedded clayey siltstone and very fine-grained sandstone.	7	0	
817	0	817	9	Claystone.....		9	
817	9	818	0	Bone.....		3	
818	0	826	0	Interbedded and crossbedded fine-grained sandstone and clayey siltstone.	8	0	
826	0	839	0	Hard dense siltstone that weathers bentonitic.	13	0	
839	0	843	0	Medium- to coarse-grained sandstone.	4	0	
843	0	847	9	Dark claystone with streaks of coaly claystone.	4	9	
847	9	848	0	Ironstone.....		3	
848	0	851	8	Claystone.....	3	8	
851	8	852	7	Bony COAL.....		11	) D-25051.
852	7	853	4	Coaly claystone.....		9	
853	4	853	8	Bony COAL.....		4	)
853	8	855	4	Coaly claystone.....	1	8	
855	4	856	1	COAL.....		9	) D-25052.
856	1	856	6	Coaly claystone.....		5	
856	6	857	4	Bony COAL.....		10	)
857	4	857	7	Coaly claystone and bone...		3	
857	7	861	4	Claystone.....	3	9	
861	4	862	6	Bony COAL.....	1	2	No sample taken.
862	6	863	3	Coaly claystone and bone...		9	
863	3	884	0	Shaly clayey claystone.....	20	9	
884	0	887	0	Interbedded and crossbedded fine-grained sandstone and siltstone with ironstone nodules.	3	0	
887	0	889	0	Shaly claystone.....	2	0	

Log, Hole WH-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
889	0	891	0	Crossbedded medium-grained sandstone.	2	0	
891	0	910	0	Silty claystone grading into siltstone with a coaly thin streak at 900 feet.	19	0	
910	0	928	0	Medium- to coarse-grained massive light-gray-brown speckled sandstone.	18	0	
928	0	940	0	Interbedded and crossbedded siltstone and fine-grained sandstone.	12	0	Average dip 45°.
940	0	949	0	Coarse sandstone with conglomeratic streaks.	9	0	
949	0	971	0	Medium- to coarse-grained gray sandstone with interbedded and crossbedded fine-grained sandstone streaks.	22	0	Dip 45° to 60°.
971	0	978	0	Shaly claystone with ironstone nodules, slickensides.	7	0	Dip 30° to 60°.
978	0	988	0	Medium-grained sandstone with streaks of fine-grained sandstone.	10	0	
988	0	1004	0	Shaly clayey claystone with silty streaks, slickensides.	16	0	Dip 30° to 45°.
Bottom of hole.							

Log, Hole WH-2

Location: 810 feet N. and 1,890 feet E. of the W1/4 corner of sec. 20, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 739.8 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	40	0	Overburden, glacial drift, boulders, gravel, and sand; last 2 feet conglomeratic.	40	0	
40	0	55	0	Dark silty claystone with thin streaks of sandstone.	15	0	Dip 70°.
55	0	57	0	Ironstone.....	2	0	
57	0	62	0	Siltstone (80° fractures)..	5	0	Dip 30° to 70°.
62	0	70	0	Dark claystone containing small coal blebs.	8	0	Dip: 70° at 82 feet; 60° at 110 feet.
70	0	90	0	Siltstone with streaks of ironstone.	20	0	
90	0	180	0	Crossbedded very fine-grained sandstone and siltstone with blebs of coal and ironstone nodules.	90	0	
180	0	197	0	Light-gray claystone with very steep fractures or bedding.	17	0	
197	0	236	3	Dark-black claystone and coaly claystone with vertical fractures or bedding.	39	3	
236	3	236	11	COAL.....		8	Dip 30°.
236	11	248	0	Dark-black claystone and coaly claystone with vertical fractures and slickensides.	11	1	
248	0	248	6	COAL.....		6	Dip 20° to 45°.
248	6	265	0	Dark-gray claystone with steep fractures from 70° to vertical and slickensides.	16	6	
265	0	288	0	Gray siltstone with occasional ironstone nodules.	23	0	Fractures 30° to 60°.
288	0	302	0	Claystone with vertical fractures and flat bedding, silty near base.	14	0	

Log, Hole WH-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
302	0	302	6	COAL.....		6	
302	6	348	0	Claystone and silty claystone.	45	6	Dip 5°.
348	0	400	0	Siltstone with streaks of sandstone and ironstone.	52	0	Few steep fractures.
400	0	420	0	Silty fine-grained sandstone.	20	0	
420	0	447	0	Interbedded and crossbedded fine- and medium-grained sandstone.	27	0	
447	0	450	0	Ironstone and limestone....	3	0	
450	0	452	0	Claystone with coaly streaks.	2	0	
452	0	505	0	Light-gray medium-grained sandstone with dark specks.	53	0	
505	0	515	0	Hard coarse light-gray sandstone with quartz and dark speckles and carbonaceous bands and inclusions.	10	0	
515	0	525	0	Fine-grained silty sandstone.	10	0	
525	0	534	0	Hard coarse arkosic gray sandstone with carbonaceous bands and inclusions.	9	0	
534	0	580	0	Very fine-grained silty sandstone.	46	0	
580	0	610	0	Interbedded and crossbedded dark siltstone and fine-grained sandstone.	30	0	
610	0	656	0	Hard crossbedded light-gray medium-grained sandstone with occasional blebs of coal.	46	0	
656	0	667	0	Interbedded fine-grained sandstone and siltstone.	11	0	Dip 70° to 90°.
667	0	726	0	Very fine-grained sandstone with thin silty streaks.	59	0	Do.
726	0	727	0	Siltstone.....	1	0	Dip 60° to 80°.
727	0	729	6	Coaly claystone and bone...	2	6	Do.
729	6	732	0	Bony COAL.....	2	6	Dip 60° to 80°. No sample taken.

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Log, Hole WH-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
732	0	733	1	Coaly claystone with streaks of bone.	1	1	
733	1	738	0	No core, hole caving; COAL and coaly claystone chips washed up.	4	11	
738	0	742	10	Coaly claystone with streaks of ironstone and bone.	4	10	Dip 70°.
742	10	747	6	Bony COAL with streaks of coaly claystone.	4	8	Dip 70°. No sample taken.
747	6	754	0	Slickensided coaly claystone with streaks of bone.	6	6	Dip 70°.
754	0	756	0	Bony COAL.....	2	0	No sample taken.
756	0	757	0	Coaly claystone.....	1	0	
Bottom of hole.							

Log, Hole WH-3

Location: 825 feet S. and 1,665 feet W. of the E1/4 corner of sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 784.9 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	67	0	Overburden, glacial boulders down to 35 feet, conglomerate slide with coarse sand to 67 feet. Hole started near the base of Eska conglomerate.	67	0	
67	0	82	0	Coarse-grained sandstone...	15	0	
82	0	85	0	Clay.....	3	0	
85	0	99	0	Coarse-grained sandstone...	14	0	
99	0	102	0	Clay and sandstone.....	3	0	
102	0	110	0	Coarse arkosic sandstone with occasional blebs of coal.	8	0	
110	0	115	0	Light-gray siltstone.....	5	0	
115	0	120	0	Fine-grained sandstone and siltstone.	5	0	
120	0	163	0	Massive coarse-grained light-gray arkosic sandstone with thin streaks of medium-grained sandstone and occasional blebs of coal.	43	0	
163	0	165	0	Coaly claystone with ironstone nodules.	2	0	Dip 30°.
165	0	166	6	Bony COAL with streaks of coal and coaly claystone.	1	6	Do.
166	6	168	0	Claystone with streaks of coaly claystone.	1	6	
168	0	168	6	Bone.....		6	
168	6	168	9	Ironstone.....		3	
168	9	170	3	Coaly claystone.....	1	6	
170	3	170	6	Ironstone with coal inclusions.		3	
170	6	173	0	Bony COAL.....	2	6	Dip 30°.
173	0	190	0	Claystone and silty claystone with thin streaks of coaly claystone, slickensides on bedding.	17	0	Do.

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
190	0	210	0	Siltstone with streaks of fine-grained sandstone and silty claystone.	20	0	Dip 10° to 30°.
210	0	220	0	Fine-grained sandstone.....	10	0	
220	0	234	0	Siltstone.....	14	0	
234	0	240	0	Crossbedded fine-grained sandstone.	6	0	
240	0	245	0	Silty claystone.....	5	0	
245	0	251	0	Coaly claystone with streaks of coal and bone.	6	0	
251	0	272	0	Fine-grained sandstone with clayey streaks and ironstone.	21	0	Dip 20°.
272	0	287	0	Siltstone with ironstone nodules and carbonized leaf fragments.	15	0	Dip 30°.
287	0	298	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	11	0	
298	0	325	0	Interbedded siltstone, silty claystone and ironstone, and claystone with carbonized leaf fragments.	27	0	Do.
325	0	335	0	Interbedded siltstone and fine-grained sandstone.	10	0	
335	0	345	0	Claystone with ironstone nodules.	10	0	
345	0	347	0	Coaly claystone.....	2	0	
347	0	348	0	Claystone.....	1	0	
348	0	349	0	Interbedded coaly claystone and bone.	1	0	
349	0	351	0	Claystone.....	2	0	
351	0	351	6	Ironstone.....		6	
351	6	354	6	Bony COAL and coaly claystone.	3	0	Dip 20° to 30°.
354	6	356	0	Bony COAL with coaly claystone.	1	6	Dip 30°.
356	0	360	6	Claystone with streaks of coaly claystone.	4	6	
360	6	361	6	Bony COAL with streaks of coaly claystone.	1	0	
361	6	362	0	Coaly claystone.....		6	
362	0	364	0	COAL with thin streaks of bone.	2	0	
364	0	365	3	Bony COAL.....	1	3	

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
365	3	366	0	Claystone.....		9	
366	0	367	7	COAL with very thin streaks of bone and coaly claystone.	1	7	) D-22819.
367	7	368	3	Claystone.....		8	
368	3	368	6	COAL.....		3	)
368	6	368	9	Ironstone.....		3	
368	9	384	0	Claystone.....	15	3	
384	0	384	9	COAL.....		9	) D-22820.
384	9	386	3	Claystone with coaly claystone streak.	1	6	
386	3	386	10	Bony COAL.....		7	) Dip 25°.
386	10	387	3	Claystone.....		5	Dip 30°.
387	3	388	6	COAL.....	1	3	)
388	6	389	9	Bony COAL and coaly claystone.	1	3	
389	9	390	2	Ironstone.....		5	
390	2	402	0	Claystone with streaks of ironstone.	11	10	
402	0	419	0	Interbedded fine-grained sandstone and siltstone.	17	0	
419	0	430	6	Silty claystone.....	11	6	
430	6	433	1	Coaly claystone with thin streaks of coal.	2	7	
433	1	447	0	Claystone with ironstone nodules and coaly streaks.	13	11	
447	0	460	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	13	0	
460	0	465	0	Silty claystone.....	5	0	
465	0	467	6	Clayey shaly claystone.....	2	6	Slickenside.
467	6	470	0	Bentonitic claystone with calcite veinlets.	2	6	Do.
470	0	473	0	Siltstone.....	3	0	
473	0	475	0	Claystone.....	2	0	
475	0	476	6	COAL.....	1	6	
476	6	477	6	Claystone.....	1	0	
477	6	478	6	Coaly claystone.....	1	0	
478	6	478	9	Ironstone.....		3	
478	9	479	9	COAL.....	1	0	
479	9	480	3	Ironstone.....		6	
480	3	482	3	Claystone.....	2	0	
482	3	483	9	COAL.....	1	6	

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
483	9	486	9	Coaly claystone with streaks of ironstone and coal.	3	0	
486	9	492	0	Shaly claystone.....	5	3	
492	0	493	0	Coaly claystone.....	1	0	
493	0	494	6	COAL with thin streaks of ironstone.	1	6	
494	6	495	0	Coaly claystone.....		6	
495	0	532	0	Shaly claystone with thin streak of coaly claystone, blebs of coal and ironstone nodules.	37	0	Dip 30°. Slickensides.
532	0	533	6	Coaly claystone.....	1	6	Dip 20°.
533	6	534	0	Bony COAL.....		6	
534	0	534	4	Claystone.....		4	
534	4	535	6	Bony COAL.....	1	2	
535	6	536	0	Ironstone.....	0	6	
536	0	538	0	Clayey shaly claystone.....	2	0	
538	0	552	0	Claystone with streaks of coaly claystone.	14	0	
552	0	555	0	Fine-grained sandstone and siltstone.	3	0	
555	0	565	0	Claystone with thin streaks of coal and clay.	10	0	
565	0	576	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	11	0	
576	0	582	0	Bentonitic silty claystone.	6	0	
582	0	594	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	12	0	
594	0	596	0	Bentonitic silty claystone.	2	0	
596	0	610	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	14	0	
610	0	633	0	Green shaly silty claystone.	23	0	Slickensides.
633	0	642	0	Clayey claystone (bentonitic).	9	0	Dip 20°.
642	0	680	0	Interbedded fine-grained sandstone.	38	0	Bentonitic.
680	0	681	0	Clayey claystone.....	1	0	

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
681	0	689	0	Clayey bentonitic siltstone.	8	0	
689	0	705	0	Interbedded and crossbedded clayey siltstone and fine-grained sandstone.	16	0	
705	0	778	0	Medium- and coarse-grained light-gray sandstone with dark speckles.	73	0	Dip 20° to 30°.
778	0	778	6	Conglomeratic sandstone....		6	
778	6	794	0	Fine-grained sandstone.....	15	6	
794	0	832	0	Silty claystone with streaks of claystone and thin coaly streaks.	38	0	Dip 10° to 30°.
832	0	846	0	Very fine-grained sandstone.	14	0	Do.
846	0	850	0	Interbedded silty claystone and siltstone and thin streaks of coaly claystone.	4	0	
850	0	851	0	Ironstone.....	1	0	
851	0	852	0	Silty claystone.....	1	0	
852	0	853	0	Coaly claystone with streaks of bone.	1	0	
853	0	858	0	Fine-grained sandstone and siltstone.	5	0	
858	0	862	0	Dark claystone.....	4	0	
862	0	864	0	Bony COAL with thin streaks of coaly claystone.	2	0	
864	0	884	0	Claystone with very thin coaly streaks.	20	0	
884	0	934	0	Interbedded siltstone, fine-grained sandstone, and claystone with occasional ironstone.	50	0	
934	0	945	0	Claystone.....	11	0	
945	0	946	0	Ironstone with vertical calcite veinlets.	1	0	
946	0	949	0	Claystone.....	3	0	
949	0	961	0	Interbedded siltstone and fine-grained sandstone.	12	0	
961	0	984	0	Claystone and silty claystone with ironstone bands.	23	0	
984	0	985	0	Bone with streaks of coaly claystone.	1	0	

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
985	0	1007	0	Interbedded claystone and siltstone with ironstone bands.	22	0	
1007	0	1047	0	Interbedded and crossbedded siltstone, fine- and medium-grained sandstone.	40	0	
1047	0	1052	0	Claystone with thin coaly streaks.	5	0	
1052	0	1106	0	Interbedded and crossbedded fine- and medium-grained sandstone.	54	0	
1106	0	1108	0	Claystone.....	2	0	
1108	0	1109	0	Bony COAL with calcite veinlets.	1	0	
1109	0	1120	0	Claystone with thin coaly streaks and ironstone nodules.	11	0	
1120	0	1121	0	COAL.....	1	0	
1121	0	1136	0	Silty claystone.....	15	0	
1136	0	1174	0	Interbedded siltstone, fine- and medium-grained sandstone.	38	0	
1174	0	1175	0	Claystone.....	1	0	
1175	0	1175	3	COAL.....		3	
1175	3	1175	5	Ironstone.....		2	
1175	5	1175	8	COAL.....		3	
1175	8	1192	0	Claystone with thin coaly streaks and ironstone bands.	16	4	Dip 20°.
1192	0	1200	0	Interbedded medium-grained sandstone and siltstone.	8	0	
1200	0	1208	0	Claystone with silty and coaly streaks.	8	0	
1208	0	1213	0	Interbedded fine-grained sandstone and siltstone.	5	0	
1213	0	1222	0	Claystone with silty streaks.	9	0	
1222	0	1228	0	Interbedded fine-grained sandstone and siltstone.	6	0	
1228	0	1238	0	Claystone with thin clayey streaks.	10	0	Dip 20°.
1238	0	1239	0	Clayey claystone.....	1	0	
1239	0	1271	0	Interbedded and crossbedded medium- and fine-grained sandstone and siltstone.	32	0	

Log, Hole WH-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1271	0	1273	0	Claystone with thin coaly streaks.	2	0	
1273	0	1298	0	Interbedded fine- and medium-grained sandstone and siltstone.	25	0	Dip 10°.
1298	0	1305	0	Claystone with clayey streaks.	7	0	
1305	0	1306	0	Bony COAL.....	1	0	
1306	0	1342	6	Interbedded siltstone, silty claystone and claystone.	36	6	Dip 20°.
1342	6	1344	0	Clayey claystone.....	1	6	
1344	0	1358	0	Interbedded siltstone, silty claystone and claystone.	14	0	
Bottom of hole.							

Log, Hole WH-4

Location: 305 feet S. and 680 feet W. of the E1/4 corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 842.3 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	56	0	Conglomerate slide, gravel and sand.	56	0	
56	0	132	0	Eska conglomerate.....	76	0	
132	0	133	0	Silty very fine-grained sandstone.	1	0	Slickensides.
133	0	153	0	Greenish coarse-grained sandstone with white specks.	20	0	
153	0	184	0	Fine- to medium-grained sandstone with thin silty streaks and scattered leaf fragments.	31	0	
184	0	192	0	Silty claystone grading into claystone.	8	0	Dip 15°. Slickensides.
192	0	193	6	Coarse-grained sandstone...	1	6	
193	6	195	6	Claystone.....	2	0	Slickensides.
195	6	196	0	Clayey shaly claystone.....		6	Do.
196	0	202	0	Claystone.....	6	0	Do.
202	0	205	0	Green medium-grained sandstone with hard soapy clay streaks.	3	0	
205	0	205	3	Light-gray clayey limestone.		3	
205	3	209	0	Silty claystone.....	3	9	
209	0	211	0	Reddish tuffaceous silty fine-grained sandstone.	2	0	
211	0	215	0	Silty claystone.....	4	0	
215	0	221	0	Shaly claystone grading down into silty claystone.	6	0	Slickensides.
221	0	231	0	Siltstone with thin sandy streaks.	10	0	Dip 20°.
231	0	233	6	Interbedded and crossbedded fine- and medium-grained sandstone.	2	6	
233	6	268	0	Coarse-grained green sandstone with white bands and specks.	34	6	Dip 30°.

Log, Hole WH-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
268	0	370	0	Coarse-grained conglomeratic sandstone with thin fine- and medium-grained sandstone streaks.	102	0	
370	0	371	6	Bony COAL with thin ironstone streaks.	1	6	
371	6	372	0	Coaly claystone.....		6	
372	0	374	0	Claystone with streaks of coaly claystone.	2	0	
374	0	377	0	Claystone.....	3	0	Dip 10° to 20°.
377	0	386	0	Siltstone with streaks of very fine-grained sandstone.	9	0	
386	0	392	0	Claystone.....	6	0	
392	0	392	3	Coaly claystone.....		3	
392	3	393	3	COAL.....	1	0	) D-25130.
393	3	394	0	Claystone.....		9	
394	0	395	9	COAL with very thin streaks of bone and coaly claystone.	1	9	)
395	9	398	0	Claystone.....	2	3	
398	0	398	9	COAL.....		9	
398	9	401	0	Claystone with thin silty and sandy streaks.	2	3	
401	0	416	0	Light-gray medium-grained sandstone with dark speckles.	15	0	Redrilled to 440 feet.
416	0	417	6	Claystone with ironstone bands and clayey streaks and pyrite nodule.	1	6	Dip 20°.
417	6	419	3	Coaly claystone with thin streaks of coal.	1	9	Dip 20° to 30°.
419	3	419	9	Claystone with streaks of coaly claystone.		6	
419	9	420	0	COAL.....		3	) D-25456.
420	0	420	2	Bone.....		2	
420	2	420	5	COAL.....		3	)
420	5	420	7	Ironstone.....		2	
420	7	422	0	COAL.....	1	5	)
422	0	422	4	Dark gray siltstone.....		4	
422	4	423	2	COAL.....		10	)
423	2	423	5	Bone.....		3	
423	5	425	11	COAL.....	2	6	)
425	11	425	11½	Ironstone.....		½	

Log, Hole WH-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
425	11½	427	5	COAL.....	1	5½	)
427	5	427	6	Bone.....		1	
427	6	428	6	Coaly claystone with streaks of coal.	1	0	
428	6	429	10	Claystone.....	1	4	
429	10	430	2	Coaly claystone.....		4	
430	2	433	0	COAL with thin calcite veinlets.	2	10	) D-25457. Dip 30° to 45°.
433	0	433	5	Claystone.....		5	
433	5	433	11	Bony COAL.....		6	
433	11	434	3	COAL.....		4	
434	3	434	6	Folded ironstone and bone..		3	
434	6	438	3	COAL.....	3	9	) D-25458.
438	3	438	9	Coaly claystone and bone...		6	
438	9	440	0	Shaly claystone with streaks of coaly claystone.	1	3	
440	0	440	3	Coaly claystone.....		3	
440	3	445	0	COAL with thin streaks of bone and limey veinlets.	4	9	) D-24784.
445	0	445	6	Coaly claystone.....		6	
445	6	447	0	Folded coal and ironstone..	1	6	Niggerhead.
447	0	460	0	Clayey shaly claystone.....	13	0	Dip 45°.
460	0	461	9	Claystone with coaly streaks.	1	9	
461	9	463	3	COAL with thin streaks of bone.	1	6	) D-25131.
463	3	466	0	Coaly claystone with streaks of coal and ironstone.	2	9	
466	0	480	0	Clayey shaly claystone with 60° to vertical fractures.	14	0	Slickensides.
480	0	491	0	Interbedded and crossbedded fine-grained sandstone with many leaf fragments.	11	0	
491	0	495	6	Claystone with ironstone nodules.	4	6	
495	6	497	6	Clayey claystone.....	2	0	
497	6	499	6	Bentonitic claystone.....	2	0	
499	6	501	8	Claystone.....	2	2	
501	8	503	0	COAL.....	1	4	) D-25132.
503	0	504	0	Claystone.....	1	0	
504	0	504	9	Coaly claystone with streaks of bone.		9	

Log, Hole WH-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
504	9	505	1	Claystone.....		4	
505	1	505	4	Coaly claystone with streaks of bone.		3	
505	4	507	4	COAL.....	2	0	)
507	4	507	6	Coaly claystone with ironstone nodules.		2	
507	6	508	2	Sandy ironstone.....		8	
508	2	510	2	Claystone.....	2	0	
510	2	512	6	COAL.....	2	4	) D-25133.
512	6	512	7	Coaly claystone.....		1	
512	7	514	0	Claystone.....	1	5	
514	0	515	0	Ironstone.....	1	0	
515	0	521	0	Claystone with thin streaks of coaly claystone and bone, slickensides.	6	0	Dip 30°.
521	0	527	0	Claystone with slickensides at 60°.	6	0	Dip 30° to 45°.
527	0	529	6	COAL with white limey streaks.	2	6	) D-24785. Dip 30°.
529	6	530	6	Folded ironstone and bone..	1	0	Niggerhead.
530	6	531	9	COAL with 1-inch ironstone nodule.	1	3	)
531	9	532	2	Folded ironstone and bone..		5	Do.
532	2	532	9	COAL.....		7	)
532	9	540	0	Clay shaly claystone with slickensides and fractures at 60°.	7	3	Dip 30° to 45°.
540	0	549	0	Siltstone and fine-grained sandstone.	9	0	
549	0	560	0	Claystone with thin coaly and clay streaks.	11	0	
560	0	572	0	Silty claystone and claystone with very thin coaly streaks and slickensides.	12	0	
572	0	581	0	Medium-grained gray sandstone.	9	0	
581	0	582	0	Bentonitic clayey shaly claystone.	1	0	
582	0	585	0	Shaly claystone with slickensides.	3	0	
585	0	600	0	Very fine-grained sandstone with silty streaks.	15	0	
600	0	605	0	Shaly clayey claystone.....	5	0	Slickensides.
605	0	606	0	Bony COAL.....	1	0	

Log, Hole WH-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
606	0	645	0	Massive crossbedded and interbedded medium- to fine-grained clayey gray sandstone.	39	0	
645	0	672	0	Massive fine-grained sandstone.	27	0	
672	0	720	0	Massive medium-grained sandstone with dark speckles.	48	0	
720	0	721	0	Bony COAL.....	1	0	
721	0	725	0	Fractured shaly claystone with many slickensides.	4	0	
725	0	732	0	Hard dense siltstone with slickensides.	7	0	
732	0	743	0	Shaly claystone with slickensides.	11	0	
743	0	800	0	Green hard dense slaty siltstone with slickensides, streaks of fine-grained green sandstone and an occasional reddish-brown nodule with white calcite veinlets.	57	0	Dip 20° to 45°.
800	0	826	0	Interbedded siltstone and silty claystone with streaks of ironstone.	26	0	Dip 30°.
826	0	830	0	Fine-grained sandstone.....	4	0	
830	0	850	0	Interbedded siltstone and silty claystone with streaks of ironstone.	20	0	Dip 20° to 30°.
850	0	870	0	Fine-grained sandstone with clayey or tuffaceous streaks.	20	0	Do.
870	0	877Ø	0	Gray fine-grained sandstone interbedded and crossbedded with dark siltstone containing carbonized plant fragments.	7	0	
877	0	964	0	Massive gray medium-grained sandstone with dark speckles.	87	0	
964	0	974	0	Silty claystone and claystone with thin coaly streaks.	10	0	

Log, Hole WH-4 (Con.)

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
974	0	975	0	Bony COAL.....	1	0	
975	0	983	0	Interbedded and crossbedded gray fine-grained sandstone and dark siltstone with carbonized plant fragments.	8	0	
983	0	987	0	Silty claystone.....	4	0	
987	0	998	0	Interbedded and crossbedded gray gine-grained sandstone and dark siltstone.	11	0	
Bottom of hole.							

Log, Hole WH-5

Location: 470 feet N. and 1,130 feet E. of the W1/4 corner, sec. 20, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 871.5 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	106	0	Overburden, conglomerate boulders, 10 to 19 feet, conglomerate slide rock and some glacial till with glacial silt from 30 to 98 feet.	106	0	
106	0	109	0	Soft sandstone.....	3	0	
109	0	130	0	Interbedded and crossbedded gray medium-grained sandstone and dark silty fine-grained sandstone (No core 106 to 116 feet).	21	0	
130	0	135	0	Hard dense gray sandstone with dark-green speckles.	5	0	
135	0	139	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	4	0	
139	0	154	0	Massive gray medium-grained sandstone with dark speckles.	15	0	
154	0	156	0	Conglomeratic sandstone....	2	0	
156	0	167	0	Medium-grained sandstone with dark silty streaks containing plant fragments.	11	0	Dip 30°.
167	0	177	0	Gray coarse-grained to conglomeratic sandstone with dark and green speckles.	10	0	
177	0	186	0	Medium-grained gray sandstone with dark silty streaks.	9	0	
186	0	218	0	Coarse conglomeratic sandstone with silty and fine-grained sandstone streaks.	32	0	
218	0	240	0	Interbedded and crossbedded medium- and fine-grained sandstone and siltstone (10 feet of core for 22 feet).	22	0	

Log, Hole WH-5 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
240	0	253	0	Coarse-grained conglomerate sandstone.	13	0	
253	0	294	0	Gray medium-grained sandstone with dark fine-grained sandstone streaks containing carbonized plant fragments.	41	0	Dip 30°.
294	0	298	6	Siltstone.....	4	6	
298	6	301	0	Eska conglomerate.....	2	6	
301	0	331	0	Silty claystone.....	30	0	
331	0	335	0	Calcareous siltstone.....	4	0	
335	0	339	5	Claystone.....	4	5	Dip 20°.
339	5	340	10	COAL.....	1	5	) D-25176.
340	10	342	0	Light-gray claystone.....	1	2	
342	0	346	7	COAL.....	4	7	) D-25175.
346	7	346	9	Bone.....		2	
346	9	347	10	COAL.....	1	1	)
347	10	348	0	Bone.....		2	
348	0	348	2	Claystone.....		2	
348	2	348	3	Shaly clayey claystone.....		1	
348	3	351	0	Claystone with thin coaly claystone streaks.	2	9	Dip 20°.
351	0	370	0	Silty claystone with an occasional ironstone nodule and carbonized plant fragments.	19	0	
370	0	384	0	Interbedded and crossbedded medium- and fine-grained sandstone grading down to siltstone.	14	0	
384	0	387	0	Silty claystone with ironstone bands.	3	0	
387	0	390	0	Interbedded sandstone and siltstone.	3	0	
390	0	400	0	Silty claystone and claystone.	10	0	Dip 10° to 20°.
400	0	401	6	Dark claystone with coal blebs.	1	6	
401	6	402	3	COAL with thin bony streaks.		9	
402	3	402	9	Claystone.....		6	
402	9	403	5	COAL with thin bony streaks.		8	) D-25460.
403	5	403	6	Ironstone.....		1	

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Log, Hole WH-5 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Materials	Thickness Ft.	Thickness in.	Remarks
403	6	406	7	COAL with two very thin nodules.	3	1	)
406	7	407	4	Siltstone with ironstone bands and coal blebs.		9	
407	4	407	10	COAL.....		6	) D-25461.
407	10	408	2	Coaly claystone.....		4	
408	2	408	10	COAL.....		8	)
408	10	409	1	Silty ironstone.....		3	
409	1	409	5	Bony COAL.....		4	
409	5	409	5½	Ironstone.....		½	
409	5½	409	7½	Bony COAL.....		2	
409	7½	410	0	Coaly claystone.....		4½	
410	0	410	8	COAL.....		8	
410	8	411	5	Coaly claystone.....		9	
411	5	411	9	Claystone.....		4	
411	9	412	7	Coaly claystone.....		10	
412	7	412	9	Bony COAL.....		2	
412	9	416	6	Shaly claystone with carbonized plant fragments, slickensides 30° to 60°.	3	9	Dip 30°.
416	6	416	11	Ironstone.....		5	
416	11	418	0	Coaly claystone.....	1	1	
418	0	420	6	COAL.....	2	6	) D-25459.
420	6	423	5	Bony COAL with thin streaks of ironstone and coaly claystone.	2	11	
423	5	424	3	Coaly claystone.....		10	
424	3	426	5	Folded bony COAL with ironstone and coaly claystone.	2	2	
426	5	427	6	Shaly clayey claystone.....	1	1	
427	6	428	0	Ironstone.....		6	
428	0	435	0	Claystone with folded blebs of coal, slickensides fractures 30° to 80°.	7	0	
435	0	435	3	COAL.....		3	
435	3	448	0	Shaly claystone with folded blebs of coal and slickensides (fractures 30° to 80°, 440 to 450 feet) (dip 30°, 45°, and 60°).	12	9	
448	0	454	0	Fine-grained silty sandstone.	6	0	Bedding 60° to 80°.
454	0	455	0	Ironstone with calcite veinlets dipping 45° to 60°.	1	0	

Log, Hole WH-5 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
455	0	465	0	Interbedded siltstone and silty claystone.	10	0	Dip 50°.
465	0	471	0	Hard dense limey fine-grained sandstone interbedded with siltstone, slickensides.	6	0	Do.
471	0	473	0	Shaly siltstone.....	2	0	Slickensides.
473	0	483	0	Hard dense sandy limestone with calcite veinlets crossbedded and interbedded with siltstone (two or three oily cavities in limey zones).	10	0	
483	0	493	0	Interbedded and crossbedded hard limey sandstone and siltstone.	10	0	Dip 45°.
493	0	500	0	Folded shaly claystone with streaks of coaly claystone and coal (vertical bedding and slickensides).	7	0	
500	0	500	6	Ironstone.....		6	
500	6	504	0	Claystone.....	3	6	
504	0	505	0	Folded shaly claystone with streaks of coaly claystone and coal.	1	0	
505	0	510	0	Silty fine-grained sandstone.	5	0	Dip 10° to 30°.
510	0	515	0	Interbedded fine- to medium-grained sandstone.	5	0	
515	0	553	0	Gray medium- to coarse-grained massive sandstone with dark speckles occasionally silty and conglomeratic streaks.	38	0	
553	0	553	6	Claystone.....		6	Dip 30°.
553	6	554	0	Bony coal with calcite veinlets.		6	
554	0	554	6	Siltstone.....		6	
554	6	575	0	Hard fine-grained gray sandstone with dark silty streaks and carbonized plant fragments.	20	6	Dip 20° to 30°.
575	0	594	6	Medium-grained gray sandstone with dark speckles.	19	6	

Log, Hole WH-5 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
594	6	594	9	Claystone.....		3	
594	9	595	0	Bony COAL.....		3	
595	0	595	6	COAL.....		6	
595	6	596	6	Coaly claystone.....	1	0	
596	6	597	4	Bony COAL.....		10	Dip 20° to 30°.
597	4	598	0	Ironstone.....		8	
598	0	598	5	Coaly claystone.....		5	
598	5	598	6	Ironstone.....		1	
598	6	600	3	Coaly claystone with streaks of bone.	1	9	
600	3	604	9	Shaly clayey claystone folded and slickensides.	4	6	
604	9	606	3	Coaly claystone with streaks of bone.	1	6	
606	3	607	3	Bony COAL.....	1	0	Do.
607	3	607	7	Bone and ironstone.....		4	
607	7	607	9	Coaly claystone.....		2	
607	9	610	0	Shaly claystone with streaks of ironstone slickensides.	2	3	
610	0	614	0	Clayey shaly claystone with thin coaly streaks.	4	0	611 to 614 feet, no core.
614	0	616	0	Coaly claystone with streaks of bone.	2	0	
616	0	617	0	Silty claystone.....	1	0	
617	0	620	0	Hard dense siltstone.....	3	0	
620	0	624	0	Silty fine-grained sandstone.	4	0	
624	0	637	0	Silty claystone and claystone with ironstone bands.	13	0	
637	0	638	0	Shaly clayey claystone.....	1	0	
638	0	638	3	COAL.....		3	
638	3	639	3	Very fine-grained sandstone.	1	0	
639	3	645	0	Clayey shaly claystone with coal streaks.	5	9	
645	0	664	6	Fine- to medium-grained sandstone with silty streaks.	19	6	
664	6	665	0	COAL.....		6	
665	0	684	0	Siltstone and very fine-grained sandstone with occasional ironstone nodule.	19	0	Dip 20°.

Log, Hole WH-5 (Con.)

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
684	0	690	0	Silty claystone with carbonized leaf fragments.	6	0	
690	0	706	0	Fine- to medium-grained sandstone.	16	0	
706	0	736	0	Very fine-grained hard silty sandstone.	30	0	Dip 10° to 20°.
Bottom of hole.							

Log, Hole WH-6

Location: 1,005 feet N. and 1,625 feet E. of the W1/4 corner, sec. 20, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 856.8 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0.	45	0	Overburden, conglomerate slide, large boulders, sand and gravel.	45	0	
45	0	60	0	Interbedded and crossbedded dark-gray sandstone and dark siltstone (1/2-inch pyrite at base).	15	0	
60	0	67	0	Coarse-grained to conglomeratic sandstone.	7	0	
67	0	70	0	Siltstone with ironstone nodules.	3	0	
70	0	98	0	Coarse-grained sandstone with conglomeratic streaks.	28	0	
98	0	104	0	Interbedded siltstone and fine-grained sandstone.	6	0	Dip 20°.
104	0	142	0	Massive coarse-grained to conglomeratic sandstone with silty streaks near base and blebs of coal.	38	0	
142	0	162	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	20	0	
162	0	166	0	Fine-grained sandstone.....	4	0	
166	0	177	0	Very coarse-grained sandstone occasional coal bleb.	11	0	
177	0	178	0	Siltstone.....	1	0	
178	0	183	0	Hard conglomeratic sandstone.	5	0	
183	0	190	0	Coarse-grained sandstone...	7	0	
190	0	196	0	Interbedded siltstone and fine-grained sandstone.	6	0	
196	0	208	0	Medium-grained sandstone...	12	0	
208	0	209	6	Conglomeratic sandstone....	1	6	
209	6	228	0	Medium-grained sandstone...	18	6	
228	0	230	0	Silty claystone.....	2	0	

Log, Hole WH-6 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
230	0	235	0	Medium-grained sandstone with thin carbonized streaks.	5	0	
235	0	237	0	Siltstone.....	2	0	
237	0	249	6	Coarse-grained conglomeratic sandstone.	12	6	
249	6	250	0	Claystone.....		6	
250	0	252	0	COAL with streaks of bone..	2	0	) D-29671.
252	0	252	5	Coaly claystone.....		5	
252	5	254	2	Coaly claystone with streaks of bone.	1	9	
254	2	257	0	Siltstone.....	2	10	
257	0	288	0	Very fine-grained gray sandstone with dark silty streaks and carbonized blebs.	31	0	
288	0	299	0	Coarse-grained sandstone with thin dark silty streaks and carbonized blebs.	11	0	
299	0	301	0	Fine-grained sandstone and siltstone.	2	0	
301	0	311	6	Silty claystone grading down into claystone with ironstone bands.	10	6	
311	6	311	8	Bone and claystone.....		2	
311	8	312	2	COAL.....		6	) D-27206.
312	2	312	4	Bone.....		2	
312	4	312	9	Silty claystone.....		5	
312	9	315	10	COAL.....	3	1	)
315	10	315	11	Claystone.....		1	
315	11	316	5	COAL.....		6	)
316	5	316	6	Bone.....		1	
316	6	316	10	COAL.....		4	)
316	10	316	11	Claystone.....		1	
316	11	317	6	COAL.....		7	)
317	6	318	0	Bone.....		6	
318	0	318	9	Silty ironstone.....		9	
318	9	319	3	Coaly claystone.....		6	
319	3	319	8	COAL.....		5	) D-27207.
319	8	319	9	Bone.....		1	
319	9	320	9	COAL.....	1	0	)
320	9	321	3	Dark-gray claystone with coaly streaks and ironstone concretions.		6	

Log, Hole WH-6 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
321	3	321	10	COAL.....		7	)
321	10	321	11	Bone.....		1	
321	11	322	9	COAL.....		10	)
322	9	324	9	Coaly claystone with streaks of coal and bone.	2	0	
324	9	325	0	Ironstone.....		3	
325	0	327	0	Coaly claystone with streaks of coal and bone.	2	0	
327	0	327	9	Bony COAL.....		9	
327	9	328	3	Coaly claystone and bone...		6	
328	3	334	0	Claystone.....	5	9	Dip 30° to 35°.
334	0	337	0	Very fine calcareous sandstone.	3	0	
337	0	338	0	Ironstone.....	1	0	
338	0	342	0	Siltstone with streaks of ironstone and leaf fragments.	4	0	
342	0	342	3	Bony COAL.....		3	
342	3	370	0	Siltstone and silty claystone with streaks of ironstone and carbonized leaf fragments.	27	9	Dip 20°.
370	0	381	0	Medium-grained sandstone with ironstone nodules and dark silty streaks with carbonized plant fragments.	11	0	Dip 35°.
381	0	383	0	COAL with thin bony streaks.	2	0	) D-27208.
383	0	383	5	Claystone with coaly streaks.		5	
383	5	385	3	Bony COAL.....	1	10	
385	3	385	9	Coaly claystone.....		6	
385	9	387	2	COAL.....	1	5	) D-27209.
387	2	392	0	Medium-grained sandstone, coal particles near top.	4	10	
392	0	411	0	Interbedded very fine-grained sandstone and siltstone with ironstone bands and dark carbonized plant fragments.	19	0	Dip 20° to 30°.
Bottom of hole.							

Log, Hole WH-7

Location: 770 feet N. and 2,270 feet E. of the S1/4 corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 833.7 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	35	0	Overburden; soil and sand to 24 feet, fine sand and clay to 28 feet, conglomerate to 32 feet, sand to 35 feet.	35	0	
35	0	39	0	Siltstone and very fine-grained sandstone with erratic large pebbles.	4	0	
39	0	50	0	Silty claystone with carbonized plant fragments.	11	0	
50	0	50	3	Shaly clay with coal fragments.		3	Crushed.
50	3	53	9	Claystone with one coal bleb.	3	6	Dip 5° to 10°.
53	9	54	0	Clayey claystone.....		3	Crushed.
54	0	59	0	Silty claystone.....	5	0	
59	0	65	0	Siltstone grading into fine-grained sandstone (green).	6	0	Dip 25°.
65	0	81	0	Claystone with 60° to 80° fractures.	16	0	
81	0	85	0	Very fine-grained sandstone.	4	0	
85	0	86	0	Siltstone.....	1	0	
86	0	140	0	Silty claystone and claystone with coal blebs from 105 to 106 feet and blue-greenish cast.	54	0	
140	0	148	0	Claystone.....	8	0	
148	0	151	0	Claystone with coaly streaks and blebs of coal.	3	0	Do.
151	0	152	6	Silty claystone.....	1	6	
152	6	158	0	Shaly clayey claystone with carbonized plant fragments.	5	6	
158	0	159	0	Silty claystone.....	1	0	

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
159	0	164	0	Fine- to coarse-grained calcareous sandstone with carbonaceous streaks and blebs.	5	0	
164	0	258	0	Eska conglomerate (base of Eska conglomerate).	94	0	
258	0	280	0	Massive green medium- to coarse-grained bedded sandstone with white specks.	22	0	
280	0	281	0	Conglomeratic sandstone....	1	0	
281	0	285	0	Silty claystone.....	4	0	
285	0	288	0	Fine-grained sandstone.....	3	0	
288	0	291	0	Slickensided reddish silty claystone.	3	0	
291	0	306	0	Green chloritic medium-grained sandstone.	15	0	
306	0	310	0	Conglomeratic green sandstone.	4	0	
310	0	316	0	Fine- to medium-grained sandstone with dark silty streaks.	6	0	
316	0	321	0	Hard coarse-grained green sandstone.	5	0	
321	0	326	0	Silty claystone.....	5	0	Dip 30°.
326	0	327	6	Medium-grained light-gray sandstone.	1	6	
327	6	345	0	Hard silty claystone with slickensides and vertical fractures.	17	6	Dip 20°.
345	0	356	0	Siltstone with carbonized plant fragments.	11	0	
356	0	358	0	Sugary (sacraoidal) sandstone.	2	0	
358	0	360	0	Siltstone.....	2	0	
360	0	362	0	Claystone.....	2	0	
362	0	365	0	Folded shaly clayey claystone with coal streaks at base.	3	0	
365	0	373	0	Silty claystone becoming shaly near base.	8	0	Dip 10° to 20°.
373	0	378	0	Fine-grained sandstone.....	5	0	Dip 20°.
378	0	406	0	Green medium- to coarse-grained sandstone.	28	0	

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
406	0	410	0	Interbedded fine-grained sandstone and siltstone.	4	0	
410	0	417	0	Calcareous siltstone.....	7	0	
417	0	419	0	Limestone.....	2	0	
419	0	445	0	Silty claystone with carbonized leaf fragments.	26	0	Dip 35° to 40°.
445	0	449	0	Medium-grained sandstone with thin silty carbonized streaks and few coal blebs.	4	0	
449	0	468	0	Conglomeratic sandstone....	19	0	
468	0	470	0	Fine-grained sandstone with dark carbonized silty streaks.	2	0	Dip 40°.
470	0	474	0	Conglomeratic sandstone....	4	0	
474	0	476	0	Silty claystone with carbonized plant fragments.	2	0	
476	0	484	0	Medium- to coarse-grained sandstone.	8	0	
484	0	500	0	Soft medium-grained sandstone.	16	0	3-foot core.
500	0	509	0	Coarse-grained sandstone...	9	0	
509	0	515	0	Medium-grained sandstone with thin dark silty streaks with few carbonized plant fragments.	6	0	
515	0	579	4	Coarse-grained to conglomeratic gray sandstone with dark specks, blebs of coal and thin carbonized streaks.	64	4	
579	4	580	0	COAL.....		8	
580	0	584	3	Claystone.....	4	3	
584	3	584	6	Coaly claystone.....		3	
584	6	584	9	Ironstone.....		3	
584	9	585	0	Bony COAL.....		3	
585	0	585	3	Claystone.....		3	
585	3	586	6	COAL with thin streaks of bone.	1	3	) D-28276.
586	6	587	1	Claystone.....		7	
587	1	587	9	COAL.....		8	) D-28277.
587	9	587	11	Ironstone and clay.....		2	
587	11	589	1	COAL.....	1	2	)
589	1	589	2	Ironstone.....		1	
589	2	589	11	COAL.....		9	)

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
589	11	590	0	Ironstone.....	0	1	
590	0	591	10	COAL.....	1	10	)
591	10	592	0	Ironstone.....		2	
592	0	593	0	COAL.....	1	0	)
593	0	593	2	Ironstone.....		2	
593	2	595	2	COAL with a few calcite veinlets.	2	0	) D-28278.
595	2	595	7	Clayey claystone.....		5	Dip 20° to 35°.
595	7	596	10	COAL with thin bony streaks.	1	3	)
596	10	597	9	Bony COAL.....		11	
597	9	597	11	Coaly claystone.....		2	
597	11	598	4	Claystone.....		5	
598	4	600	6	Coaly claystone with very thin coaly streaks.	2	2	
600	6	602	0	Claystone.....	1	6	Dip 30° to 40°.
602	0	602	6	Shaly clayey claystone.....		6	
602	6	605	9	Coaly claystone and COAL...	3	3	6-inch core.
605	9	606	0	Ironstone.....		3	
606	0	606	6	Bony COAL.....		6	
606	6	607	0	Dark claystone with streaks of coaly claystone.		6	
607	0	607	3	Bony COAL.....		3	
607	3	608	4	Claystone with blebs of coal.	1	1	
608	4	609	0	Coaly claystone.....		8	
609	0	611	8	Bony COAL.....	2	8	) D-28279. Dip 30°.
611	8	611	10	Coaly claystone.....		2	
611	10	614	0	Claystone.....	2	2	
514	0	644	0	Interbedded fine-grained sandstone and dark siltstone with few carbonized plant fragments and an occasional ironstone nodule.	30	0	
644	0	648	0	Siltstone with calcareous ironstone bands.	4	0	
648	0	651	0	Claystone.....	3	0	Dip 20°.
651	0	651	6	Ironstone.....		6	
651	6	656	0	Dark claystone with streaks of coaly claystone.	4	6	
656	0	694	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	38	0	

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
694	0	694	6	Bony COAL.....	0	6	
694	6	710	0	Siltstone with streaks of fine-grained sandstone and occasional ironstone nodule.	15	6	
710	0	727	0	Fine- to medium-grained sandstone interbedded with dark siltstone with carbonized plant fragments.	17	0	
727	0	746	0	Claystone with occasional carbonized plant fragments and silty streaks.	19	0	Dip 25°.
746	0	747	0	COAL.....	1	0	
747	0	748	0	Coaly claystone.....	1	0	
748	0	750	0	Claystone.....	2	0	
750	0	771	0	Interbedded siltstone and silty claystone with carbonized plant fragments.	21	0	
771	0	855	0	Gray medium-grained sandstone with thin cross-bedded streaks of dark siltstone with carbonized plant fragments.	84	0	Dip 55°
855	0	859	0	Folded shaly claystone with vertical fractures and coaly at base.	4	0	
859	0	860	0	Ironstone.....	1	0	
860	0	869	0	Folded shaly claystone with 60° to vertical fractures and an occasional carbonized plant fragment.	9	0	Dip 60° to 70°.
869	0	869	2	Bony COAL.....		2	
869	2	869	4	Claystone.....		2	
869	4	869	6	Bony COAL.....		2	
869	6	872	0	Folded shaly claystone with 60° vertical fractures.	2	6	Dip 60° to 90°.
872	0	872	6	Ironstone.....		6	
872	6	874	0	Folded shaly claystone.....	1	6	
874	0	874	2	Bony COAL.....		2	Dip 30°.
874	2	879	6	Folded shaly claystone with 60° to vertical fractures.	5	4	Dip 50°.
879	6	882	6	Dark claystone with thin coaly streaks and 60° to 70° fractures.	3	0	Dip 60° to 70°.

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
882	6	883	9	Bony COAL with streaks of coaly claystone.	1	3	Dip 70°.
883	9	884	0	Claystone.....		3	
884	0	885	0	Bony COAL.....	1	0	
885	0	885	3	Silty ironstone.....		3	
885	3	886	6	COAL.....	1	3	) D-28280.
886	6	890	0	Claystone with carbonized plant fragments.	3	6	
890	0	890	6	Ironstone.....		6	
890	6	894	6	Claystone.....	4	0	
894	6	897	0	Coaly claystone.....	2	6	
897	0	898	9	Claystone with thin coaly streaks	1	9	Dip 20° to 45°.
898	9	899	0	Claystone.....		3	
899	0	899	5	Coaly claystone.....		5	
899	5	899	10	Bony COAL.....		5	
899	10	900	0	Silty ironstone.....		2	
900	0	902	0	Bony COAL.....	2	0	Dip 40°.
902	0	902	7	Coaly claystone.....		7	
902	7	903	7	COAL.....	1	0	) D-28281.
903	7	903	9	Silty ironstone.....		2	Dip 45°.
903	9	904	7	COAL.....		10	)
904	7	905	0	Coaly claystone.....		5	
905	0	908	0	Claystone.....	3	0	
908	0	908	2	COAL.....		2	
908	2	913	0	Claystone with coaly streaks.	4	10	
913	0	914	0	Medium-grained sandstone...	1	0	
914	0	916	0	Shaly claystone.....	2	0	
916	0	917	0	Bony COAL.....	1	0	
917	0	918	0	Claystone.....	1	0	
918	0	923	0	Interbedded and crossbedded siltstone and fine-grained sandstone with many ironstone nodules and coal blebs.	5	0	
923	0	925	0	Conglomeratic sandstone....	2	0	
925	0	933	0	Interbedded and crossbedded fine-grained sandstone and siltstone.	8	0	
933	0	937	0	Siltstone.....	4	0	Dip 10° to 30°.
937	0	941	6	Medium-grained speckled sandstone.	4	6	

Log, Hole WH-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
941	6	942	6	COAL.....	1	0	
942	6	958	0	Claystone with slickensides shaly and clayey streaks.	15	6	
958	0	959	0	COAL.....	1	0	
959	0	963	0	Claystone with shaly and clayey streaks.	4	0	
Bottom of hole.							

Log, Hole WH-8

Location: 1,195 feet N. and 690 feet W. of the S1/4 corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 832.8 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	21	0	Overburden, sand, and conglomeratic boulders.	21	0	
21	0	24	0	Weathered Eska conglomerate.	3	0	
24	0	26	0	Fine- to medium-grained sandstone.	2	0	
26	0	38	0	Eska conglomerate.....	12	0	
38	0	43	0	Medium-grained sandstone with scattered conglomeratic pebbles.	5	0	
43	0	100	0	Eska conglomerate.....	57	0	
100	0	118	0	Coarse-grained gray sandstone.	18	0	
118	0	230	0	Eska conglomerate.....	112	0	
230	0	240	0	Medium- to coarse-grained gray sandstone with white specks.	10	0	
240	0	243	0	Siltstone.....	3	0	
243	0	245	0	Claystone.....	2	0	
245	0	245	6	Folded shaly claystone.....		6	
245	6	276	0	Silty claystone.....	30	6	
276	0	293	0	Silty very fine-grained sandstone.	17	0	
293	0	303	0	Siltstone.....	10	0	Dip 20°
303	0	312	0	Claystone with carbonized leaf fragments and coaly streaks, 310 to 312 feet.	9	0	Dip 40°
312	0	318	0	Siltstone grading down into fine-grained sandstone (40° to 80° fractures).	6	0	Dip 20°.
318	0	419	0	Conglomerate, base of Eska conglomerate.	101	0	
419	0	420	0	Siltstone.....	1	0	
420	0	422	0	Clay (top of Chickaloon, no core).	2	0	

Log, Hole WH-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
422	0	423	0	Folded shaly clayey claystone.	1	0	
423	0	424	0	Shaly fine-grained sandstone.	1	0	
424	0	426	0	Folded shaly claystone and siltstone with carbonized plant fragments and 60° fractures.	2	0	
426	0	428	0	Sandstone and claystone folded and contorted with contact varying from 60° to vertical.	2	0	
428	0	433	0	Folded shaly clayey claystone and claystone.	5	0	Dip 60° to 80°.
433	0	438	0	Claystone with occasional blebs of coal and slickensides at 60° to 80°.	5	0	
438	0	438	6	COAL.....		6	
438	6	438	9	Claystone.....		3	Dip 50°.
438	9	439	3	Coaly claystone.....		6	Dip 50° to 60°.
439	3	440	0	Bony COAL with folded ironstone.		9	
440	0	441	0	Coaly claystone with streaks of bone.	1	0	
441	0	441	6	Bony COAL.....		6	
441	6	442	7	Coaly claystone with 2-inch streaks of coal.	1	1	
442	7	443	0	Silty ironstone.....		5	
443	0	443	8	Bony COAL.....		8	
443	8	444	6	Coaly claystone.....		10	Dip 25°.
444	6	445	0	Bone.....		6	
445	0	445	11	COAL with thin streaks of bone.		11	) D-28282.
445	11	446	2	Bone.....		3	
446	2	446	9	COAL.....		7	)
446	9	447	0	Bone and ironstone.....		3	
447	0	448	6	COAL.....	1	6	)
448	6	448	7	Ironstone.....		1	
448	7	449	2	COAL.....		7	)
449	2	449	5	Calcareous veinlets and ironstone nodules.		3	
449	5	450	3	COAL.....		10	)

Log, Hole WH-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
450	3	451	6	Bony COAL.....	1	3	
451	6	452	9	Claystone.....	1	3	Dip 25°.
452	9	455	0	COAL.....	2	3	) D-28283.
455	0	455	1	Ironstone.....		1	Dip 25°.
455	1	455	9	Bone.....		8	
455	9	457	10	COAL.....	2	1	)
457	10	459	0	Coaly claystone.....	1	2	
459	0	459	9	Bony COAL.....		9	
459	9	461	6	Coaly claystone.....	1	9	
461	6	463	0	Interbedded coaly claystone and bone.	1	6	
463	0	463	11	Bone.....		11	
463	11	465	0	Coaly claystone.....	1	1	
465	0	465	8	Bone.....		8	
465	8	468	4	Claystone.....	2	8	
468	4	469	0	Coaly claystone with streaks of coal.		8	
469	0	470	6	Ironstone.....	1	6	
470	6	478	0	Dark claystone with slickensides (60° to vertical fractures).	7	6	
478	0	488	0	Interbedded medium-grained gray sandstone and dark siltstone with carbonized plant fragments.	10	0	Dip 25°.
488	0	492	0	Siltstone.....	4	0	
492	0	494	0	Claystone.....	2	0	
494	0	494	11	Silty claystone with coaly streaks.		11	
494	11	495	4	COAL.....		5	
495	4	495	6	Coaly claystone.....		2	
495	6	495	10	Silty ironstone.....		4	
495	10	497	6	COAL with streaks of bone..	1	8	) D-29672.
497	6	498	0	Folded shaly claystone with fragments of coal.		6	
498	0	499	4	Dark claystone with shaly coaly streaks.	1	4	
499	4	500	4	Ironstone.....	1	0	
500	4	502	0	Silty claystone.....	1	8	
502	0	512	0	Fine sandstone with thin dark silty streaks with carbonized plant fragments.	10	0	Dip 25°.
512	0	520	0	Silty claystone.....	8	0	

Log, Hole WH-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
520	0	523	0	Coaly claystone with streaks of clay and claystone.	3	0	
523	0	523	5	Ironstone.....		5	
523	5	523	9	COAL.....		4	
523	9	523	11	Coaly claystone.....		2	
523	11	524	1	Folded shaly clayey claystone with slickensides.		2	
524	1	526	0	Claystone.....	1	11	
526	0	528	0	Siltstone.....	2	0	
528	0	583	0	Green with white speckels coarse conglomeratic sandstone with streaks of medium-grained sandstone and occasional blebs of coal, 1-inch coal at base.	55	0	
583	0	591	0	Fine-grained sandstone with dark siltstone streaks with carbonized plant fragments and occasional ironstone nodule.	8	0	Dip 45°.
591	0	599	3	Siltstone with streaks of claystone.	8	3	
599	3	599	6	Bone.....		3	
599	6	601	0	Coaly claystone.....	1	6	
601	0	608	10	Claystone with shaly and thin coaly streaks slickensides.	7	10	
608	10	610	0	Bony COAL with coaly claystone streaks.	1	2	
610	0	648	0	Very fine-grained silty sandstone with dark silty streaks with carbonized plant fragments and occasional ironstone.	38	0	Dip 40° to 60°.
648	0	648	1	COAL.....		1	
648	1	670	0	Claystone with few silty streaks and occasional ironstone nodules and blebs of coal.	21	11	Dip 20° to 30°.
670	0	679	0	Siltstone.....	9	0	
679	0	681	0	Fine-grained sandstone.....	2	0	

Log, Hole WH-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
681	0	693	0	Silty claystone grading down into siltstone with thin streaks of sandstone and very few carbonized plant fragments.	12	0	
693	0	696	0	Very fine-grained sandstone.	3	0	
696	0	706	0	Siltstone.....	10	0	
706	0	708	0	Claystone.....	2	0	
708	0	710	0	Coaly claystone with two 1-inch streaks of coal.	2	0	
710	0	712	0	Claystone.....	2	0	
712	0	713	0	Coaly claystone with coal blebs.	1	0	
713	0	718	0	Claystone with few blebs of coal fractures and slickensides.	5	0	
718	0	718	2	Calcareous claystone.....		2	
718	2	718	10	Claystone with streaks of coaly claystone.		8	
718	10	719	0	Bone.....		2	
719	0	720	0	Claystone with streaks of coaly claystone.	1	0	Dip 45°.
720	0	726	6	Claystone with a few blebs of coal slickensides 60° to vertical fractures.	6	6	
726	6	726	7	Shaly clayey claystone.....		1	Gouge.
726	7	727	0	Coaly claystone with streaks of coal.		5	
727	0	729	0	Coaly shaly folded claystone.	2	0	
729	0	732	0	Claystone with thin coal blebs, carbonized plant fragments, and 20° to 60° fractures.	3	0	
732	0	754	0	Interbedded and crossbedded very fine-grained gray sandstone and dark siltstone with carbonized plant fragments.	22	0	
754	0	760	2	Claystone with carbonized plant fragments and occasional ironstone band.	6	2	

Log, Hole WH-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remark
760	2	760	5	COAL with calcite veinlets.		3	Dip 20° to 30°.
760	5	760	10	Folded ironstone with bony inclusions.		5	
760	10	762	0	Claystone with thin coaly streaks.	1	2	
762	0	763	8	Claystone with few carbonized plant fragments.	1	8	
763	8	764	0	Ironstone.....		4	
764	0	766	8	Claystone.....	2	8	
766	8	767	0	Ironstone.....		4	
767	0	767	3	Coaly claystone.....		3	
767	3	767	6	Bony COAL.....		3	
767	6	774	8	Claystone.....	7	2	
774	8	775	0	Bony COAL.....		4	
775	0	776	0	Claystone.....	1	0	
776	0	784	0	Fine-grained gray sandstone with thin dark silty streaks.	8	0	Dip 30°.
784	0	787	0	Claystone.....	3	0	
787	0	787	3	Bony COAL.....		3	
787	3	787	8	Coaly claystone.....		5	
787	8	788	0	Bony COAL.....		4	
788	0	789	6	Claystone.....	1	6	
789	6	789	9	Coaly claystone.....		3	
789	9	790	0	Bony COAL.....		3	
790	0	792	9	Claystone.....	2	9	
792	9	793	6	Bony COAL with coaly claystone streaks.		9	
793	6	799	0	Claystone with thin coaly and silty streaks.	5	6	
799	0	800	0	Ironstone.....	1	0	
800	0	809	7	Siltstone.....	9	7	
809	7	810	4	Folded bony coal including ironstone.		9	
810	4	814	0	Claystone with few carbonized plant fragments.	3	8	
814	0	875	0	Interbedded and crossbedded fine-grained gray sandstone and dark siltstone with carbonized plant fragments.	61	0	Dip 20° to 30°.
875	0	880	0	Silty claystone grading down into claystone.	5	0	
880	0	880	6	Coaly claystone.....		6	

Log, Hole WH-8 (Con.)

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
880	6	881	6	Bony COAL with streaks of coaly claystone.	1	0	
881	6	882	6	Coaly claystone.....	1	0	
882	6	885	0	Claystone.....	2	6	Dip 20°.
885	0	885	4	Coaly claystone.....		4	
885	4	885	10	Claystone.....		6	
885	10	886	0	COAL.....		2	
886	0	887	0	Siltstone.....	1	0	
Bottom of hole.							

Log, Hole WH-9

Location: 1,005 feet S. and 905 feet W. of the NE. corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,240.5 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	4	0	Overburden, clay, and angular gravel.	4	0	Churn drilled.
4	0	24	0	Medium- to coarse-grained gray sandstone.	20	0	Do.
24	0	155	0	Pebble to cobble Eska conglomerate.	131	0	Do.
155	0	157	0	Carbonaceous shale.....	2	0	Do.
157	0	915	0	Variable Eska conglomerate.	758	0	Do.
915	0	1050	0	Gray silty claystone.....	135	0	Do.
1050	0	1225	0	Variable conglomerate.....	175	0	Do.
1225	0	1257	0	Sandstone.....	32	0	Do.
1257	0	1259	6	Dark fine-grained sandstone, crossbedded.	2	6	Cased and continued by core drilling.
1259	6	1280	9	Medium- to coarse-grained sandstone, occasional coal streaks and shale inclusions.	21	3	
1280	9	1298	10	Claystone grading down to fine silty sandstone.	18	1	
1298	10	1311	2	Greenish-to-gray medium-grained sandstone.	12	4	
1311	2	1328	4	Medium-grained gray to dark sandstone, stray pebbles and small angular inclusions, calcareous.	17	2	
1328	4	1345	3	Interbedded siltstone, fine-grained sandstone and claystone.	16	11	
1345	3	1368	0	Dark silty claystone, laminated and soft.	22	9	
1368	0	1370	4	Soft speckled (biotite) sandstone.	2	4	
1370	4	1384	0	Dark silty claystone with coaly streaks, laminated and soft.	13	8	

Log, Hole WH-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1384	0	1385	5	Coaly claystone.....	1	5	
1385	5	1387	6	Dark silty claystone, laminated and soft.	2	1	
1387	6	1388	10	Ironstone.....	1	4	
1388	10	1394	0	Soft laminated claystone...	5	2	
1394	0	1416	2	Interbedded claystone, siltstone and fine-grained sandstone.	22	2	Average bedding angle 13°.
1416	2	1471	0	Interbedded fine- to medium-grained sandstone with silty and coaly streaks, very pronounced cross-bedding.	54	10	
1471	0	1482	11	Interbedded claystone and silty sandstone.	11	11	9-foot core loss.
1482	11	1494	3	Dark silty fine-grained sandstone.	11	4	Average bedding angle 10°.
1494	3	1514	8	Medium- to coarse-grained, poorly consolidated sandstone, many coal streaks and fragments.	20	5	
1514	8	1535	6	Fine-grained sandstone with interbedded claystone and siltstone, occasional coaly streaks, pronounced crossbedding.	20	10	
1535	6	1536	6	Coaly claystone.....	1	0	
1536	6	1669	2	Interbedded siltstone and fine-grained sandstone, occasional coaly claystone inclusions and claystone lenses.	132	8	
1669	2	1671	2-1/4	Claystone, light-gray carbonaceous, slickensided.	2	1/4	2-1/4-inch core loss.
1671	2-1/4	1672	3/4	COAL, calcite veinlets.....		10-1/2	) D-71977.
1672	3/4	1672	4	Shale, dark-gray, carbonaceous coal streaks.		3-1/4	
1672	4	1675	6	Claystone, dark-gray, carbonaceous plant remains.	3	2	3-1/2-inch core loss.
1675	6	1677	0	Pulverized coal and shale..	1	6	4-inch core loss.
1677	0	1677	5	COAL.....		5	
1677	5	1678	1-1/2	Bone COAL with siderite streaks and lenses.		8-1/2	
1678	1-1/2	1678	6-1/2	Claystone, dark-gray, carbonaceous.		5	

Log, Hole WH-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1678	6-½	1678	10-½	COAL.....		4	
1678	10-½	1679	2	Siltstone, dark, carbonaceous coal lens.		3-½	
1679	2	1680	4	COAL, broken.....	1	2	) D-71978.
1680	4	1680	6	Bone and shale, broken.....		2	
1680	6	1684	6	Siltstone, dark-gray.....	4	0	3-feet, 1-inch core loss.
1684	6	1685	10-½	COAL, ¼-inch - clay lens rejected.	1	4-½	) D-71979.
1685	10-½	1686	½	Shale, dark-gray, carbonaceous.		2	
1686	½	1686	7	COAL.....		6-½	)
1686	7	1687	6	Shale, dark-gray, carbonaceous, coal streaks.		11	
1687	6	1688	9	COAL, bone parting ½-inch - one rejected.	1	3	) D-71980. 3-inch core loss.
1688	9	1689	0	Shale, dark-gray, carbonaceous.		3	
1689	0	1689	7	Bone with coal streaks.....		7	
1689	7	1693	1	COAL and broken COAL, 2 inches of shale and bone rejected.	3	6	) D-71981. 6-½-inch core loss.
1693	1	1694	6	COAL and shale, pulverized.	1	5	7-inch core loss.
1694	6	1695	2	COAL with calcite veinlets and ironstone lenses.		8	Not sampled for analyses.
1695	2	1695	10	Claystone, dark-gray, carbonaceous.		8	
1695	10	1698	8-¾	Claystone, dark-gray, coal fragments, pulverized.	2	10-¾	1-foot, 1-¼-inch core loss.
1698	8-¾	1698	11	COAL.....		2-¼	
1698	11	1700	0	Bone and claystone, dark-gray.	1	1	
1700	0	1700	6	Claystone, coal streaks....		6	
1700	6	1735	8	Interbedded claystone, siltstone, and fine-grained sandstone.	35	2	Bedding angle 16° to 30°.
1735	8	1741	3	Coaly claystone with bone and sandstone bands.	5	7	2-foot core loss.
1741	3	1743	8	Bony COAL.....	2	5	Not sampled for analyses. 8-inch core loss.
1743	8	1745	2	Dark claystone, coal streaks.	1	6	

Log, Hole WH-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1745	2	1791	10	Interbedded claystone, siltstone, and fine-grained sandstone.	46	8	
1791	10	1794	0	Bony COAL and coaly claystone.	2	2	
1794	0	1826	10	Interbedded claystone, siltstone, and sandstone with frequent coal streaks and inclusions.	32	10	
1826	10	1828	4	Soft calcareous shale, light color.	1	6	
1828	4	1830	4	Claystone, coal streaks....	2	0	
1830	4	1836	4	COAL, bony COAL and coaly claystone.	6	0	
1836	4	1843	0	Claystone, coal streaks....	6	8	4-foot core loss.
1843	0	1848	8	Bony COAL and coaly claystone.	5	8	
1848	8	1855	5	Claystone, coal streaks....	6	9	2-foot, 9-inch core loss.
1955	5	1859	0	COAL and coaly claystone...	3	7	
1859	0	1863	2	Claystone, coaly streaks...	4	2	1-foot, 6-inch core loss.
1863	2	1877	8	Interbedded claystone and siltstone, occasional coal streaks and ironstone concretions.	14	6	2-foot, 6-inch core loss.
1877	8	1893	0	Fine-grained sandstone grading down to siltstone and claystone with occasional coal streaks.	15	4	2-foot, 4-inch core loss.
1893	0	1895	3	Bony COAL (Poorly defined roof).	2	3	
1895	3	1896	1	Very soft claystone.....		10	
1896	1	2032	0	Interbedded fine-grained sandstone and siltstone, occasional claystone and bony bands.	135	11	
2032	0	2034	4	Conglomeratic sandstone with coaly fragments.	2	4	
2034	4	2104	0	Interbedded fine-grained sandstone, siltstone, and claystone, occasional thin coal lenses.	69	8	
Bottom of hole.							

Log, Hole WH-10

Location: 555 feet N. and 3,380 feet E. of the E1/4 corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,032.0 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	11	0	Overburden, sandy clay.....	11	0	Churn drilled.
11	0	50	0	Coarse-pebble Eska conglomerate.	39	0	Do.
50	0	125	0	Soft Eska conglomerate or conglomerate sandstone.	75	0	Do.
125	0	150	0	Sandstone, silty ?.....	25	0	Do.
150	0	215	0	Sandstone, gray, medium-grained.	65	0	Do.
215	0	264	0	Claystone.....	49	0	Do.
264	0	290	0	Claystone, carbonaceous....	26	0	Do.
290	0	295	0	Sandstone, clayey ?.....	5	0	Do.
295	0	345	0	Soft Eska conglomerate or conglomeratic sandstone.	50	0	Do.
345	0	385	0	Eska conglomerate, medium to coarse pebble.	40	0	Do.
385	0	400	0	Soft Eska conglomerate or conglomeratic sandstone.	15	0	Do.
400	0	730	0	Eska conglomerate, medium to coarse pebble.	330	0	Do.
730	0	755	0	Sandstone, gray, coarse....	25	0	Do.
755	0	770	0	Soft Eska conglomerate or conglomeratic sandstone.	15	0	Do.
770	0	790	0	Sandstone, gray, medium-grained.	20	0	Do.
790	0	938	0	Sandstone, gray, coarse- to medium-grained.	148	0	Do.
938	0	955	0	Eska conglomerate, medium pebble and cobble.	17	0	Do.
955	0	1020	0	Soft Eska conglomerate or conglomeratic sandstone.	65	0	Do.
1020	0	1025	0	Eska conglomerate, coarse pebble and cobble.	5	0	Do.
1025	0	1133	0	Sandstone, gray, coarse- to medium-grained (few pebbles).	108	0	Do.
1133	0	1151	0	Claystone, silty ?.....	18	0	Do.

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1151	0	1151	5	Claystone, brownish with gray streak.		5	Cased and continued by core drilling.
1151	5	1155	7	Siltstone, gray.....	4	2	
1155	7	1157	0	Claystone, gray, dense.....	1	5	
1157	0	1158	2	Siltstone to claystone, gray.	1	2	
1158	2	1171	5	Claystone, dark-gray.....	13	3	Bedding angle 15°.
1171	5	1173	5	Siltstone, gray.....	2	0	
1173	5	1174	7	Sandstone, dense, medium- to fine-grained, gray.	1	2	
1174	7	1182	10	Sandstone, fine-grained, silty, gray.	8	3	Do.
1182	10	1183	8	Sandstone, fine-grained, gray, interlaminated with claystone.		10	
1183	8	1185	4	Sandstone, fine-grained, gray with thin coaly streaks.	1	8	
1185	4	1191	0	Sandstone, medium to coarse-grained, gray with a few coaly fragments.	5	8	
1191	0	1193	6	Eska conglomerate, coarse pebbles in coarse-grained sandstone matrix.	2	6	
1193	6	1194	4	Sandstone, medium- to coarse-grained, greenish with coaly streaks.		10	
1194	4	1194	10	Eska conglomerate, cherty pebbles in greenish sandstone matrix, coaly fragments.		6	
1194	10	1195	7	Conglomeratic sandstone, greenish-gray coaly fragments.		9	
1195	7	1219	10	Eska conglomerate, pebbles in a coarse-grained sandstone matrix.	24	3	6-foot, 4-inch core loss.
1219	10	1220	2	Sandstone, dense, medium-grained, gray.		4	
1220	2	1272	2	Eska conglomerate, pebbles in a coarse-grained sandstone matrix.	52	0	37-foot, 4-inch core loss.

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1272	2	1281	0	Sandstone, dense, medium-grained, gray.	8	10	
1281	0	1302	0	Eska conglomerate, volcanic, and cherty pebbles in gray medium-grained sandstone matrix, occasional coaly streaks.	21	0	8-foot, 6-inch core loss.
1302	0	1309	8	Eska conglomerate, pebbles in coarse-grained porous sandstone matrix.	7	8	
1309	8	1310	1	Sandstone, medium-grained dense, gray.		5	
1310	1	1313	5	Eska conglomerate with interbedded and crossbedded coarse- to medium-grained sandstone.	3	4	6-inch core loss.
1313	5	1332	0	Sandstone, very coarse-grained, granitic, chloritic stain, occasional interbedded medium-grained sandstone.	18	7	10-foot core loss.
1332	0	1338	10	Sandstone, medium-grained, crossbedded.	6	10	
1338	10	1340	1	Siltstone, dark, dense.....	1	3	
1340	1	1344	3	Conglomeratic sandstone, occasional siltstone fragments.	4	2	
1344	3	1345	11	Sandstone, fine-grained, crossbedded.	1	8	
1345	11	1348	0	Sandstone, coarse-grained, chloritic.	2	1	
1348	0	1351	3	Sandstone, dense, fine- to medium-grained, gradational.	3	3	
1351	3	1361	2	Sandstone, interbedded, medium- to coarse-grained, chloritic.	9	11	
1361	2	1366	0	Conglomeratic sandstone with a few silty streaks.	4	10	
1366	0	1394	2	Sandstone, interbedded and crossbedded, medium- to very coarse-grained with occasional silt and clay bands.	28	2	

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1394	2	1430	10	Sandstone, interbedded and crossbedded, medium- to coarse-grained with occasional dark siltstone fragments and clay and silt bands.	36	8	
1430	10	1442	8	Sandstone, medium-grained with interbedded dark-gray conglomeratic sandstone.	11	10	
1442	8	1453	2	Eska conglomerate, fine pebble grading to conglomeratic sandstone.	10	6	
1453	2	1458	10	Eska conglomerate, medium pebble.	5	8	
1458	10	1461	8	Sandstone, medium-grained to conglomeratic.	2	10	
1461	8	1465	6	Claystone, dark.....	3	10	2-foot, 4-inch core loss.
1465	6	1466	6	Sandstone, medium-grained crossbedded, light-gray.	1	0	
1466	6	1474	8	Claystone, dark.....	8	2	
1474	8	1475	10	Sandstone, medium-grained, crossbedded.	1	2	
1475	10	1483	7	Interbedded and crossbedded sandstone and claystone.	7	9	4-inch core loss.
1483	7	1511	9	Sandstone, fine- to medium-grained, crossbedded.	28	2	7-inch core loss.
1511	9	1574	5	Sandstone, medium- to coarse-grained, conglomeratic with occasional dark claystone bands and fragments.	62	8	
1574	5	1575	9	Sandstone, medium-grained with carbonaceous streaks.	1	4	Bedding angle 10°.
1575	9	1576	4	Dark claystone.....		7	
1576	4	1577	8	Sandstone, medium-grained to conglomeratic.	1	4	
1577	8	1578	0	Dark claystone.....		4	
1578	0	1578	10	Sandstone, conglomeratic, fine matrix.		10	
1578	10	1579	6	Dark claystone.....		8	
1579	6	1590	7	Sandstone, medium-grained with dark claystone bands and streaks.	11	1	

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1590	7	1591	2	Dark siltstone.....		7	
1591	2	1593	8	Sandstone, medium-grained, interbedded with dark siltstone.	2	6	
1593	8	1601	4	Siltstone with interbedded sandstone bands.	7	8	
1601	4	1602	6	Sandstone, fine-grained....	1	2	
1602	6	1604	4	Dark siltstone with interbedded fine-grained sandstone.	1	10	
1604	4	1640	7	Sandstone, fine- to medium-grained with poorly defined siltstone interbedding.	36	3	
1640	7	1651	10	Dark siltstone, laminated, with few coaly streaks.	11	3	
1651	10	1652	7-½	COAL, bright, calcite, and kaolinite facing minerals.		9-½	) D-74888.
1652	7-½	1653	3-½	Shale, dark-gray carbonaceous coal streaks.		8	
1653	3-½	1655	1	COAL, bright, calcite facing minerals.	1	9-½	)
1655	1	1655	4	Shale, dark-gray, carbonaceous.		3	
1655	4	1655	8	COAL.....		4	)
1655	8	1655	10	Shale, dark-gray, coaly streaks.		2	
1655	10	1656	8	COAL, bright, calcite and kaolinite facing minerals.		10	)
1656	8	1656	9-½	Shale, dark-gray, carbonaceous.		1-½	
1656	9-½	1657	0	Clay, gray, soft.....		2-½	
1657	0	1657	11-½	Bony COAL.....		11-½	Not sampled for analyses.
1657	11-½	1660	5	Shale, dark-gray, carbonaceous.	2	5-½	
1660	5	1660	7	Bone and shale.....		2	
1660	7	1663	5-½	COAL, bright, broken.....	2	10-½	) D-74889. 1-foot, 4-½-inch core loss.
1663	5-½	1664	0	COAL, bright, kaolinite facing minerals.		6-½	)
1664	0	1664	1	Shale, dark-gray, carbonaceous.		1	

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1664	1	1664	9	COAL, bright, kaolinite facing minerals.		8	)
1664	9	1665	5-½	Shale, dark-gray.....		8-½	
1665	5-½	1665	8-½	Bone.....		3	
1665	8-½	1666	5	COAL, broken.....		8-½	Not sampled for analyses. 5-inch core loss.
1666	5	1667	9	Bone and shale, dark-gray, carbonaceous.	1	4	5-inch core loss.
1667	9	1680	0	Sandstone and siltstone, interbedded and crossbedded.	12	3	
1680	0	1681	11	Sandstone, coaly with erratic fluvial bedding.	1	11	
1681	11	1683	0	Black claystone with coal fragments.	1	1	
1683	0	1684	4	Dark claystone.....	1	4	
1684	4	1694	6	Siltstone with crossbedded fine-grained sandstone.	10	2	
1694	6	1704	10	Interlaminated bony COAL and coaly claystone.	10	4	
1704	10	1711	10	Dark siltstone with coal streaks and fragments.	7	0	
1711	10	1780	5	Sandstone and siltstone, interbedded and crossbedded with coal streaks and fragments.	68	7	
1780	5	1786	1	Claystone, partly foliated.	5	8	
1786	1	1792	6	Siltstone and sandstone, crossbedded.	6	5	
1792	6	1796	6	Dark claystone with coaly streaks.	4	0	
1796	6	1801	4	Siltstone and sandstone with bone streaks and inclusions.	4	10	
1801	4	1805	6	Intermixed COAL and bone...	4	2	) E-188.
1805	6	1806	5	Bright COAL.....		11	) E-189.
1806	5	1807	5	Bone and COAL.....	1	0	) E-190.
1807	5	1809	0	Black carbonaceous claystone.	1	7	
1809	0	1809	4	Bone.....		4	
1809	4	1809	10	Bone and clay.....		6	
1809	10	1812	6	Bright COAL with thin streaks of bone.	2	8	) E-191.

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1812	6	1815	0	Claystone with streaks of bone.	2	6	
1815	0	1823	9	Interbedded sandstone and siltstone with carbonaceous streaks.	8	9	
1823	9	1851	6	Medium-grained gray sandstone with plant fragments and coaly streaks.	27	9	
1851	6	1852	10	Coaly claystone.....	1	4	
1852	10	1853	8	Silty coaly sandstone.....		10	
1853	8	1854	2	Bony COAL.....		6	
1854	2	1854	4	Coaly siltstone.....		2	
1854	4	1855	8	Bony COAL and COAL.....	1	4	Not sampled for analyses.
1855	8	1857	0	Coaly claystone.....	1	4	
1857	0	1887	0	Interbedded siltstone and claystone with occasional coal fragments.	30	0	
1887	0	1889	0	Bony COAL and COAL.....	2	0	Do.
1889	0	1899	4	Coaly claystone.....		4	
1899	4	1891	6	Bony COAL with occasional silty streaks.	2	2	Do.
1891	6	1893	6	Silty claystone.....	2	0	
1893	6	1894	7	Gray silty sandstone.....	1	1	
1894	7	1899	9	Siltstone, crossbedded with occasional plant fragments.	5	2	
1899	9	1901	2	Dark carbonaceous claystone with silty streaks.	1	5	
1901	2	1913	5	Interbedded and crossbedded gray siltstone and sandstone, occasional coaly streaks.	12	3	
1913	5	1919	0	Interlaminated claystone and siltstone, bentonitic appearance.	5	7	
1919	0	1919	5	Dark claystone with coal streaks and fragments.		5	
1919	5	1921	1	Bony COAL.....	1	8	Not sampled for analyses.
1921	1	1923	7	Coaly claystone, laminated.	2	6	
1923	7	1924	0	COAL.....		5	Do.

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Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1924	0	1924	2	Coaly claystone.....		2	
1924	2	1925	0	COAL.....		10	
1925	0	1927	0	Dark claystone with coaly bands and fragments, slickensides.	2	0	
1927	0	1932	10	Coaly claystone with bony coal bands.	5	10	
1932	10	1934	0	Silty sandstone with occasional coaly fragments.	1	2	
1934	0	1936	3	Dark claystone with coal fragments, slickensides.	2	3	
1936	3	1937	0	Gougy clay with coal fragments.		9	
1937	0	1942	0	Carbonaceous claystone, coaly streaks, slickensides.	5	0	
1942	0	1942	8	Siltstone with coal streaks and fragments.		8	
1942	8	1946	6	Coaly claystone, bony streaks.	3	10	7-inch core loss.
1946	6	1970	0	Interbedded silty claystone to very fine-grained sandstone, crossbedded.	23	6	10-inch core loss.
1970	0	1971	10	Coaly claystone, silty streaks.	1	10	4-inch core loss.
1971	10	1972	8	Dark silty claystone.....		10	
1972	8	1973	4	Coaly claystone.....		8	
1973	4	1979	0	Interbedded and crossbedded siltstone and sandstone.	5	8	
1979	0	1979	10	Claystone.....		10	
1979	10	1982	5	Silty claystone with distorted soft clay streaks, slickensides.	2	7	1-foot core loss.
1982	5	1985	2	Coaly claystone.....	2	9	
1985	2	1990	5	Interbedded sandstone and siltstone.	5	3	
1990	5	1991	10	Coaly claystone.....	1	5	
1991	10	1992	6	Soft claystone with slickensides.		8	
1992	6	1993	2	Coaly claystone.....		8	
1993	2	1997	2	Dark silty claystone, coal streaks and slickensides.	4	0	6-inch core loss.
1997	2	1997	11	Bony COAL.....		9	Not sampled for analyses. 3-inch core loss.

Log, Hole WH-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1997	11	1998	5	Soft clay, bentonite appearance.		6	
1998	5	2010	1	Interbedded siltstone and fine-grained sandstone.	11	8	Bedding angle 15°.
2010	1	2014	6	Silty claystone, slickensides.	4	5	
2014	6	2089	9	Siltstone grading uniformly into medium-grained conglomeratic sandstone with no demarcation, few coaly streaks and fragments in lower 20 feet.	75	3	Bedding angle 5° to 15°.
2089	9	2094	8	Claystone with a few silty streaks.	4	11	
2094	8	2097	9	Fine-grained silty sandstone.	3	1	
2097	9	2110	0	Siltstone to silty claystone.	12	3	
Bottom of hole.							

Log, Hole WH-11

Location: 735 feet N. and 1,500 feet W. of the E1/4 corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,197.3 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	2	6	Sandy clay overburden.....	2	6	Churn drilled.
2	6	260	0	Eska conglomerate.....	257	6	Do.
260	0	270	0	Sandstone, brown, medium-grained, soft.	10	0	Do.
270	0	395	0	Eska conglomerate.....	125	0	Do.
395	0	425	0	Coarse-grained sandstone, greenish-brown.	30	0	Do.
425	0	445	0	Eska conglomerate.....	20	0	Do.
445	0	455	0	Medium-grained sandstone...	10	0	Churn drilled. Water course at 450 feet.
455	0	725	0	Eska conglomerate.....	270	0	Churn drilled.
725	0	730	0	Sandstone, greenish-brown, medium soft.	5	0	Do.
730	0	835	0	Eska conglomerate.....	105	0	Do.
835	0	1065	0	Variable sandstone.....	230	0	Do.
1065	0	1230	0	Clayey sandstone with shale or claystone lenses.	165	0	Do.
1230	0	1250	0	Coarse-grained gray-white sandstone.	20	0	Do.
1250	0	1291	0	Sandstone, medium- to fine-grained, claystone lenses.	41	0	Do.
1291	0	1293	8	Medium-grained sandstone, ironstone concretions and coaly streaks.	2	8	Cased and continued by core drilling.
1293	8	1294	9	Coarse-grained speckled sandstone.	1	1	
1294	9	1341	2	Interbedded fine-grained sandstone and siltstone, occasional coaly streaks and concretions.	46	5	
1341	2	1351	1	Medium-grained sandstone, ironstone inclusions.	9	11	
1351	1	1351	10	Siltstone.....		9	
1351	10	1354	4	Interbedded fine-grained sandstone and siltstone.	2	6	

Log, Hole WH-11 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1354	4	1371	0	Medium- to coarse-grained conglomeratic sandstone, few coaly streaks.	16	8	
1371	0	1372	8	COAL with ½-inch silty streak.	1	8	Not sampled for analyses.
1372	8	1398	10	Interbedded claystone, siltstone, and silty sandstone.	26	2	
1398	10	1399	10	COAL.....	1	0	) E-185.
1399	10	1399	10-½	Clay parting.....		½	
1399	10-½	1400	1-½	COAL.....		3	)
1400	1-½	1400	3-½	Bone and clay.....		2	
1400	3-½	1400	8-½	COAL.....		5	)
1400	8-½	1401	5-½	Intermixed bone and clay...		9	
1401	5-½	1403	7-½	COAL.....	2	2	)
1403	7-½	1404	3-½	Bone and clay.....		8	
1404	3-½	1405	8	COAL.....	1	4-½	) 9-½-inch core loss.
1405	8	1406	0	Bone.....		4	
1406	0	1407	3	COAL.....	1	3	)
1407	3	1407	9	Bone and clay.....		6	
1407	9	1408	8	COAL.....		11	)
1408	8	1410	3	Claystone, coal, and sandy streaks.	1	7	
1410	3	1411	4	COAL.....	1	1	) E-186.
1411	4	1411	11	Claystone (slack).....		7	
1411	11	1412	1	Bone.....		2	
1412	1	1412	7	COAL.....		6	)
1412	7	1412	8	Bone.....		1	
1412	8	1412	11	COAL.....		3	)
1412	11	1413	2	Bone.....		3	
1413	2	1414	6	COAL.....	1	4	)
1414	6	1415	0	Clay, siltstone, and sandstone.		6	
1415	0	1466	5	Interbedded claystone, siltstone, and silty sandstone.	51	5	
1466	5	1467	1	COAL, bony.....		8	Not sampled for analyses.
1467	1	1467	11	Claystone.....		10	
1467	11	1468	5	Bone.....		6	
1468	5	1477	2	Interbedded claystone and siltstone, few coaly bands.	8	9	

Log, Hole WH-11 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1477	2	1486	6	Coaly claystone.....	9	4	7-foot, 4-inch core loss.
1486	6	1493	1	Claystone, silty bands and coaly streaks.	6	7	Average indicated dip from 1,291 to 1,493 feet, 25°.
1493	1	1578	0	Fine-grained gray massive sandstone, occasional coaly streaks.	84	11	Bedding angle 20° to 30°.
1578	0	1580	9	Claystone.....	2	9	
1580	9	1608	6	Interbedded siltstone, claystone, and silty sandstone.	27	9	
1608	6	1621	7	Claystone, coaly bands and streaks.	13	1	8-foot, 4-inch core loss.
1621	7	1623	11	Claystone, coaly streaks...	2	4	
1623	11	1624	7	COAL.....		8	) E-187.
1624	7	1624	9	Clay.....		2	
1624	9	1625	9	COAL.....		12	)
1625	9	1625	10-3/4	Siltstone.....		1-3/4	
1625	10-3/4	1626	5-3/4	COAL.....		7	)
1626	5-3/4	1626	6-3/4	Siltstone.....		1	
1626	6-3/4	1629	4	COAL.....	2	9-1/4	)
1629	4	1629	8	Siltstone.....		4	
1629	8	1630	9	Bone and clay, thin banded.	1	1	
1630	9	1634	6	COAL.....	3	9	)
1634	6	1634	8	Bone.....		2	
1634	8	1634	10	COAL.....		2	)
1634	10	1664	7	Interbedded claystone, siltstone, and silty sandstone, coal streaks on top.	29	9	
1664	7	1671	0	Claystone with a few coal bands and silty streaks.	6	5	
1671	0	1712	6	Interbedded claystone and siltstone, few coal streaks.	41	6	
1712	6	1712	8	COAL.....		2	
1712	8	1712	11	Claystone.....		3	
1712	11	1714	5	Coaly claystone.....	1	6	
1714	5	1715	4	COAL.....		11	Not sampled for analyses.

Log, Hole WH-11 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1715	4	1716	10	Claystone, coaly top 3 inches.	1	6	
1716	10	1765	10	Siltstone and silty sandstone, few coaly claystone bands.	49	0	
1765	10	1768	0	COAL.....	2	2	Not sampled for analyses.
1768	0	1769	0	Dark claystone, coaly streaks and fragments.	1	0	Bedding angle 15° to 35°.
1769	0	1771	4	COAL.....	2	4	Not sampled for analyses.
1771	4	1775	2	Dark claystone, coal streaks.	3	10	2-foot, 10-inch core loss.
1775	2	1776	4	COAL.....	1	2	Not sampled for analyses.
1776	4	1776	11	Bony COAL.....		7	Do.
1776	11	1780	5	Coaly claystone and claystone with coal streaks.	3	6	
1780	5	1785	0	COAL.....	4	7	3-foot, 5-inch core loss. Not sampled for analyses.
1785	0	1788	0	Claystone, coaly streaks...	3	0	
1788	0	1790	6	COAL.....	2	6	Not sampled for analyses.
1790	6	1796	4	Dark claystone, coal streaks and fragments.	5	10	
1796	4	1801	4	Interbedded claystone, silty claystone and silty sandstone.	5	0	
1801	4	1814	0	Interbedded claystone, siltstone, and fine-grained sandstone, few coaly streaks.	12	8	5-foot, 10-inch core loss. Bedding poorly defined.
1814	0	1815	8	COAL, bony.....	1	8	Not sampled for analyses.
1815	8	1815	11	Claystone, coaly streaks...		3	
1815	11	1816	10	Bony COAL.....		11	Do.
1816	10	1817	0	Claystone.....		2	
1817	0	1817	6	Bony COAL.....		6	Do.
1817	6	1819	5	Silty claystone.....	1	11	
1819	5	1838	5	Interbedded claystone, siltstone, silty sandstone, few coaly fragments.	19	0	

Log, Hole WH-11 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1838	5	1840	5	Coaly claystone.....	2	0	
1840	5	1841	2	Siltstone.....		9	
1841	2	1842	1	Silty sandstone.....		11	
1842	1	1843	10	Silty claystone.....	1	9	
1843	10	1846	4	Coaly claystone.....	2	6	1-foot core loss.
1846	4	1853	5	Siltstone, sandy streaks...	7	1	
1853	5	1861	0	Claystone, coaly streaks...	7	7	4-foot, 1-inch core loss.
1861	0	1862	4	Bony COAL.....	1	4	Not sampled for analyses.
1862	4	1863	2	Coaly claystone.....		10	
1863	2	1898	0	Interbedded claystone, siltstone and fine-grained sandstone.	34	10	
1898	0	1921	4	Massive gray medium-grained sandstone, coal fragments lower 5 feet.	23	4	
1921	4	1937	2	Interbedded siltstone and fine-grained sandstone.	15	10	
1937	2	1938	0	Dark laminated claystone (shale).		10	
1938	0	1959	6	Massive gray medium-grained sandstone, occasional coaly fragments.	21	6	
1959	6	1977	8	Fine silty sandstone.....	18	2	
1977	8	1997	0	Dark claystone, frequent coaly bands and streaks.	19	4	9-foot core loss.
1997	0	2003	0	Claystone.....	6	0	3-foot core loss.
2003	0	2037	0	Interbedded claystone, siltstone, and fine-grained sandstone, coaly fragments and coaly claystone streaks.	34	0	
2037	0	2100	0	Greenish silty claystone, ironstone concretions.	63	0	
Bottom of hole.							

Log, Hole WH-12

Location: 875 feet S. and 2,630 feet W. of the NE. corner, sec. 19, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,171.5 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	15	0	Overburden - sandy clay....	15	0	Churn drilled.
15	0	70	0	Interbedded sandstone and Eska conglomerate.	55	0	Do.
70	0	120	0	Eska conglomerate.....	50	0	Do.
120	0	150	0	Clayey sandstone.....	30	0	Do.
150	0	220	0	Interbedded sandstone and Eska conglomerate.	70	0	Do.
220	0	370	0	Interbedded claystone and clayey sandstone.	150	0	Do.
370	0	390	0	Brown shale.....	20	0	Do.
390	0	623	0	Eska conglomerate.....	233	0	Do.
623	0	635	0	Sandstone.....	12	0	Do.
635	0	670	0	Claystone.....	35	0	Do.
670	0	805	0	Eska conglomerate.....	135	0	Do.
805	0	848	0	Sandstone.....	43	0	Do.
848	0	865	0	Eska conglomerate.....	17	0	Do.
865	0	880	0	Claystone.....	15	0	Do.
880	0	925	0	Eska conglomerate.....	45	0	Do.
925	0	955	0	Sandstone.....	30	0	Do.
955	0	970	0	Eska conglomerate.....	15	0	Do.
970	0	975	0	Sandstone.....	5	0	Do.
975	0	1005	0	Eska conglomerate.....	30	0	Do.
1005	0	1035	0	Sandstone.....	30	0	Do.
1035	0	1260	0	Eska conglomerate.....	225	0	Do.
1260	0	1293	0	Sandy or silty claystone...	33	0	Do.
1293	0	1303	0	No core.....	10	0	Cased and continued by core drilling.
1303	0	1311	10	Interbedded and crossbedded claystone and siltstone, some iron stain.	8	10	
1311	10	1353	8	Interbedded fine-grained sandstone, siltstone, and claystone, occasional calcite-filled fractures.	41	10	Average bedding angle 10°.
1353	8	1423	0	Eska conglomerate.....	69	4	

Log, Hole WH-12 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1423	0	1429	1	Hard medium-grained sandstone, many coaly streaks and fragments.	6	1	
1429	1	1464	5	Eska conglomerate, some interbedded medium-grained sandstone.	35	4	
1464	5	1475	0	Massive medium-grained sandstone.	10	7	
1475	0	1495	0	Eska conglomerate.....	20	0	
1495	0	1516	8	Medium- to coarse-grained very granular sandstone, conglomeratic.	21	8	
1516	8	1520	4	Medium-grained sandstone, no true bedding discernable.	3	8	
1520	4	1523	0	Medium- to coarse-grained sandstone, claystone blebs.	2	8	
1523	0	1524	4	Dark claystone, sandy streaks.	1	4	
1524	4	1535	0	Medium-grained sandstone, angular conglomeratic streaks.	10	8	
1535	0	1538	0	Dark silty claystone, sandy streaks and inclusions.	3	0	
1538	0	1585	10	Medium-grained to conglomeratic sandstone, occasional silty streaks and claystone inclusions.	47	10	
1585	10	1587	0	Dark claystone.....	1	2	
1587	0	1588	5	Medium-grained sandstone, few claystone blebs.	1	5	
1588	5	1592	2	Dark claystone, sandy streaks on bottom.	3	9	
1592	2	1625	7	Massive medium-grained sandstone, feldspathic.	33	5	Average bedding angle 15°.
1625	7	1692	0	Interbedded Eska conglomerate and medium-grained sandstone.	66	5	
1692	0	1710	0	Interbedded and crossbedded fine-grained sandstone and siltstone, occasional shaly streaks.	18	0	Average indicated bedding angle 25°.

Log, Hole WH-12 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1710	0	1734	3	Dark medium-grained sandstone, calcite streaks and fracture filling.	24	3	
1734	3	1756	8	Medium-grained sandstone, soft to dense, granitic.	22	5	
1756	8	1851	7	Dark claystone, occasional coaly streaks.	94	11	
1851	7	1852	5	COAL.....		10	Not sampled for analyses.
1852	5	1852	10	Coaly claystone.....		5	
1852	10	1853	2	COAL.....		4	Do.
1853	2	1853	7	Claystone.....		5	
1853	7	1853	11	COAL.....		4	Do.
1853	11	1854	0	Silty claystone.....		1	
1854	0	1855	0	COAL.....	1	0	Do.
1855	0	1855	4	Claystone.....		4	
1855	4	1855	11	Bony COAL.....		7	Do.
1855	11	1856	2	Silty claystone.....		3	
1856	2	1857	6	Coaly shale.....	1	4	
1857	6	1857	10	Silty claystone.....		4	
1857	10	1859	2	Bony COAL.....	1	4	Do.
1859	2	1859	9	Claystone, coaly streaks...		7	
1859	9	1860	9	Bony COAL.....	1	0	Do.
1860	9	1861	7	Coaly claystone.....		10	
1861	7	1862	1	Bony COAL.....		6	Do.
1862	1	1865	0	COAL.....	2	11	Do.
1865	0	1866	1	Claystone, coaly streaks...	1	1	
1866	1	1867	1	Carbonaceous shale.....	1	0	
1867	1	1868	7	COAL.....	1	6	Do.
1868	7	1869	0	Shale.....		5	
1869	0	1899	2	Dark claystone, occasional sandy and coaly streaks.	30	2	Bedding angle indeterminate.
1899	2	1900	7	Carbonaceous shale.....	1	5	
1900	7	1900	10	Bony COAL.....		3	
1900	10	1909	9	Interbedded claystone and coaly claystone.	8	11	
1909	9	1910	11	Bony COAL.....	1	2	Not sampled for analyses.
1910	11	1920	1	Dark claystone, occasional coal fragments, sandy streaks.	9	2	
1920	1	1953	9	Dense medium-grained sandstone, multiple thin coaly streaks.	33	8	

Log, Hole WH-12 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1953	9	1955	2	Crossbedded fine-grained silty sandstone.	1	5	Bedding angle 0° to 10°.
1955	2	1963	8	Dark claystone, occasional coaly and sandy streaks.	8	6	Do.
1963	8	1966	2	Crossbedded fine-grained sandstone, silty streaks.	2	6	
1966	2	1967	1	Dark claystone.....		11	Bedding angle 5°.
1967	1	1990	0	Interbedded claystone, siltstone, silty claystone, occasional coaly streaks.	22	11	
1990	0	1991	5	Variable coaly claystone...	1	5	
1991	5	1991	7-½	Bone.....		2-½	
1991	7-½	1996	0	COAL.....	4	4-½	) D-99652. 2-foot, 6-inch core loss.
1996	0	1996	1	Bone.....		1	
1996	1	1996	7	COAL.....		6	) D-99653.
1996	7	1996	8	Bone.....		1	
1996	8	1997	7	COAL.....		11	)
1997	7	1997	8	Bone.....		1	
1997	8	1998	4	COAL.....		8	)
1998	4	1998	5-½	Bone.....		1-½	
1998	5-½	1998	9	COAL.....		3-½	)
1998	9	1999	3	Bone.....		6	
1999	3	2000	0	Dark-gray siltstone with thin streaks of coal.		9	
2000	0	2001	6	Bone.....	1	6	
2001	6	2003	1-½	COAL.....	1	7-½	) D-99654.
2003	1-½	2003	2	Bone.....		½	
2003	2	2003	10	COAL.....		8	)
2003	10	2005	9	Bone.....	1	11	
2005	9	2006	9	COAL.....	1	0	) D-99655.
2006	9	2007	0	Bone.....		3	
2007	0	2007	9	COAL.....		9	)
2007	9	2008	1	Bone.....		4	
2008	1	2008	5	Dark-gray siltstone.....		4	
2008	5	2034	6	Interbedded claystone and fine-grained sandstone, occasional ironstone concretions and coaly streaks.	26	1	
2034	6	2034	11	Black carbonaceous clay....		5	

Log, Hole WH-12 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
2034	11	2036	1	COAL.....	1	2	) D-99656.
2036	1	2037	1	Clay, siltstone and bone...	1	0	
2037	1	2037	8	COAL.....		7	)
2037	8	2038	0	Clay with streaks of bone..		4	
2038	0	2038	2	COAL.....		2	)
2038	2	2038	3	Bone.....		1	
2038	3	2039	4	COAL.....	1	1	)
2039	4	2039	6	Bone.....		2	
2039	6	2040	3	COAL.....		9	)
2040	3	2040	7	Dark-gray siltstone.....		4	
2040	7	2073	1	Interbedded and crossbedded claystone and fine-grained sandstone, occasional concretions and coaly streaks.	32	6	Average indicated bedding angle 20°.
2073	1	2078	9	Light micaceous shale.....	5	8	
2078	9	2080	3	Dark claystone, coaly streaks.	1	6	
2080	3	2081	11	Bright COAL.....	1	8	) D-99657.
2081	11	2083	8	Dark-gray claystone with streaks of coal and bone.	1	9	
2083	8	2084	2	Bright COAL.....		6	)
2084	2	2084	5-½	Clay and bone.....		3-½	
2084	5-½	2085	3	COAL.....		9-½	)
2085	3	2086	3	Bone and clay.....	1	0	
2086	3	2090	1	COAL.....	3	10	)
2090	1	2090	7	Clay with streaks of coal..		6	
2090	7	2094	1	Interbedded claystone and coaly claystone.	3	6	
2094	1	2095	1	COAL.....	1	0	Not sampled for analyses.
2095	1	2102	9	Dark claystone.....	7	8	
2102	9	2102	11	COAL.....		2	
2102	11	2107	5	Dark claystone, coaly streaks, occasional concretions.	4	6	
2107	5	2108	0	COAL.....		7	
2108	0	2114	0	Interbedded claystone, silty claystone, occasional concretions.	6	0	
Bottom of hole.							

Log, Hole WH-13

Location: 1,190 feet N. and 1,125 feet W. of the SE. corner, sec. 18, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,646 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	1305	0	Eska conglomerate, included sandstone and shale lenses.	1305	0	Churn drilled. Water in variable volume, occasionally approaching artesian.
1305	0	1315	6	Soft brown shale.....	10	6	Cased and continued by core drilling.
1315	6	1323	9	Siltstone and silty claystone.	8	3	
1323	9	1324	5	Silty fine-grained sandstone.		8	
1324	5	1335	7	Siltstone and very fine-grained sandstone.	11	2	
1335	7	1337	9	Fine-grained sandstone, silty streaks.	2	2	
1337	9	1340	6	Soft sandstone, silty streaks.	2	9	
1340	6	1537	0	Eska conglomerate, occasional sandstone lenses.	196	6	
1537	0	1549	6	Medium- to coarse-grained crossbedded sandstone, occasional pebbles.	12	6	
1549	6	1555	11	Dense medium-grained sandstone, occasional pebbles.	6	5	
1555	11	1562	11	Claystone.....	7	0	
1562	11	1588	3	Fine- to medium-grained sandstone, interbedded with numerous claystone streaks and blebs.	25	4	
1588	3	1707	0	Medium- to coarse-grained sandstone with occasional claystone and fine-grained sandstone streaks and bands, coal fragments at 1,660 feet.	118	9	Hole lost and abandoned. Average indicated bedding angle near bottom of hole 15°, occasionally steepening to 30° at contacts.
. Bottom of hole.							

Log, Hole WH-14

Location: 1,605 feet S. and 2,130 feet E. of the NW. corner, sec. 20, T. 19 N., R. 3 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 731.0 feet, mean sea level datum.

Bearing: N. 40° W.

Dip of hole: Horizontal.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	192	9	Evan Jones Coal Co. drift entry.	192	9	Drilling accomplished thru casing to drift face.
192	9	199	6	Medium-coarse to conglomeratic sandstone, occasional coaly fragments and siltstone inclusions.	6	9	Bedding angle 52°.
199	6	206	10	Medium-grained sandstone, occasional silty slips and cherty joints.	7	4	Bedding angle 30° to 40°.
206	10	265	8	Interbedded silty claystone and fine- to medium-grained sandstone.	58	10	Bedding angle 32°.
265	8	271	2	Fine- to coarse-grained sandstone, many ironstone inclusions and coaly fragments.	5	6	Bedding distorted.
271	2	273	1	Silty claystone.....	1	11	Do.
273	1	274	11	Distorted varigrained sandstone, claystone, and coaly claystone streaks and inclusions.	1	10	
274	11	276	8	Interbedded claystone and coaly claystone.	1	9	
276	8	307	8	Coarse- to medium-grained sandstone, "granitic", partially crossbedded, frequent claystone fragments and streaks.	31	0	
307	8	348	2	Fine- to medium-grained sandstone, multiple thin dark sandstone streaks, few silty bands.	40	6	Average bedding angle 32°.

Log, Hole WH-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
348	2	390	11	Coarse- to fine-grained sandstone, very small claystone inclusions and occasional coaly streaks, massive.	42	9	Bedding angle at lower contact 30°.
390	11	394	2	Interbedded siltstone and claystone, sandstone streaks and inclusions.	3	3	
394	2	422	3	Interbedded silty claystone and claystone, occasional iron bands and concretions, very thin coaly streaks.	28	1	Average bedding angle 30°.
422	3	427	0	Soft to dense medium-grained sandstone, crossbedded.	4	9	
427	0	515	6	Interbedded silty claystone and claystone, frequent ironstone concretions and streaks, occasional thin coaly streaks.	88	6	Do.
515	6	520	8	Soft medium-grained sandstone, chloritic.	5	2	
520	8	570	0	Interbedded claystone and silty claystone, frequent slickensides, occasional ironstone concretions and thin coaly streaks.	49	4	Average bedding angle 36°. Probable fault intersection within interval.
570	0	572	5	Crossbedded medium-grained sandstone.	2	5	
572	5	603	6	Interbedded claystone, silty claystone, siltstone, crossbedded with sandy streaks, no definable changes (gradational).	31	1	
603	6	687	2	Dense medium- to fine-grained chloritic sandstone, occasional conglomeratic sandstone bands, occasional calcite-filled fractures, crossbedded throughout.	83	8	Bedding angle at lower contact 17°.
687	2	703	1	Crossbedded fine-grained sandstone.	15	11	

Log, Hole WH-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
703	1	717	8	Dark chloritic medium-grained sandstone, conglomeratic sandstone bands.	14	7	Bedding angle 25°.
717	8	762	7	Interbedded silty claystone and fine-grained silty sandstone, occasional crossbedding and slickensides bottom 6 feet.	44	11	
762	7	870	7	Dark conglomeratic sandstone, medium- to fine-grained, occasional claystone inclusions and fractures with calcite filling.	108	0	
870	7	878	11	Silty claystone, coaly streaks.	8	4	Bedding angle at lower contact 24°.
878	11	888	4	Very fine-grained silty sandstone.	9	5	
888	4	942	10	Interbedded siltstone, silty claystone and claystone, occasional very fine-grained silty sandstone, no demarcation and bedding undefinable.	54	6	
942	10	961	0	Coarse angular to conglomeratic sandstone, occasional claystone inclusions.	18	2	
961	0	968	9	Sandy siltstone.....	7	9	
968	9	976	9	Conglomeratic sandstone....	8	0	
976	9	1007	3	Crossbedded medium-grained sandstone.	30	6	Maximum bedding angle 10°.
1007	3	1011	10	Dark claystone, silty and sandy streaks.	4	7	
1011	10	1315	0	Coarse-grained to conglomeratic sandstone, occasional claystone and sandstone streaks and claystone blebs.	303	2	No definable bedding, some distortion. Strong water course 1,106 to 1,110 feet. Probable fault intersection.

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Log, Hole WH-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1315	0	1354	7	Interbedded and crossbedded sandstone, siltstone and claystone, coaly streaks beginning at 1,356 feet.	39	7	Average bedding angle 23°.
1354	7	1375	8	Medium-grained to conglomeratic sandstone, coaly streaks.	21	1	
1375	8	1425	0	Eska conglomerate, thin sandstone lenses.	49	4	
Bottom of hole.							

NOTE: Hole surveyed at 1,015 feet and 1,400 feet. No appreciable deviation.

Logs of Drill Holes, Western Part of District

Log, Hole MC-1

Location: 1,675 feet N. and 1,043 feet E. of the SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,063 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	19	0	Glacial clay, gravel, and boulders.	19	0	
19	0	36	0	Silty claystone.....	17	0	7-foot core loss.
36	0	44	2	Soft claystone and coaly shale.	8	2	
44	2	46	4	Soft dark shale, coaly streaks.	2	2	
46	4	48	10	COAL, bony streaks.....	2	6	No sample taken.
48	10	51	9	Coaly claystone.....	2	11	
51	9	63	0	Soft gray shale.....	11	3	11-foot core loss. Bedding angle 19 feet to 63 feet, 55° to 65°.
63	0	68	10	Soft claystone, coaly and shale streaks.	5	10	1-foot, 8-inch core loss.
68	10	79	2	Interbedded claystone, silty claystone and siltstone.	10	4	Do.
79	2	85	2	Soft gray shale.....	6	0	
85	2	87	4	COAL.....	2	2	No sample taken. Core badly broken.
87	4	87	5	Coaly claystone.....		1	Core badly broken.
87	5	88	0	COAL.....		7	No sample taken. Core badly broken.
88	0	88	1	Coaly claystone.....		1	Core badly broken.
88	1	89	6	Bony COAL.....	1	5	No sample taken. Core badly broken.
89	6	91	0	Coaly claystone.....	1	6	Core badly broken.
91	0	109	4	Interbedded and crossbedded claystone, siltstone, and fine-grained sandstone.	18	4	1-foot core loss.
109	4	109	9	Compact light-gray clay....		5	Bedding angle $68\frac{1}{2}^c$.

Log, Hole MC-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
109	9	110	0	Dark gray slickensided clay.		3	Bedding angle 68½°.
110	0	110	10	Bone COAL.....		10	7-inch core loss. Bedding angle 68½°.
110	10	111	4	Interbanded COAL, bone, and claystone.		6	Bedding angle 68½°.
111	4	112	11	Fine-banded bright COAL with thin calcite parting.	1	7	) E-18650. Bedding angle 68½°.
112	11	114	8	Fine-banded bright COAL with thin streak of calcite and blebs of coarse silty impurities.	1	9	) Bedding angle 68½°.
114	8	116	6	Fine-banded bright COAL....	1	10	) Do.
116	6	120	4	Fine-to-coarse banded COAL with clay parting.	3	10	) Do.
120	4	122	4	Fine-to-coarse banded bright COAL.	2	0	) True thickness of sample calculated to be 48-¼ inches. Bedding angle 68½°.
122	4	124	4	Dark-gray carbonaceous clay with streak of coal.	2	0	
124	4	126	0	Fine-banded COAL with streak of bone.	1	8	Not included in sample.
126	0	126	4	Gray sandstone, coarse-grained.		4	
126	4	220	4	Light-gray fine- to medium-grained sandstone, occasional coaly streaks and fragments.	94	0	
220	4	230	11	Interbedded claystone and siltstone.	10	7	Average bedding angle 60°
230	11	236	0	Coaly shale.....	5	1	
236	0	236	9	Sandstone, coaly blebs.....		9	
236	9	240	1	Coaly shale.....	3	4	
240	1	245	9	Bony COAL.....	5	8	No sample taken.
245	9	255	11	Coaly claystone, bony coal bands.	10	2	
255	11	306	3	Interbedded claystone, siltstone, very fine-grained sandstone, occasional coaly fragments and calcite streaks.	50	4	

Log, Hole MC-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
306	3	326	4	Very fine- to medium fine-grained gray sandstone.	20	1	
326	4	342	2	Claystone.....	15	10	
342	2	343	0	Claystone, coaly streaks...		10	Average bedding angle 60°.
343	0	520	11	Fine- to medium-grained gray sandstone, occasional coaly fragments.	177	11	
520	11	683	3	Interbedded siltstone and fine-grained sandstone.	162	4	
683	3	690	0	Claystone, coaly streaks, occasional iron concretions.	6	9	
690	0	691	4	Claystone with many bands and streaks of coal.	1	4	Bedding angle 68°.
691	4	692	10	COAL, some bony.....	1	6	) Sample No. 8.
692	10	694	7	Claystone, many streaks of coal.	1	9	
694	7	695	1	Bony COAL.....		6	)
695	1	695	5	Coaly claystone.....		4	
695	5	695	10	COAL.....		5	)
695	10	696	0	SiO_2 concretion.....		2	
696	0	696	2	Coaly claystone.....		2	
696	2	697	4	Bony COAL.....	1	2	)
697	4	697	6	Coaly claystone.....		2	
697	6	700	4	Bony COAL.....	2	10	)
700	4	700	8	Claystone, many streaks of coal.		4	
700	8	702	5	Bony COAL.....	1	9	)
702	5	703	4	Coaly claystone.....		11	
703	4	706	8	Bony COAL.....	3	4	)
706	8	706	10	Coaly claystone.....		2	
706	10	708	4	Bony COAL.....	1	6	) Bedding angle 60°.
708	4	709	7	Claystone, many streaks and bands of coal.	1	3	
709	7	710	7	COAL, some bony.....	1	0	) Sample No. 9.
710	7	711	11	COAL.....	1	4	)
711	11	712	0	Bone.....		1	
712	0	712	8	COAL, some slightly bony...		8	)
712	8	712	11	Claystone, streaks and bands of coal.		3	
712	11	716	4	COAL.....	3	5	)
716	4	717	2	Coaly claystone.....		10	

Log, Hole MC-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
717	2	720	10	Claystone, many streaks and bands of coal.	3	8	Bedding angle 55°.
720	10	722	10	Bony COAL.....	2	0	) Sample No. 10.
722	10	724	10	Claystone, many streaks and bands of coal.	2	0	Bedding angle 50°.
724	10	727	1	Bony COAL.....	2	3	)
727	1	730	7	Claystone, many streaks and bands of coal.	3	6	
730	7	734	1	COAL.....	3	6	) Sample No. 11.
734	1	734	5	Claystone, many coal streaks.		4	
734	5	734	8	Bony COAL.....		3	)
734	8	737	11	COAL.....	3	3	)
737	11	738	4	Claystone (parting).....		5	
738	4	740	8	COAL.....	2	4	)
740	8	741	0	Claystone, coal bands.....		4	
741	0	741	6	COAL.....		6	)
741	6	744	1	Claystone, many bands and streaks of coal	2	7	Bedding angle 55°.
744	1	744	5	Bony COAL.....		4	)
744	5	748	11	COAL, occasional thin claystone partings.	4	6	)
748	11	749	4	Bony COAL.....		5	)
749	4	749	6	Coaly claystone.....		2	
749	6	753	10	Claystone, many bands and streaks of coal.	4	4	
753	10	759	10	Bony COAL.....	6	0	5-foot, 2-inch core loss. No sample taken of small amount bony COAL recovered.
759	10	760	1	Coaly claystone.....		3	
760	1	763	5	Claystone, many streaks and bands of coal.	3	4	
763	5	764	4	COAL.....		11	No sample taken.
764	4	764	10	Bony COAL.....		6	Do.
764	10	765	8	Claystone, many streaks of coal.		10	
765	8	766	2	Ironstone.....		6	
766	2	767	6	Claystone, many streaks of coal.	1	4	Bedding angle 53°.

Log, Hole MC-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
767	6	788	0	Interbedded claystone, coaly claystone, occasional iron concretions and bands.	20	6	
788	0	788	10	Claystone.....		10	
788	10	799	0	Interbanded claystone and coal (apparently).	10	2	7-foot, 4-inch core loss.
799	0	799	6	Coaly claystone.....		6	
799	6	800	4	Bony COAL.....		10	) Sample No. 12.
800	4	807	5	COAL, occasionally slightly bony.	7	1	)
807	5	812	8	Claystone, many coal streaks and bands.	5	3	
812	8	813	1	Ironstone.....		5	
813	1	816	0	Claystone, many coal streaks and bands.	2	11	Bedding angle 52°.
816	0	816	4	COAL.....		4	No sample taken.
816	4	817	8	Claystone, many streaks and bands of coal.	1	4	
817	8	821	6	COAL, some bony.....	3	10	) Sample No. 13.
821	6	824	2	Claystone, many streaks and bands of coal.	2	8	Bedding angle 45°.
824	2	825	8	COAL.....	1	6	)
825	8	826	0	SiO_2 concretion.....		4	
826	0	828	4	COAL, some slightly bony...	2	4	)
828	4	836	0	Claystone, many streaks and bands of coal.	7	8	Bedding angle 55°.
836	0	836	6	COAL, slightly bony.....		6	No sample taken.
836	6	837	0	Claystone.....		6	
837	0	837	7	COAL.....		7	Do.
837	7	838	5	Claystone with many bands and streaks of coal.		10	
838	5	841	5	Claystone.....	3	0	
841	5	842	3	Ironstone.....		10	
842	3	848	0	Claystone.....	5	9	
848	0	920	3	Fine-grained sandstone.....	72	3	Bedding angle 55°.
920	3	932	0	Claystone, occasional coaly streaks.	11	9	
Bottom of hole.							

Log, Hole MC-2

Location: 1,560 feet N. and 1,180 feet E. of the SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,083.6 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	13	0	Overburden - gravel.....	13	0	
13	0	14	8	Clayey conglomeratic sandstone.	1	8	
14	8	46	0	Interbedded siltstone and fine-grained sandstone with claystone bands.	31	4	
46	0	48	0	Fine-grained sandstone.....	2	0	
48	0	50	11	Silty claystone.....	2	11	
50	11	55	6	Medium- to fine-grained sandstone.	4	7	
55	6	102	6	Interbedded claystone and siltstone, fine-grained sandstone and coaly stringers on bottom.	47	0	
102	6	111	3	Silty claystone.....	8	9	
111	3	112	8	Dense medium-grained sandstone, gray.	1	5	
112	8	122	0	Claystone.....	9	4	
122	0	125	4	Dark shale.....	3	4	
125	4	143	0	Interbedded claystone, siltstone, and fine-grained sandstone.	17	8	
143	0	146	0	Dense gray medium-grained sandstone.	3	0	
146	0	162	0	Siltstone, ironstone bands, and concretions, calcite stringers.	16	0	
162	0	191	0	Claystone.....	29	0	
191	0	192	4	Limestone, brown stain.....	1	4	Average bedding angle 50°.
192	4	248	4	Claystone to silty claystone, light gray with occasional sandy streaks.	56	0	
248	4	346	0	Claystone, dark gray with occasional interbedded siltstone lenses and ironstone concretions.	97	8	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
346	0	349	3	Claystone, many streaks and bands of coal.	3	3	Bedding angle 55°.
349	3	349	9	Bony COAL.....		6	No sample taken. 2-foot, 7-inch core loss.
349	9	352	9	Claystone, streaks and bands of coal.	3	0	
352	9	353	5	Bony COAL.....		8	No sample taken.
353	5	356	6	Claystone, many streaks and bands of coal.	3	1	
356	6	356	8	Coaly claystone.....		2	
356	8	357	10	COAL.....	1	2	Do.
357	10	359	6	Claystone, many streaks and bands of coal.	1	8	
359	6	364	6	Do.	5	0	3-foot core loss.
364	6	370	0	Dark gray claystone, siltstone band.	4	6	
370	0	372	9	COAL, one SiO_2 concretion and some slightly bony.	2	9	Bedding angle 55°. No sample taken.
372	9	374	9	Claystone.....	2	0	
374	9	391	0	Interbedded claystone, siltstone and very fine-grained sandstone.	16	3	
391	0	392	3	Claystone.....	1	3	
392	3	393	6	Interbanded claystone and coal.	1	3	
393	6	401	5	COAL, occasional thin claystone partings and occasional calcite streaks.	7	11	) Sample No. 14. Bedding angle 60°.
401	5	401	9	Coaly claystone.....		4	
401	9	404	5	Claystone, occasional bands and streaks of coal.	2	8	
404	5	405	2	Coaly claystone.....		9	
405	2	406	3	Bony COAL.....	1	1	) Do.
406	3	409	7	COAL, some bony, many calcite streaks.	3	4	)
409	7	411	0	Interbanded coal and claystone.	1	5	
411	0	413	0	Claystone.....	2	0	
413	0	414	5	Claystone, occasional streaks and inclusions of coal.	1	5	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
414	5	419	3	Bony COAL, some calcite streaks.	4	10	) 6 inches of ironstone excluded.
419	3	421	2	Coaly claystone.....	1	11	
421	2	421	9	Claystone, many streaks and bands of coal.		7	
421	9	422	6	Bony COAL.....		9	) Bedding angle 52°.
422	6	423	0	Coaly claystone.....		6	
423	0	423	6	Claystone, coal streaks and bands.		6	
423	6	430	5	COAL, occasional calcite streaks, a few thin claystone partings.	6	11	)
430	5	431	3	Coaly claystone.....		10	
431	3	433	0	Fine-grained sandstone.....	1	9	
433	0	467	10	Interbedded claystone, siltstone, and fine-grained sandstone.	34	10	
467	10	475	0	Interbedded claystone and fine-grained sandstone with included fragments of each.	7	2	
475	0	507	0	Medium dense light-gray "granitic" sandstone, occasional small coaly fragments.	32	0	
507	0	534	0	Interbedded claystone, siltstone, and fine-grained sandstone.	27	0	
534	0	534	11	Claystone.....		11	
534	11	539	1	Bony COAL.....	4	2	) Sample No. 15. Bedding angle 55°.
539	1	539	3	Coaly claystone.....		2	
539	3	539	6	Claystone.....		3	
539	6	541	10	Coaly claystone.....	2	4	
541	10	543	10	Claystone, many streaks and bands of coal.	2	0	
543	10	544	8	Coaly claystone.....		10	
544	8	546	5	Bony COAL.....	1	9	)
546	5	546	6	Coaly claystone.....		1	
546	6	548	0	Claystone.....	1	6	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
548	0	564	10	Fine-grained sandstone, thin clayey streaks.	16	10	Average bedding angle 50°.
564	10	581	3	Interbedded claystone, siltstone, occasional coal streaks.	16	5	
581	3	589	11	Coaly claystone, a few coal bands.	8	8	
589	11	929	10	Moderately crossbedded fine-grained sandstone grading down to siltstone, clayey binder throughout.	339	11	
929	10	934	0	Dark claystone, coaly streaks.	4	2	
934	0	934	11	Claystone, many streaks, bands, and inclusions of coal.		11	
934	11	935	2	Ironstone.....		3	
935	2	936	5	Claystone, many streaks and bands of coal.	1	3	
936	5	937	6	Bony COAL.....	1	1	No sample taken.
937	6	937	8	Ironstone.....		2	
937	8	940	0	Claystone, many streaks and bands of coal.	2	4	
940	0	944	0	Coaly claystone.....	4	0	
944	0	944	11	Bony COAL.....		11	) Sample No. 16.
944	11	945	3	Coaly claystone.....		4	
945	3	945	6	Ironstone.....		3	
945	6	947	3	Bony COAL.....	1	9	) Bedding angle 55°.
947	3	947	7	Coaly claystone.....		4	
947	7	948	3	Bony COAL.....		8	)
948	3	948	6	Claystone.....		3	
948	6	949	8	COAL, some slightly bony...	1	2	)
949	8	949	10	SiO_2 concretion.....		2	
949	10	955	5	COAL, some slightly bony...	5	7	) Bedding angle 50°.
955	5	957	6	Coaly claystone.....	2	1	
957	6	960	5	COAL, some slightly bony...	2	11	)
960	5	961	7	Coaly claystone.....	1	2	
961	7	963	6	Bony COAL.....	1	11	)
963	6	963	9	Coaly claystone.....		3	
963	9	964	3	Bony COAL.....		6	) Do.
964	3	965	0	Coaly claystone.....		9	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
965	0	966	6	Claystone, many streaks of coal.	1	6	
966	6	968	0	COAL, some slightly bony...	1	6	)
968	0	968	3	Claystone, parting.....		3	
968	3	969	9	COAL.....	1	6	)
969	9	970	3	Ironstone concretion.....		6	
970	3	971	7	COAL, some slightly bony...	1	4	)
971	7	972	3	Coaly claystone.....		8	
972	3	975	2	COAL.....	2	11	)
975	2	975	5	Claystone and coaly claystone.		3	
975	5	977	5	COAL, some slightly bony...	2	0	)
977	5	977	10	Coaly claystone.....		5	
977	10	980	8	Claystone, many streaks and bands of coal.	2	10	Bedding angle 40°.
980	8	981	8	Coaly claystone.....	1	0	Core badly broken.
981	8	981	10	Ironstone.....		2	
981	10	984	1	COAL.....	2	3	)
984	1	984	3	Ironstone.....		2	
984	3	984	11	COAL, some slightly bony...		8	)
984	11	987	2	Coaly claystone.....	2	3	
987	2	990	9	Claystone and ironstone concretions, many bands and streaks of coal.	3	7	
990	9	991	5	Coaly claystone.....		8	
991	5	992	11	COAL, some slightly bony...	1	6	) Sample No. 17.
992	11	993	0	Claystone, parting.....		1	
993	0	995	5	COAL, some slightly bony...	2	5	)
995	5	997	3	Coaly claystone.....	1	10	
997	3	999	0	Claystone, many streaks and bands of coal.	1	9	Bedding angle 50°.
999	0	1000	3	Claystone.....	1	3	
1000	3	1001	1	Claystone, streaks and bands of coal.		10	
1001	1	1001	11	Ironstone.....		10	
1001	11	1004	3	Claystone, many streaks and bands of coal.	2	4	Bedding angle 40°.
1004	3	1010	3	Do.	6	0	
1010	3	1028	0	Interbedded claystone and siltstone.	17	9	
1028	0	1029	0	Claystone.....	1	0	
1029	0	1030	1	Claystone, many streaks bands of coal.	1	1	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1030	1	1030	3	Coaly claystone.....		2	
1030	3	1031	8	COAL.....	1	5	) Sample No. 18. Core badly broken.
1031	8	1032	3	Coaly claystone.....		7	
1032	3	1033	3	Claystone, many streaks of coal.	1	0	
1033	3	1034	0	Coaly claystone.....		9	
1034	0	1043	10	COAL, some slightly bony...	9	10	) 3-foot core loss between 1,029 and 1,039 feet. Loss assumed to be COAL.
1043	10	1044	4	Coaly claystone.....		6	
1044	4	1051	0	Claystone, streaks and bands of coal.	6	8	Bedding angle 40°.
1051	0	1052	8	Do.	1	8	
1052	8	1053	10	COAL.....	1	2	)
1053	10	1054	1	Ironstone.....		3	
1054	1	1055	0	COAL, some slightly bony...		11	)
1055	0	1055	5	Bony COAL.....		5	)
1055	5	1056	11	Coaly claystone.....	1	6	
1056	11	1058	1	Claystone, streaks of coal.	1	2	
1058	1	1058	4	Coaly claystone.....		3	Do.
1058	4	1061	6	COAL, some bony.....	3	2	)
1061	6	1063	0	Coaly claystone.....	1	6	
1063	0	1069	0	Claystone, many streaks and bands of coal.	6	0	
1069	0	1069	6	Ironstone.....		6	
1069	6	1071	0	Claystone, many streaks and bands of coal.	1	6	
1071	0	1071	6	Claystone.....		6	
1071	6	1071	10	Bony COAL.....		4	No sample taken.
1071	10	1076	4	Claystone.....	4	6	
1076	4	1095	3	Interbedded claystone, siltstone and very fine-grained sandstone.	18	11	
1095	3	1140	1	Fine- to medium-grained sandstone with coaly streaks, moderately cross-bedded to dense.	44	10	
1140	1	1162	0	Interbedded claystone and siltstone.	21	11	

Log, Hole MC-2 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1162	0	1167	6	Claystone, many streaks and bands of coal.	5	6	
1167	6	1173	5	COAL, some slightly bony, occasional calcite streaks.	5	11	) Sample No. 19. 2-foot core loss.
1173	5	1174	0	Ironstone with coal inclusions.		7	
1174	0	1176	0	Claystone.....	2	0	
1176	0	1200	1	Interbedded claystone, and siltstone.	24	1	
1200	1	1230	11	Moderately crossbedded fine-grained sandstone, clayey streaks.	30	10	
1230	11	1359	2	Fine- to medium-grained sandstone, occasional coaly blebs and fragments and claystone fragments.	128	3	Average bedding angle: 50°.
1359	2	1361	0	Claystone.....	1	10	
1361	0	1363	9	Claystone, many streaks of coal.	2	9	
1363	9	1367	4	COAL, a few thin partings and a few calcite streaks.	3	7	) Sample No. 20. Bedding angle: 40°.
1367	4	1369	0	Claystone, many streaks and bands of coal.	1	8	
1369	0	1371	0	Claystone.....	2	0	
1371	0	1405	0	Interbedded claystone and siltstone, one 4-inch band coaly claystone at 1,377 feet.	34	0	
Bottom of hole.							

Log, Hole MC-3

Location: 1,236 feet N. and 1,600 feet E. of the SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,095.9 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	106	0	Overburden of sand, fine gravel, and clay matrix with large boulders.	106	0	Churn drilled to 90 feet.
106	0	112	0	Overburden.....	6	0	Core lost.
112	0	114	10	Dense medium-grained to conglomeratic sandstone.	2	10	
114	10	209	8	Pebble to cobble conglomerate (Eska) with sandstone lenses up to 8 feet thick.	94	10	
209	8	372	6	Dense medium-grained sandstone, occasional conglomeratic sandstone bands and claystone streaks.	162	10	Part of Eska conglomerate formation.
372	6	399	0	Pebble to cobble conglomerate, sandstone lenses up to 2 feet.	26	6	Considered base of Eska conglomerate.
399	0	435	1	Soft gray-to-brown claystone.	36	1	
435	1	476	5	Fine- to medium-grained basic sandstone, occasional clayey streaks and bands.	41	4	
476	5	482	6	Basic (green) silty claystone.	6	1	
482	6	532	0	Very fine-grained sandstone, occasional silty streaks and claystone bands.	49	6	
532	0	533	8	Siltstone.....	1	8	
533	8	537	3	Dark basic sandstone.....	3	7	
537	3	549	0	Interbedded siltstone and very fine-grained sandstone.	11	9	
549	0	550	8	Dense fine- to medium-grained sandstone.	1	8	
550	8	582	2	Dark claystone to silty claystone.	31	6	

Log, Hole MC-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
582	2	591	9	Dark fine-grained sandstone, occasional calcite streaks.	9	7	
591	9	599	1	Interbedded siltstone and very fine-grained sandstone, calcite streaks.	7	4	
599	1	603	11	Silty claystone.....	4	10	
603	11	607	10	Fine to medium-grained sandstone, silty streaks, chloritic.	3	11	
607	10	650	0	Claystone, some interbedded silty claystone and siltstone.	42	2	
650	0	660	7	Claystone and soft gray shale.	10	7	
660	7	666	6	Crossbedded very fine-grained sandstone and siltstone, medium-grained sandstone blebs and streaks.	5	11	
666	6	676	0	Siltstone to fine-grained sandstone.	9	6	Bedding angle 30° to 35°.
676	0	684	2	Claystone, occasional thin silty streaks.	8	2	
684	2	714	9	Siltstone, occasional crossbedded very fine-grained sandstone, few calcite streaks.	30	7	
714	9	729	8	Silty claystone.....	4	11	
729	8	735	5	Interbedded siltstone and very fine-grained sandstone.	5	9	Bedding angle 30°.
735	5	738	7	Claystone.....	3	2	
738	7	739	0	Bone.....		5	
739	0	749	8	Interbedded claystone and siltstone.	10	8	
749	8	758	3	Silty claystone.....	8	7	
758	3	759	11	Calcareous shale.....	1	8	
759	11	761	3	COAL, thin bony streaks....	1	4	No sample taken.
761	3	761	11	Silty claystone.....		8	
761	11	765	2	Fine-grained sandstone, calcareous and clay inclusions.	3	3	
765	2	765	6	Bony COAL.....		4	Do.

Log, Hole MC-3 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
765	6	772	8	Soft sandy shale.....	7	2	
772	8	773	2	COAL.....		6	No sample taken.
773	2	793	0	Crossbedded siltstone and very fine-grained sandstone, many shale bands.	19	10	
793	0	800	0	COAL.....	7	0	6-foot core loss. Assumed to be COAL.
800	0	804	11	Dark claystone, few coaly streaks.	4	11	
804	11	805	11	Siltstone, dense.....	1	0	
805	11	809	7	Dark claystone, few coaly streaks.	3	8	
809	7	814	6	Claystone to dark shale....	4	11	
814	6	815	0	Coaly claystone.....		6	
815	0	901	3	Claystone grading in to siltstone.	86	3	Bedding angle 35° to 45°.
901	3	909	1	Hard dense fine-grained sandstone with inclusions of fine-grained "granitic" sandstone and siltstone.	7	10	
909	1	924	1	Fine- to medium-grained granitic sandstone, semiporous, occasional coal blebs.	15	0	
924	1	932	7	Claystone, silty and sandy top 2 feet.	8	6	
932	7	932	10	Soft clay band.....		3	
932	10	934	5	Silty claystone, slickensides.	1	7	Slip or fault beginning at 932 feet 7 inches.
934	5	940	8	Clay.....	6	3	
940	8	941	4	Claystone.....		8	
941	4	944	10	COAL.....	3	6	
944	10	958	0	Claystone.....	13	2	
Bottom of hole.							

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Log, Hole MC-4

Location: 921 feet N. and 1,964 feet E. of SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,100.0 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	110	0	Sand, clay, and boulder overburden.	110	0	Contains water channels. Churn drilled.
110	0	135	0	Tsadaka conglomerate.....	25	0	Churn drilled.
135	0	220	6	Eska conglomerate with sandstone lenses.	85	6	Do.
220	6	222	6	Gray medium-grained massive sandstone.	2	0	Continued by diamond-core drilling.
222	6	228	3	Eska conglomerate.....	5	9	
228	3	234	10	Gray dense fine- to medium-grained massive sandstone.	6	7	
234	10	242	6	Interbedded Eska conglomerate and sandstone.	7	8	
242	6	264	2	Gray massive fine-grained sandstone.	21	8	
264	2	383	0	Eska conglomerate, sandstone lenses.	118	10	
383	0	544	0	Fine- to medium-grained sandstone with Eska conglomerate lenses, occasional streaks and fragments of claystone and coaly matter.	161	0	Base of Eska conglomerate at 544 feet.
544	0	552	0	Red-to-brown silty claystone.	8	0	
552	0	749	9	Interbedded siltstone and fine-grained sandstone, claystone bands and lenses, calcite streaks on bottom.	197	9	Bedding angle 25°.
749	9	755	0	Light-gray silty claystone, limestone bands.	5	3	
755	0	760	5	Claystone.....	5	5	
760	5	764	4	Light-gray micaceous siltstone and fine-grained sandstone.	3	11	

Log, Hole MC-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
764	4	769	4	Claystone, few thin coaly streaks.	5	0	
769	4	771	2	Soft medium-grained sandstone, clay bands.	1	10	
771	2	772	3	Soft claystone.....	1	1	
772	3	772	9	Coaly claystone.....		6	
772	9	773	1	Soft white clay.....		4	
773	1	773	10	COAL.....		9	No sample taken.
773	10	788	0	White-to-gray claystone, hygroscopic.	14	2	
788	0	792	0	Coaly claystone.....	4	0	
792	0	802	0	Dark claystone, many coal streaks, slickensides.	10	0	
802	0	851	0	Claystone, occasional lenses of siltstone and fine-grained sandstone, occasional ironstone bands.	49	0	
851	0	854	2	Calcareous medium-grained sandstone.	3	2	
854	2	860	0	Fine-grained crossbedded sandstone.	5	10	
860	0	861	9	Dense medium-grained sandstone.	1	9	
861	9	865	0	Dense fine-grained sandstone.	3	3	
865	0	865	4	Claystone band.....		4	
865	4	866	10	Dense medium-grained sandstone.	1	6	
866	10	867	0	Claystone band.....		2	
867	0	880	6	Dense medium-grained sandstone.	13	6	
880	6	902	2	Claystone, occasional ironstone concretion.	21	8	
902	2	903	3	COAL.....	1	1	Do.
903	3	903	8	Claystone.....		5	Bedding angle 22°.
903	8	904	0	COAL.....		4	No sample taken.
904	0	904	1	Claystone.....		1	
904	1	908	0	COAL.....	3	11	Do.
908	0	917	6	Coaly claystone.....	9	6	
917	6	919	11	COAL.....	2	5	Do.
919	11	929	7	Claystone.....	9	8	
929	7	935	6	COAL, few bony streaks.....	5	11	Do.
935	6	937	8	Claystone, coaly streaks...	2	2	

Log, Hole MC-4 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
937	8	940	8	COAL.....	3	0	No sample taken.
940	8	1012	0	Interbedded claystone, siltstone and fine-grained sandstone, occasional ironstone concretions and occasional coaly streaks.	71	4	
Bottom of hole.							

Log, Hole MC-5

Location: 635 feet N. and 2,384 feet E. of the SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,106.5 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	139	0	Glacial overburden.....	139	0	Churn drilled.
139	0	180	0	Eska conglomerate.....	41	0	Do.
180	0	332	9	Silty claystone grading through siltstone to fine-grained sandstone, occasional angular pebble inclusions and coaly blebs in lower one-half.	152	9	Continued by diamond-core drilling. Average bedding angle 20°.
332	9	347	10	Hard, dense conglomeratic sandstone.	15	1	
347	10	380	6	Eska conglomerate, intermingled pebble and cobble, and hard, dense conglomeratic sandstone.	32	8	
380	6	381	2	Claystone.....		8	Contact bedding average 20°.
381	2	386	10	Eska conglomerate.....	5	8	
386	10	413	0	Medium- to fine-grained banded sandstone.	26	2	Average bedding angle 20°.
413	0	864	4	Eska conglomerate and medium to congomeratic sandstone, occasional claystone slips, aggregate sandstone content 175 feet.	451	4	Base of Eska conglomerate at 864 feet 4 inches.
864	4	905	9	Green and brown claystone..	41	5	
905	9	922	0	Gray arkosic sandstone.....	16	3	Bedding angle 20°.
Bottom of hole.							

Log, Hole MC-6

Location: 322 feet N. and 2,773 feet E. of the SW. corner, sec. 23, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,150.4 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	117	0	Glacial overburden and Tsadaka conglomerate ?	117	0	Churn drilled. No record of overburden depth.
117	0	163	0	Interbedded claystone, siltstone, and fine-grained sandstone.	46	0	Continued by diamond-core drilling.
163	0	206	5	Dark foliated shale with small angular sandstone inclusions and sandstone lenses.	43	5	Possible contact of Tsadaka and Eska conglomerate at 206 feet 5 inches.
206	5	230	4	Eska conglomerate, pebble and cobble.	23	11	
230	4	265	5	Medium-grained to partially conglomeratic sandstone.	35	1	
265	5	275	2	Siltstone, $\frac{1}{2}$-inch coal streak at 265 feet 5 inches.	9	9	
275	2	856	3	Eska conglomerate with medium-grained to conglomeratic sandstone lenses, occasional claystone slips, aggregate sandstone content 180 feet.	581	1	Bedding angle 15° to 25°.
856	3	915	0	Interbedded claystone, siltstone, and fine-grained sandstone.	58	9	Do.
915	0	1175	10	Eska conglomerate, occasional sandstone lenses, coaly streaks and fragments and claystone bands.	260	10	Base of Eska conglomerate at 1,175 feet 10 inches.
1175	10	1185	4	Sandstone.....	9	6	
1185	4	1202	0	Green claystone.....	16	8	
Bottom of hole.							

Log, Hole MC-7

Location: 252 feet S. and 3,550 feet E. of the NW. corner, sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 1,150.0 feet, mean sea level datum.

Dip of hole: Vertical.

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	5	0	Unconsolidated glacial overburden.	5	0	
5	0	166	2	Tsadaka conglomerate, granitic cobbles and boulders.	161	2	
166	2	198	11	Interbedded and crossbedded claystone, siltstone, and fine-grained sandstone.	32	9	Bedding angle 0° to 10°.
198	11	244	2	Tsadaka conglomerate, granitic cobbles and boulders.	45	3	
244	2	423	3	Eska conglomerate, contains occasional claystone and sandstone lenses with included coaly fragments.	179	1	
423	3	445	3	Massive medium- to fine-grained gray sandstone.	22	0	
445	3	445	10	Dark basic medium- to fine-grained sandstone, calcite streaks.	10	7	
455	10	507	6	Eska conglomerate, occasional sandstone lenses.	51	8	
507	6	509	2	Dark basic sandstone, calcite streaks.	1	8	
509	2	520	9	Gray sandstone, calcite streaks.	11	7	
520	9	535	3	Dark basic sandstone, calcite streaks, occasional pebbles, occasional coaly streaks.	14	6	
535	3	979	6	Eska conglomerate, occasional coaly streaks and fragments.	444	3	
979	6	1109	0	Interbedded siltstone and fine-grained sandstone, dark-gray color.	129	6	Bottom on Sept. 10, 1954.
1109	0	1110	0	Siltstone.....	1	0	

Log, Hole MC-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1110	0	1168	10	Interbedded siltstone and fine-grained sandstone, dark-gray color, some crossbedding. Grades to predominately fine-grained sandstone.	58	10	Bedding angles: 1,133 feet, 40°; 1,168 feet, 44°.
1168	10	1191	8	Fine-grained sandstone.....	22	10	Bedding angle: 1,175 feet, 47°.
1191	8	1209	11	Medium-grained sandstone, some crossbedding.	18	1	Bedding angle: 1,204 feet, 53°.
1209	11	1571	5	Eska conglomerate, occasional sandstone lenses.	361	6	Bedding angles: 1,348 feet 7 inches, 55°; 1,447 feet, 57°; 1,550 feet 8 inches, 46°; 1,562 feet, 53°.
1571	5	1586	0	Interbedded siltstone and fine-grained sandstone, coal inclusions at 1,574 feet.	14	7	
1586	0	1696	11	Interbedded claystone, siltstone, and fine-grained sandstone, contains red hematite or limonite silt. Light-tan fine-grained sandstone lens from 1,636 feet 11 inches to 1,638 feet and from 1,690 feet 10 inches to 1,691 feet 2 inches.	110	11	Contact bedding angle: 1,638 feet, 40°.
1696	11	1756	5	Interbedded claystone, siltstone and fine-grained sandstone, dark-gray color.	59	6	Bedding angles: 1,749 feet 6 inches, 33°; 1,753 feet 4 inches, 25°.
1756	5	1757	6	Medium-grained sandstone...	1	1	Contact angle: 1,757 feet 6 inches, 23°.
1757	6	1760	1	Interbedded dark-gray claystone and siltstone.	2	7	
1760	1	1762	0	Medium-grained sandstone, a few calcite stringers.	1	11	Bedding angle 25°.

Log, Hole MC-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1762	0	1773	2	Interbedded dark-gray claystone, siltstone, and fine-grained sandstone.	11	2	Bedding angle: 1,766 feet 2 inches, 15°.
1773	2	1777	11	Carbonaceous shale, many slickensides.	4	9	
1777	11	1806	11	Interbedded dark-gray claystone, siltstone, and fine-grained sandstone, occasional slickensides.	29	0	Bedding angles: 1,782 feet 5 inches, 10°; 1,801 feet 10 inches, 15°.
1806	11	1808	7	Carbonaceous shale, many slickensides.	1	8	
1808	7	1809	0	Light-tan claystone, resinous lustre.		5	
1809	0	1810	7	Dark-gray to black claystone.	1	7	
1810	7	1813	11	Carbonaceous shale, many slickensides.	3	4	
1813	11	1814	0	COAL, stringer.....		1	
1814	0	1817	6	Dark-gray claystone.....	3	6	
1817	6	1835	0	Fine-grained sandstone.....	17	6	Bedding angle: 1,824 feet 7 inches, 15°.
1835	0	1837	8	Dark-gray claystone.....	2	8	
1837	8	1838	4	Carbonaceous shale.....		8	
1838	4	1839	8	Dark-gray to black claystone, occasional slickensides.	1	4	
1839	8	1840	4	Light-tan fine-grained sandstone with claystone streaks and inclusions.		8	
1840	4	1841	10	Dark-gray to black claystone with occasional coal streaks and stringers, occasional slickensides.	1	6	
1841	10	1843	0	Dark-gray to black claystone, many slickensides.	1	2	
1843	0	1843	2	COAL, stringer.....		2	
1843	2	1844	1	Dark-gray to black claystone, many slickensides.		11	
1844	1	1844	2	COAL with calcite streaks, stringer.		1	
1844	2	1844	6	Fine-grained sandstone.....		4	Contact angle with COAL, 20°.

Log, Hole MC-7 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
1844	6	1853	6	Dark-gray to black claystone, occasional to many slickensides. One ½-inch stringer of COAL at 1,852 feet 6 inches.	9	0	
1853	6	1882	0	Interbedded claystone, siltstone, and fine-grained sandstone.	28	6	Plug bit used. Identification made on basis of cuttings.
1882	0	1889	2	Interbedded siltstone and claystone, dark-gray.	7	2	No recognizable bedding but fractures at 5° to 10° believed to occur along bedding planes.
1889	2	1891	6	Fine-grained sandstone grading to medium-grained sandstone.	2	4	
1891	6	1959	6	Medium-grained sandstone, slightly "granitized".	68	0	Plug bit used. Identification made on basis of cuttings.
1959	6	1970	0	Do.	10	6	
1970	0	1981	0	Do.	11	0	Do.
1981	0	2000	6	Medium-grained sandstone, slightly "granitized", occasional coal streaks.	19	6	
2000	6	2000	7	COAL, stringer.....		1	
2000	7	2006	2	Claystone, dark-gray to black, many slickensides.	5	7	
2006	2	2006	7	Coaly claystone.....		5	
2006	7	2006	10	COAL, stringer.....		3	Bedding angle 5°.
2006	10	2010	2	Claystone with a few coal streaks and inclusions, occasional slickensides.	3	4	
2010	2	2010	4	COAL, stringer.....		2	Bedding angle 0° to 5°.
2010	4	2015	10	Claystone, dark-gray, occasional coal streaks and inclusions, occasional slickensides.	5	6	
2015	10	2015	11	COAL, stringer.....		1	Bedding angle 16°.
2015	11	2016	4	Claystone, dark-gray, occasional coal streaks and inclusions.....		5	

Log, Hole MC-7 (Con.)

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
2016	4	2016	10	Very fine-grained sandstone, light-tan, a few coal streaks and inclusion.		6	Contact angle: 2,016 feet 4 inches, 15°.
2016	10	2017	0	Claystone, dark-gray, many slickensides, a few coal streaks and inclusions.		2	
Bottom of hole.							

Log, Hole P-1

Location: 126 feet N. and 944 feet E. of the E.¼ corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 899 feet, mean sea level datum.

Bearing: S. 39° E.

Dip of hole: -45°.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	00	13	11	Sand and boulder overburden.	13	11	
13	11	140	6	Eska conglomerate, occasional sandstone lenses.	126	7	
140	66	205	11	Medium-grained sandstone, occasional coaly streaks and silty bands.	65	5	Bedding angle 30°
205	11	246	6	Interbedded siltstone, claystone, occasional iron streaks.	40	7	
246	6	247	3	Dark claystone, multiple coaly streaks.		9	
247	3	251	0	COAL, few claystone bony streaks.	3	9	) Sample No. 1.
251	0	254	6	Coaly claystone and bone...	3	6	
254	6	257	3	COAL, thin bony streaks....	2	9	) Sample No. 2.
257	3	260	1	Coaly claystone.....	2	10	
260	1	261	9	COAL.....	1	8	)
261	9	263	7	Coaly shale.....	1	10	
263	7	264	4	Bony COAL.....		9	)
264	4	264	11	Coaly shale.....		7	
264	11	267	8	COAL with SiO_2 concretion..	2	9	)
267	8	271	4	Soft shale	3	8	
271	4	272	7	COAL.....	1	3	) Sample No. 3.
272	7	272	9	Claystone.....		2	
272	9	277	10	COAL (some bony).....	5	1	)
277	10	303	10	Claystone, sandy streaks...	26	0	
303	10	304	3	Bony COAL		5	No sample taken.
304	3	304	9	Claystone.....		6	
304	9	305	11	Bone.....	1	2	
305	11	306	0	Claystone.....		1	
306	0	306	1	Bony COAL		1	
306	1	309	1	Foliated shale.....	3	0	
309	1	309	5	COAL.....		4	
309	5	309	10	Claystone.....		5	

Log, Hole P-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
309	10	311	10	COAL.....	2	0	) Sample No. 4.
311	10	314	0	Carbonaceous shale.	2	2	
314	0	314	4	COAL.....		4	No sample taken.
314	4	319	0	Large coal blebs in claystone.	4	8	
319	0	322	10	Claystone, coaly streaks	3	10	
322	10	326	4	COAL.....	3	6	) Sample No. 5.
326	4	329	4	Dark claystone, coaly streaks.	3	0	
329	4	332	0	Interbedded coaly claystone and bony COAL.	2	8	
332	0	339	4	COAL, occasional claystone and bony streaks.	7	4	) Sample No. 6. Bedding angle 15°.
339	4	349	7	Claystone, coal bands and streaks.	10	3	
349	7	353	3	COAL, SiO_2 streak.....	3	8	No sample taken.
353	3	356	4	Coaly shale.....	3	1	
356	4	427	2	Interbedded claystone, siltstone, fine-grained sandstone, occasional coaly streaks and calcite stringers.	70	10	
427	2	427	6	Coaly shale.....		4	
427	6	428	0	Claystone.....		6	
428	0	428	10	Coaly claystone.....		10	
428	10	436	1	COAL, occasional SiO_2 and claystone streaks.	7	3	) Sample No. 7. Bedding angle 15°.
436	1	454	11	Claystone, many coal streaks and bands, occasional ironstone bands.	18	10	
454	11	465	7	Claystone, ironstone lenses lenses.	10	8	
465	7	473	11	Carbonaceous shale, claystone partings or bands.	8	4	
473	11	476	9	Claystone, ironstone concretions.	2	10	
476	9	480	0	Carbonaceous shale.....	3	3	
480	0	480	9	COAL.....		9	No sample taken.
480	9	480	11	Claystone.....		2	
480	11	481	5	Coaly claystone.....		6	
481	5	482	3	Bony COAL.....		10	Do.
482	3	488	0	Carbonaceous shale and claystone, coaly streaks.	5	9	

Log, Hole P-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
488	0	490	5	Bony COAL.....	2	5	No sample taken.
490	5	495	4	Claystone.....	4	11	
495	4	512	10	Fine-grained sandstone.....	17	6	Bedding angle 0°.
512	10	635	10	Soft to dense medium-grained sandstone, many coaly streaks and fragments.	123	0	
635	10	681	6	Soft to dense fine-grained sandstone and siltstone, ironstone concretions.	45	8	
681	6	682	1	Siltstone.....		7	
682	1	682	2	COAL band.....		1	Sharply bedded. Bedding angle 10°.
682	2	684	2	Siltstone.....	2	0	
684	2	684	7	Carbonaceous shale.....		5	
684	7	687	4	Bony COAL.....	2	9	No sample taken.
687	4	687	11	Coaly claystone.....		7	
687	11	688	11	Bony COAL.....	1	0	Do.
688	11	697	10	Coaly shale.....	8	11	
697	10	699	6	Bony COAL.....	1	8	Do.
699	6	699	9	Coaly shale.....		3	
699	9	701	0	Claystone.....	1	3	
701	0	705	3	COAL, 1-inch claystone parting at 704 feet 8 inches.	4	3	Bedding angle 10°.
705	3	708	4	Dark claystone, coal streaks.	3	1	
708	4	708	6	COAL.....		2	No sample taken.
708	6	708	8	Bone.....		2	
708	8	710	0	COAL.....	1	4	Do.
710	0	712	2	Bony COAL.....	2	2	Do.
712	2	724	9	Interbedded claystone and carbonaceous shale.	12	7	
724	9	730	3	Claystone.....	5	6	
730	3	731	9	COAL.....	1	6	Do.
731	9	733	3	Shale.....	1	6	
733	3	734	2	Bony COAL.....		11	
734	2	735	2	Claystone.....	1	0	
735	2	735	11	COAL.....		9	Do.
735	11	740	6	Claystone.....	4	7	

Log, Hole P-1 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
740	6	741	4	COAL, bony streaks.....		10	
741	4	751	6	Interbedded dark shale and claystone, coal streaks, and iron concretions.	10	2	
751	6	754	4	COAL.....	2	10	No sample taken.
754	4	766	11	Claystone, ironstone lenses.	12	7	
766	11	769	5	Dark shale.....	2	6	
769	5	771	7	Claystone, ironstone lenses, and coal fragments.	2	2	
771	7	772	11	COAL	1	4	Do.
772	11	788	0	Dark shale, coaly claystone top 2 feet. No contact.	15	1	
788	0	788	8	COAL.....		8	No sample taken. Mangled core.
788	8	789	0	Claystone.....		4	
789	0	797	0	COAL, few SiO_2 streaks.....	8	0	No sample taken.
797	0	799	0	Coaly claystone.....	2	0	
799	0	799	6	COAL.....		6	Do.
799	6	802	10	Claystone.....	3	4	
802	10	803	6	Bony COAL.....		8	Do.
803	6	803	7	Claystone.....		1	
803	7	804	3	Bony COAL.....		8	Do.
804	3	805	0	Dark shale.....		9	
805	0	808	10	COAL.....	3	10	Do.
808	10	809	10	Coaly shale.....	1	0	
809	10	822	7	Interbedded fine-grained sandstone, siltstone, claystone streaks.	12	9	
822	7	823	5	COAL.....		10	Do.
823	5	837	1	Claystone, lenses of siltstone, ironstone, and fine-grained sandstone.	13	8	
		Bottom of hole.					

Log, Hole MC-8

Location: 2,163 feet N. and 2,595 feet W. of SE. corner, sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 873.8 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	21	0	Glacial overburden.....	21	0	Churn drilled.
21	0	198	0	Eska conglomerate.....	177	0	Do.
198	0	353	7	Eska conglomerate.....	155	7	Continued by core drilling to bottom of hole.
353	7	395	2	Interbedded claystone, silty claystone and very fine-grained sandstone.	41	7	
395	2	417	8	Fine- to medium-grained sandstone, granitized.	22	6	Average bedding angle 30°.
417	8	425	1	Eska conglomerate (smaller pebbles than normal).	7	5	Considered base of Eska conglomerate.
425	1	433	5	Interbedded claystone, silty claystone and very fine-grained sandstone.	8	4	
433	5	434	11	Medium-grained sandstone, granitized.	1	6	
434	11	435	8	Silty claystone.....		9	
435	8	453	4	Medium- to fine-grained sandstone, granitized with occasional coal streaks.	17	8	Average bedding angle 30°.
453	4	460	7	Interbedded very fine-grained sandstone and fine-grained sandstone with occasional coal and fine-grained sandstone inclusions.	7	3	
460	7	470	8	Medium-grained sandstone...	10	1	
470	8	471	7	Interbedded silty claystone and very fine-grained sandstone.		11	
471	7	472	4	COAL.....		9	) F-64479.
472	4	472	7	Claystone.....		3	
472	7	473	7	COAL.....	1	0	)
473	7	473	10	Claystone.....		3	
473	10	475	11	COAL.....	2	1	)

Log, Hole MC-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
475	11	476	1	Claystone.....		2	
476	1	478	2	COAL.....	2	1	)
478	2	478	8	Carbonaceous shale.....		6	
478	8	478	11	Bone coal.....		3	
478	11	481	0	COAL.....	2	1	)
481	0	481	1	COAL.....		1	) F-64480.
481	1	481	3	Claystone.....		2	
481	3	481	10	COAL.....		7	)
481	10	481	11½	Siltstone parting.....		1½	
481	11½	482	3	COAL.....		3½	)
482	3	483	2	Claystone with thin streaks of coal.		11	
483	2	483	8½	Claystone.....		6½	
483	8½	484	1	COAL.....		4½	)
484	1	485	3	Interbanded shale and coal.	1	2	
485	3	485	7	Claystone.....		4	
485	7	490	10	COAL.....	5	3	) 7-inch core loss.
490	10	492	4	Claystone with coal streaks and inclusions.	1	6	
492	4	493	2½	COAL.....		10½	) F-64481.
493	2½	493	3½	Claystone.....		1	
493	3½	493	8½	COAL.....		5	)
493	8½	494	6½	Bone, mixed claystone and coal in thin streaks and layers.		10	Core badly broken.
494	6½	495	11½	COAL.....	1	5	)
495	11½	500	8	Claystone with occasional coal streaks and inclusions.	4	8½	
500	8	501	2½	COAL.....		6½	)
501	2½	503	1	Claystone with thin streaks of coal.	1	10½	
503	1	506	2	Fine-grained sandstone.....	3	1	
506	2	507	11	Claystone with many coal streaks and inclusions.	1	9	
507	11	508	1	Ironstone.....		2	
508	1	508	5	Claystone.....		4	
508	5	508	7	Siltstone.....		2	
508	7	508	8	COAL.....		1	
508	8	509	1	Bony Coal.....		5	
509	1	510	0	Claystone, many coal streaks and inclusions.		11	
510	0	511	0	Bony coal.....	1	0	Core badly broken.

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Log, Hole MC-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
511	0	515	4	Interbedded claystone, siltstone and very fine-grained sandstone with occasional coal streaks and inclusions.	4	4	
515	4	516	10	COAL.....	1	6	) F-64482.
516	10	518	4½	Hard gray claystone.....	1	6½	
518	4½	520	6	COAL.....	2	1½	)
520	6	520	6½	Claystone parting.....		½	
520	6½	523	8	COAL.....	3	1½	)
523	8	528	5	Claystone with thin streaks and inclusions of coal.	4	9	
528	5	529	4	Very fine-grained sandstone.		11	Rusty color with calcite inclusions.
529	4	530	8	Claystone with occasional coal streaks and inclusions.	1	4	
530	8	530	11	Ironstone.....		3	
530	11	531	10	Claystone with coal streaks and inclusions.		11	
531	10	533	6	COAL.....	1	8	) F-64483.
533	6	533	10½	Hard siltstone parting.....		4½	
533	10½	535	6	COAL.....	1	7½	)2½-inch core loss.
535	6	538	10	Claystone with many streaks and bands of coal.	3	4	Bedding angle 35°.
538	10	539	1	Ironstone.....		3	
539	1	541	6	Claystone with occasional streaks and bands of coal.	2	5	
541	6	541	10	COAL.....		4	
541	10	548	8	Claystone-occasional streaks, inclusions, and bands of coal-one ½-inch calcite band.	6	10	
548	8	550	0	COAL.....	1	4	
550	0	555	0	Claystone, many streaks, bands, and inclusions of coal.	5	0	Includes one 3-inch band of coal.
555	0	556	0	COAL.....	1	0	
556	0	556	5	Bony coal.....		5	
556	5	558	6	Claystone with many streaks, bands, and inclusions of coal.	2	1	

Log, Hole MC-8 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
558	6	559	7	Bony coal.....	1	1	
559	7	581	8	Interbedded siltstone, fine-grained sandstone and medium-grained sandstone.	22	1	
581	8	694	10	Medium-grained sandstone with occasional fine-grained sandstone bands and occasional coal fragments.	113	2	
694	10	930	7	Interbedded gray-to-green claystone and silty claystone containing a reddish hematite or limonite silt. Interval contains occasional bands fine-grained sandstone; fine-grained sandstone bands sometimes contain calcite bands, streaks, or inclusions.	235	9	Possible fault intersection at about 775 feet as evidenced by loss of drilling fluid and heavy ground.
930	7	981	7	Interbedded claystone, silty claystone, fine-grained sandstone and medium-grained sandstone, occasional slickensides.	51	0	Average bedding angle 30° to 35°.
		Bottom of hole.					

Log, Hole MC-9

Location: 1,950 feet N. and 2,310 feet W. of SE. corner, sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 800.1 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	108	0	Glacial and/or stream gravel and sand.	108	0	Churn drilled.
108	0	172	0	Eska conglomerate.....	64	0	Do.
172	0	265	0	Variable claystone, shale, and sandstone?	93	0	Do.
265	0	313	0	Interbedded claystone, silty claystone and siltstone with occasional slickensides.	48	0	Cased and continued by diamond-core drilling.
313	0	314	4	Ironstone.....	1	4	
314	4	317	7	Very fine-grained sandstone.	3	3	
317	7	340	6	Interbedded claystone, silty claystone, and siltstone with fine-grained sandstone inclusions in lower 3 feet.	22	11	
340	6	343	6	Fine-grained sandstone-crossbedded.	3	0	
343	6	356	1	Light-green to dark claystone with occasional calcite stringers.	12	7	
356	1	395	1	Interbedded fine-grained sandstone and siltstone with blebs and bands of claystone.	39	0	Bedding angles: 370 feet, 55°; 376 feet, 50°; 390 feet, 45°.
395	1	426	7	Fine-grained to medium-grained hard dense, sandstone, granitic, with coaly streaks and fragments.	31	6	
426	7	429	5	Silty claystone with coal streaks.	2	10	
429	5	430	6	Fine banded bright COAL. Highly fractured and slickensided. Thin mineral films of calcite and kaolinite on fracture surfaces.	1	1	) F-33782.

Hole MC-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remark
430	6	431	0	Dark-gray claystone with thin streaks of coal.	0	6	
431	0	432	11	Fine banded bright COAL with small calcareous blebs and sandy inclusions.	1	11	)
432	11	433	3½	Dark-gray claystone with thin streaks of coal.		4½	
433	3½	434	3	Fine banded bright COAL.		11½	) 2-inch core loss.
434	3	437	0	Claystone.....	2	9	
437	0	439	4	Sandy siltstone.....	2	4	
439	4	442	8	Coaly claystone.....	3	4	
442	8	444	8	Fine banded bright COAL with thin films of calcite mineral on fracture surfaces.	2	0	) F-33783.
444	8	446	0	Claystone with thin streaks of coal.	1	4	
446	0	448	10	Fine banded bright COAL with thin films of mineral calcite on fracture surfaces.	2	10	) F-33784. 2-inch core loss.
448	10	451	8	Claystone with coal bands.	2	10	
451	8	453	6	Claystone.....	1	10	
453	6	455	8	Gray claystone with thin coal streaks.	2	2	
455	8	456	4	Fine banded bright COAL with thin films of calcite on fracture surfaces.		8	) F-33785.
456	4	457	2	Claystone with thin streaks of coal.		10	5-inch core loss?
457	2	460	7	Fine banded bright COAL with thin films of calcite on fracture surfaces.	3	5	) 1-foot, 3-inch core loss.
460	7	460	10	Claystone with thin streaks of coal.		4	
460	10	461	6	Fine banded bright COAL....		8	)
461	6	471	1	Dark claystone with slickensides.	9	7	
471	1	472	8	Siltstone with calcite stringers.		7	
472	8	476	7	Claystone with coal blebs..	3	11	
476	7	479	11	Fine banded bright COAL with blebs of clay and thin films of calcite on fracture surfaces.	3	4	) F-33786. 1-inch core loss.

Hole MC-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
479	11	481	2	Dark claystone with multiple coal bands.	1	3	
481	2	482	6	Soft claystone.....	1	4	
482	6	483	0	Dark claystone with multiple coal streaks.		6	
483	0	483	8	Light-buff fire clay, occasional coal fragments.		8	
483	8	485	2	Claystone with multiple coal bands.	1	6	
485	2	486	6	Dark claystone.....	1	4	
486	6	486	11	COAL.....		5	Stringer.
486	11	487	0	Claystone.....		1	
487	0	487	1	COAL.....		1	
487	1	489	5	Dark claystone with coal streaks.	2	4	
489	5	499	4	Interbedded claystone and very fine-grained sandstone.	9	11	Bedding angle 35°.
499	4	510	0	Medium fine-grained sandstone with coal blebs and streaks, occasional siltstone inclusions.	10	8	
510	0	511	6	Soft claystone.....	1	6	
511	6	513	0	Silty claystone.....	1	6	
513	0	513	6	Soft claystone.....		6	
513	6	513	7	COAL.....		1	Stringer.
513	7	513	8	Silty claystone.....		1	
513	8	514	5	COAL.....		9	Band.
514	5	514	7	Claystone.....		2	
514	7	514	8	COAL.....		1	Stringer.
514	8	515	2	Claystone with coal fragments.		6	
515	2	517	0	Interbedded dark claystone and carbonaceous shale.	1	10	
517	0	517	2	COAL.....		2	Do.
517	2	517	7	Dense light-colored siltstone.		5	
517	7	519	8	Claystone.....	2	1	
519	8	566	11	Interbedded claystone, siltstone and very fine-grained sandstone with occasional calcite streaks and ironstone inclusions.	47	3	
566	11	567	5	Claystone with thin streaks of coal.		6	

Log, Hole MC-9 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
567	5	569	6	Fine banded bright COAL with thin films of calcite on fracture faces.	2	1	) F-33787. 1-inch core loss.
569	6	570	0	Claystone with thin streaks of coal.		6	
570	0	574	10	Fine banded bright COAL....	4	10	) 2-inch core loss.
574	10	578	0	Dark claystone with thin streaks of coal.	3	2	
578	0	579	0	COAL.....	1	0	
579	0	580	5	Claystone with coaly streaks.	1	5	
580	5	581	0	COAL.....		7	
581	0	590	0	Dark claystone with occasional coal streaks.	9	0	Bedding angle 40°.
590	0	591	7	COAL.....	1	7	Band.
591	7	593	6	Dark claystone.....	1	11	
593	6	593	8	Bony coal.....		2	Stringer.
593	8	605	0	Interbedded claystone, siltstone and soft dark shale.	11	4	
605	0	778	0	Interbedded grey-green claystone and silty claystone containing reddish hematite or limonite silt.	173	0	
778	0	789	11	Above grades into dark-gray silty claystone.	11	11	
789	11	790	10	Dense very fine-grained sandstone with calcite streaks.		11	
790	10	826	0	Dark-gray silty claystone, occasional sandy bands and slickensides.	35	2	Bedding angle: 820 feet, 45°.
826	0	830	6	Light-gray fine-grained sandstone.	4	6	Bedding angle: 830 feet, 40°.
830	6	899	10	Dark-gray claystone, silty claystone, siltstone, grading downward, occasional slickensides and calcite stringers.	69	4	Bedding angles: 840 feet, 45°; 890 feet, 60°; 895 feet, 55°; 898 feet, 30°.
899	10	902	0	Soft dark shale.....	2	2	
902	0	908	0	Interbedded dark-gray claystone, siltstone, calcite streaks and slickensides.	6	0	Bedding angles: 905 feet, 40°; 906 feet, 45°.

Log, Hole MC-9 (Con.)

Depth				Material	Thickness		Remarks
From-		To-					
Ft.	in.	Ft.	in.		Ft.	in.	
908	0	909	0	Soft dark shale.....	1	0	
909	0	911	0	Claystone.....	2	0	
		Bottom of hole.					

Log, Hole MC-10

Location: 1,570 feet N. and 1,921 feet W. of the SE. corner sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 738.1 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	60	0	Glacial overburden.....	60	0	Churn drilled.
60	0	65	8	Interbedded claystone, siltstone and very fine-grained sandstone with occasional coal inclusions.	5	8	
65	8	67	0	Bony COAL.....	1	4	Core badly broken. No sample taken for analyses.
67	0	68	6	Carbonaceous shale.....	1	6	
68	6	76	1	Interbedded claystone, siltstone, and fine-grained sandstone with occasional coal bands not more than $\frac{1}{8}$ inch thick.	7	7	One bedding angle measured at 60°.
76	1	77	2	Bony COAL.....	1	1	No sample taken for analyses.
77	2	78	4	Soft dark claystone with occasional coal bands less than $\frac{1}{8}$ inch thick.	1	2	
78	4	79	0	Fine-grained sandstone.....		8	Contact bedding angle 75°.
79	0	81	2	Bony COAL with claystone inclusions.	2	2	
81	2	90	0	Soft dark claystone with occasional coal inclusions and thin coal bands less than $\frac{1}{8}$ inch thick.	8	10	
90	0	103	6	Interbedded claystone, silty claystone, siltstone and fine-grained sandstone.	13	6	Bedding angle 60°.
103	6	106	11	Soft dark claystone with occasional coal bands less than $\frac{1}{4}$ inch thick.	3	5	
106	11	111	0	Claystone.....	4	1	

Log, Hole MC-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
111	0	111	5	COAL.....		5	
111	5	112	6	Claystone.....	1	1	
112	6	114	2	Ironstone with coal inclusions.	1	8	
114	2	123	0	Fine- to medium-grained sandstone with occasional claystone inclusions.	8	10	Evidence of slippage at 116 feet. Contact bedding angle: 123 feet, 60°.
123	0	149	6	Interbedded claystone, siltstone, very fine-grained sandstone, and fine-grained sandstone.	26	6	
149	6	301	5	Interbedded claystone, siltstone, and fine-grained sandstone containing a reddish-to-brown (hematite or limonite) silt.	151	11	
301	5	304	0	Fine-grained sandstone containing reddish (hematite or limonite) silt and calcite stringers and inclusions.	2	7	
304	0	373	11	Dark-gray to green interbedded claystone, siltstone, and fine-grained sandstone, calcite inclusions at 360 feet 8 inches.	69	11	
373	11	379	1	Medium-grained sandstone with occasional claystone inclusions.	6	2	Bedding angle 50°.
379	1	438	4	Interbedded claystone, siltstone and fine-grained sandstone with occasional slickensides.	59	3	Bedding angle: 430 feet, 60°.
438	4	440	0	Claystone with coal bands and inclusions.	1	8	
440	0	512	11	Interbedded claystone, siltstone and fine-grained sandstone with occasional slickensides and calcite	72	11	Bedding angle: 491 feet, 80°. Evidence of slippage at

Log, Hole MC-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
				stringers. Coal inclusion at 489 feet 8 inches; ¼-inch coal band at 491 feet 2 inches.			500 feet. Bedding angle: 511 feet, 35°.
512	11	518	6	Coaly claystone.....	5	7	
518	6	522	8	Interbedded claystone, siltstone and fine-grained sandstone.	4	2	Bedding angle 50°.
522	8	523	10	Coaly claystone.....	1	2	
523	10	524	8	Claystone with occasional bands and inclusions of coal.		10	
524	8	525	11	Coaly claystone.....	1	3	
525	11	526	8	Gouge material.....		9	
526	8	527	6	Limestone containing a small amount of pyrite.		10	
527	6	532	6	Claystone with occasional coal bands and inclusions.	5	0	
532	6	536	8	Coaly claystone.....	4	2	
536	8	537	0	Fine-grained sandstone.....		4	
537	0	539	11	Coaly claystone.....	2	11	
539	11	572	4	Interbedded siltstone and fine- to medium-grained sandstone.	32	5	Bedding angles: 548 feet, 45°; 570 feet, 35°.
572	4	580	8	Interbedded claystone, siltstone and fine-grained sandstone with occasional very narrow coal bands and inclusions.	8	4	
580	8	581	4	Coaly claystone, many slickensides.		8	Core badly broken.
581	4	582	0	Claystone with occasional very thin coal bands.		8	
582	0	582	4	Bony COAL.....		4	No sample taken for analyses.
582	4	582	6	COAL.....		2	Do.
582	6	584	1	Claystone and coaly claystone.	1	7	
584	1	586	10	Interbedded claystone, siltstone and fine-grained sandstone with occasional narrow coal streaks and bands.	2	9	
586	10	587	2	Mud gouge.....		4	

Log, Hole MC-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
587	2	588	10	COAL.....	1	8	No sample taken for analyses.
588	10	590	4	Claystone with occasional narrow bands and inclusions of coal.	1	6	
590	4	593	6	Coaly claystone.....	3	2	
593	6	593	10	Fine-grained sandstone.....		4	
593	10	595	4	Coaly claystone.....	1	6	
595	4	595	7	COAL.....		3	Do.
595	7	598	11	Claystone with many coal streaks, bands, and inclusions.	3	4	
598	11	599	5	Bony COAL.....		6	
599	5	604	0	Claystone with occasional bands, streaks, and inclusions of coal.	4	7	Bedding angle 40°.
604	0	605	4	Interbedded claystone, siltstone and fine-grained sandstone.	1	4	
605	4	606	5	Coaly claystone.....	1	1	
606	5	611	10	Soft dark claystone with occasional coal bands, streaks and inclusions.	5	5	
611	10	612	5	COAL with calcite streaks and ironstone inclusions.		7	
612	5	612	11	Claystone, coal streaks and inclusions.		6	
612	11	613	4	Coaly claystone.....		5	
613	4	615	10	Claystone, occasional coal streaks.	2	6	
615	10	618	8	Ironstone and COAL with calcite streaks.	2	10	
618	8	623	4	Claystone with occasional coal streaks and inclusions.	4	8	
623	4	644	7	Interbedded fine-grained sandstone, siltstone, and claystone with occasional very small coal inclusions.	21	3	
644	7	645	4	Dark claystone with coal streaks and inclusions.		9	
645	4	646	6	Coaly claystone, slickensides.	1	2	Core badly broken.

Log, Hole MC-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
646	6	654	2	Interbedded claystone, siltstone and fine-grained sandstone.	7	8	Bedding angle: 648 feet, 5°.
654	2	655	1	Dark claystone, occasional coal streaks and inclusions.		11	
655	1	655	4	COAL, hard and bright.....		3	
655	4	655	11	Light, brown siltstone with claystone inclusions.		7	
655	11	658	6	Dark claystone, occasional coal bands, streaks, and inclusions.	2	7	
658	6	659	2	Ironstone, calcite streaks and inclusions.		8	
659	2	663	0	Interbedded claystone, siltstone and fine-grained sandstone, occasional calcite streaks, and inclusions.	3	10	
663	0	664	0	Dark claystone, coal streaks and bands.	1	0	
664	0	673	10	Interbedded claystone, siltstone and fine-grained sandstone.	9	10	Bedding angle 30°.
673	10	677	4	Dark claystone, many coal streaks, bands, and inclusions.	3	6	Core badly broken. 1-foot, 5-inch core loss.
677	4	677	11	Limestone.....		7	
677	11	682	0	Dark claystone, many coal streaks and inclusions.	4	1	Core badly broken.
682	0	682	8	Coaly claystone.....		8	
682	8	733	5	Interbedded claystone, siltstone and fine-grained sandstone; occasional coaly streaks and bands.	50	9	
733	5	735	1	Dark coaly appearing gouge material.	1	8	
735	1	737	5	Soft claystone, occasional slickensides, occasional calcite streaks and carbonaceous inclusions.	2	4	
737	5	741	0	Dark coaly appearing gouge material.	3	7	
741	0	742	0	Yellow-brown silty claystone, occasional coal streaks and inclusions.	1	0	

Log, Hole MC-10 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
742	0	744	4	Claystone.....	2	4	
744	4	744	11	Siltstone and fine-grained sandstone with large calcite inclusion running parallel to core.		7	
744	11	752	10	Dark claystone with occasional coal streaks, bands, and inclusions.	7	11	
752	10	754	6	Coaly claystone.....	1	8	Core badly broken.
754	6	756	1	Bony COAL.....	1	7	No sample taken for analyses.
756	1	757	6	Coaly claystone.....	1	5	
757	6	763	11	Claystone, occasional coal streaks and fragments, occasional slickensides.	6	5	
763	11	765	8	Coaly claystone.....	1	9	Core badly broken.
765	8	767	1	Claystone with calcite inclusion and slickensides.	1	5	
767	1	769	1	Coaly claystone.....	2	0	
769	1	769	10	Limestone with calcite and coal stringers.		9	
769	10	772	4	Carbonaceous shale.....	2	6	
772	4	793	7	Interbedded claystone, siltstone and fine-grained sandstone; occasional calcite stringers; lower 10 feet grades to poorly cemented medium-grained sandstone with granitic appearance.	21	3	
793	7	802	7	Interbedded dark claystone, fine-grained sandstone, and carbonaceous shale with occasional coal streaks and bands.	9	0	
		Bottom of hole.					

Log, Hole MC-11

Location: 357 feet S. and 1,665 feet E. of the NW. corner, sec. 35, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 766.2 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	160	0	Variable glacial overburden.	160	0	Churn drilled.
160	0	234	0	Sandstone, shale and occasional pebbles (possibly from caving).	74	0	Do.
		Bottom of hole.					

Log, Hole MC-12

Location: 16 feet N. and 2,678 feet W. of the SE. corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 855.0 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	55	0	Variable glacial overburden.	55	0	Churn drilled.
55	0	180	0	Interbedded sandstone, siltstone and claystone, occasional traces of coal.	125	0	Do.
		Bottom of hole.					

Log, Hole MC-13

Location: 886 feet N. and 3,486 feet W. of the SE. corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 863 feet, mean sea level datum.

Dip of hole: Vertical.

Log, Hole MC-13 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
0	0	160	0	Variable glacial overburden.	160	0	Churn drilled.
		Bottom of hole.					

Log, Hole MC-14

Location: 1,192 feet N. and 3,869 feet W. of the SE. corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 846.7 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From- Ft.	Depth From- in.	Depth To. Ft.	Depth To. in.	Material	Thickness Ft.	Thickness in.	Remarks
0	0	110	0	Glacial overburden.....	110	0	Churn drilled.
110	0	148	6	Apparently Tsadaka conglomerate.	38	6	Do.
148	6	150	10	Medium-grained sandstone with laminated bands of carbonaceous shale.	2	4	Bedding angle about 10°.
150	10	154	8	Interbedded medium-grained sandstone and coarse-grained light-gray sandstone.	3	10	
154	8	156	8	Tsadaka conglomerate.....	2	0	
156	8	158	0	Interbedded carbonaceous shale, medium-grained sandstone and Tsadaka conglomerate.	1	4	Contact bedding angles: 156 feet 8 inches, 5°; 158 feet, 10°.
158	0	209	4	Tsadaka conglomerate.....	51	4	
209	4	213	5	Light-gray medium- to coarse-grained sandstone and dark-gray claystone. A few bands of coal in the claystone.	4	1	Bedding angle: 210 feet, 8°.
213	5	215	0	Tsadaka conglomerate.....	1	7	
215	0	218	7	Poorly cemented dark-gray fine-grained sandstone.	3	7	Contact bedding angle: 218 feet 7 inches, 2°.

Log, Hole MC-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
218	7	219	0	Laminated carbonaceous shale and coarse-grained sandstone.		5	Bedding angle: 219 feet, 8°.
219	0	238	10	Tsadaka conglomerate with bands of coarse-grained sandstone.	19	10	
238	10	246	10	Silty claystone, occasional coal inclusions.	8	0	
246	10	247	7	Hard, dense, medium-grained sandstone.		9	
247	7	265	1	Interbedded silty claystone and fine-grained sandstone.	17	6	
265	1	267	5	Claystone with small bands of coal.	2	4	
267	5	267	9	Soft gray clay shale roof rock.		4	
267	9	268	9	Bright banded COAL.....	1	0	) F-64484.
268	9	272	11	Black carbonaceous shale with some thin streaks of coal.	4	2	
272	11	274	1	Gray clay shale.....	1	2	
274	1	276	5	Dark-gray silty claystone.	2	4	
276	5	277	0	Hard dense fine-grained sandstone with calcite stringers.		7	
277	0	280	1	Dark-gray silty claystone.	3	1	Bedding angle 10°.
280	1	282	4	Coaly claystone.....	2	3	
282	4	291	0	Interbedded silty claystone and sandstone.	8	8	Bedding angle in sandstone: 285 feet, 57°. No evidence of fault.
291	0	307	4	Friable, rusty-red silty claystone.	16	4	
307	4	308	8	Hard dense light-grey-greenish sandstone with some ironstain and calcite stringers.	1	4	Bedding angle: 308 feet 8 inches, 10°.
308	8	315	5	Interbedded rusty-red and black silty claystone.	6	9	
315	5	316	2	Hard dense fine-grained sandstone and claystone.		9	
316	2	319	11	Black silty claystone.....	3	9	

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Log, Hole-MC-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
319	11	332	8	Friable, rusty-red silty claystone.	12	9	
332	8	342	1	Black silty claystone.	9	5	
342	1	348	0	Interbedded fine-grained gray sandstone and black silty claystone.	5	11	Bedding angle: 345 feet 2 inches, 23°.
348	0	431	6	Interbedded silty claystone and fine-grained sandstone with occasional bands of carbonaceous shale. Predominantly silty claystone.	83	6	Bedding angles: 362 feet, 30°; 366 feet, 26°; 379 feet, 30°; 404 feet, 20°.
431	6	441	0	Interbedded hard dense fine-grained sandstone and dark-gray silty claystone.	9	6	Bedding angle: 44 feet, 37°.
441	0	452	1	Carbonaceous claystone and silty claystone with $\frac{1}{16}$ inch bands of coal.	11	1	
452	1	453	10	Bright banded COAL.....	1	9	
453	10	454	5	Hard gray clay shale		7	
454	5	456	7	Black carbonaceous shale with thin streaks of coal.	2	2	
456	7	456	$9\frac{1}{2}$	Bright banded COAL.....		$2\frac{1}{2}$	
456	$9\frac{1}{2}$	459	0	Black carbonaceous shale with thin streaks of coal.	2	$2\frac{1}{2}$	Bedding angle: 459 feet, 32°.
459	0	459	5	Soft gray clay shale.....		5	
459	5	467	1	Interbedded silty claystone and sandstone. Occasional thin bands coal.	7	8	Bedding angle: 466 feet, 32°.
467	1	467	11	Carbonaceous claystone and coal.		10	
467	11	473	1	Silty claystone, sandy claystone and a small amount of coal.	5	2	Core badly broken.
473	1	479	5	Silty claystone, occasional $\frac{1}{16}$-inch bands of coal.	6	4	Do.
479	5	481	11	Dense fine-grained sandstone and silty claystone.	2	6	
481	11	500	11	Interbedded hard dense medium-grained sandstone and black silty claystone.	19	0	Bedding angles: 488 feet, 33°; 495 feet, 26°.

Log, Hole MC-14 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
500	11	508	4	Black carbonaceous shale with occasional thin bands coal and silty claystone.	7	5	Badly broken core.
508	4	511	4	Silty claystone and siltstone.	3	0	
511	4	534	10	Hard, firm, alternate beds of fine dark-gray sandstone and silty claystone.	23	6	Bedding angles: 519 feet, 30°; 526 feet, 30°.
534	10	536	6	Carbonaceous shale and bony coal.	1	8	Broken core.
536	6	540	4	Black silty claystone.....	3	10	
540	4	548	6	Silty claystone, carbonaceous shale and occasional small bands of coal.	8	2	
548	6	551	0	Silty claystone.....	2	6	Bedding angle: 550 feet, 30°.
551	0	552	5	Coaly claystone and coal...	1	5	
552	5	561	8	Carbonaceous claystone with small inclusions of coal and silty claystone.	9	3	
561	8	570	0	Fine-grained sandstone and silty claystone.	8	4	Bedding angle: 566 feet, 25°.
570	0	572	0	Carbonaceous claystone and silty claystone with occasional bands of coal.	2	0	
572	0	599	5	Laminated hard, firm, fine-grained sandstone and silty claystone.	27	5	Bedding angle: 581 feet, 30°.
599	5	609	5	Hard dense medium-to coarse-grained light-gray sandstone.	10	0	Bedding angle: 609 feet, 31°.
609	5	614	2	Silty claystone.....	4	9	
614	2	617	11	Interbedded silty claystone, bone and coal. Coal in bands ½ to 1 inch thick.	3	9	
617	11	628	10	Fine-grained sandstone, silty claystone and shale. Hard, firm core.	10	11	
628	10	629	4	COAL.....		6	
629	4	648	0	Fine-grained sandstone, silty claystone and shale, Hard, firm core.	18	8	
Bottom of hole.							

Log, Hole MC-15

Location: 1,528 feet N. and 4,260 feet W. of SE. corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 849.3 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	in.	Ft.	in.		Ft.	in.	
0	0	56	0	Glacial overburden.....	56	0	Churn drilled.
56	0	165	0	Medium- to coarse-grained sandstone. Possibly some Tsadaka conglomerate.	109	0	Do.
165	0	170	0	Interbedded COAL and claystone.	5	0	Do.
170	0	170	4	Claystone.....		4	Cased and continued by core drilling.
170	4	170	7½	COAL.....		3½	
170	7½	175	6	Probably interbedded COAL and claystone.	4	10½	Core not recovered.
175	6	180	2	Coaly claystone (many slickensides).	4	8	
180	2	184	10	Black carbonaceous shale with thin streaks of coal.	4	8	
184	10	186	5	Bright banded COAL.....	1	7	) F-64485.
186	5	188	5	Black carbonaceous shale with thin streaks of coal.	2	0	
188	5	190	5	Bright banded COAL.....	2	0	)
190	5	198	7	Black carbonaceous shale with thin streaks of coal.	8	2	
198	7	202	5	Coaly claystone.....	3	10	
202	5	207	10	Claystone, occasional bands and streaks of coal.	5	5	
207	10	208	4	Coaly claystone.....		6	
208	4	208	7	Black carbonaceous shale with thin streaks of coal.		3	
208	7	210	11	Bright banded COAL.....	2	4	) F-64486.
210	11	211	10	Bone coal.....		11	
211	10	213	4	Bright banded COAL with thin streaks and films of mineral matter in cleats and fractures.	1	6	) 6-inch core loss.
213	4	214	11	Coaly claystone.....	1	7	Many slickensides. Slickensides almost parallel to core axis.

Log, Hole MC-15 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
214	11	224	11	Bright banded COAL.....	10	0	) F-64487.
224	11	228	5	Do.	3	6	) F-64488 1-foot core loss.
228	5	229	7	Bone, mixed thin streaks of siltstone and coal.	1	2	1-foot, 1-inch core loss.
229	7	233	6	Coaly claystone with fine-grained sandstone bands and inclusions. Many slickensides.	3	11	Bedding angle 65°.
233	6	234	3	Bright banded COAL.....		9	) F-64489.
234	3	234	5	Hard black carbonaceous shale.		2	
234	5	234	7	Soft black shale.....		2	
234	7	236	8	Bright banded COAL.....	2	1	)
236	8	239	11	Do.	3	3	) F-64490.
239	11	243	7	Do.	3	8	) F-64491.
243	7	247	0	Do.	3	5	) F-64492.
247	0	248	1	Do.	1	1	) F-64493.
248	1	249	10	Do.	1	9	) F-64494.
249	10	252	11	Do.	3	1	) F-64495.
252	11	254	8	Do.	1	9	) F-64496.
254	8	255	1	Coaly claystone.....		5	
255	1	257	10	Claystone, occasional streaks and bands of coal.	2	9	
257	10	258	0	Coaly claystone.....		2	
258	0	260	0	Bright banded COAL.....	2	0	) F-64497.
260	0	261	7	Claystone, bands and streaks of coal.	1	7	
261	7	262	7	COAL (stringer).....	1	0	Bedding angle 75°. Core badly broken.
262	7	269	0	Claystone, occasional bands, streaks and inclusions of coal.	6	5	
269	0	294	4	Interbedded claystone and silty claystone, occasional bands, streaks and inclusions of coal.	25	4	
294	4	510	7	Interbedded silty claystone, siltstone and fine-grained sandstone. Lower part grades to medium-grained sandstone.	16	3	No bedding angles obtainable. Core (except the fine-grained sandstone) weathers to a grayish mass.

Log, Hole MC-15 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
510	7	525	6	Medium-grained sandstone, occasional fine-grained sandstone inclusions, occasional coal streaks and inclusions.	14	11	Bedding angle: 512 feet, 45°.
525	6	617	7	Medium-grained sandstone, hard and dense, little or no weathering effect.	92	1	Bedding angle: 613 feet, 50°.
617	7	630	10	Black fine-grained sandstone and claystone.	13	3	
630	10	639	10	Hard dense gray medium-grained sandstone.	9	0	Bedding angle: 637 feet, 45°.
639	10	663	7	Black fine-grained sandstone and claystone.	23	9	
663	7	666	0	Medium-grained sandstone-hard and dense, very light-rust.	2	5	Bedding angle: 663.6 feet, 80°.
666	0	691	4	Black fine-grained sandstone and claystone, occasional small segments of hard rusty sandstone containing a small amount of calcite.	25	4	Weathers to a soft mud.
691	4	693	5	Black fine-grained sandstone and claystone.	2	1	Bedding angle: 692 feet, 80°.
693	5	763	2	Black silty claystone and medium-grained sandstone. From 717.7 to 718.6 is hard dense light-brown fine-grained sandstone with calcite stringers.	69	9	Readily weathers to a grayish mass.
763	2	774	6	Predominantly coarse-grained sandstone, hard and dense. About 20 percent silty claystone and sandstone that readily weathers to a soft gray mass.	11	4	Bedding angle 45°.
774	6	794	8	Interbedded silty claystone and sandstone.	20	2	Core lost between 791 and 793 feet.
794	8	796	6	Hard dense fine-grained rusty sandstone with calcite stringers.	1	10	
796	6	821	2	Fine-grained gray sandstone and silty claystone. Occasional rusty segments of hard dense sandstone.	24	8	

Log, Hole MC-15 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
821	2	822	2	Light-gray soapy-feeling claystone. Small amount of coal.	1	0	
822	2	825	11	Coaly claystone. Weathers to flaky material.	3	9	
825	11	827	10	Soft white soapy-like mass of claystone.	1	11	
827	10	834	1	Interbanded coal and claystone.	6	3	
834	1	839	10	Coaly claystone.....	5	9	
839	10	859	2	Interbedded silty claystone, fine-grained sandstone and coarse-grained sandstone.	19	4	Weathers to a grayish mass.
859	2	888	0	Interbedded light-gray coarse-grained sandstone and silty claystone.	28	10	Predominantly sandstone that does not weather readily.
888	0	930	0	Medium-hard dense coarse-grained sandstone with some silty claystone. Many calcite stringers.	42	0	
930	0	938	5	Coarse-grained sandstone and silty claystone, small minute specks of coal.	8	5	Weathers to a soft mass.
938	5	941	7	Coaly claystone.....	3	2	
941	7	942	1	COAL.....		6	
942	1	945	10	Claystone, sandstone and a small amount of coal.	3	9	
945	10	949	7	Black fine-grained sandstone and claystone.	3	9	Weathers to a soft flaky mass.
949	7	952	6	Hard dense light-gray coarse-grained sandstone.	2	11	
952	6	963	7	Interbedded black hard dense claystone and light gray flaky claystone that has a soapy feel.	11	1	
963	7	964	10	Bright banded COAL.....	1	3	) F-65119.
964	10	968	4	Coaly claystone.....	3	6	
968	4	969	0	COAL.....		8	
969	0	980	0	Black claystone and sandy claystone.	11	0	
980	0	981	0	Coaly claystone.....	1	0	

Log, Hole MC-15 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
981	0	985	4	Interbedded light-gray soapy-feeling claystone, black claystone and small amount of coal.	4	4	
985	4	993	2	Silty claystone.....	7	10	
993	2	1021	6	Claystone, greenish tinge or cast.	28	4	
1021	6	1023	2	Claystone, rusty colored...	1	8	
1023	2	1024	10	Claystone, greenish tinge or cast.	1	8	
1024	10	1027	8	Hard medium-grained sandstone and silty claystone.	2	10	
1027	8	1039	4	Gray silty claystone.....	11	8	Weathers to a flaky mass.
1039	4	1039	10	Hard dense sandstone.....		6	
1039	10	1046	4	Rusty-colored claystone....	6	6	Do.
		Bottom of hole.					

Log, Hole MC-16

Location: 24 feet S. and 1,260 feet E. of SW. corner, sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 794.0 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From-		Depth To-		Material	Thickness		Remarks
Ft.	In.	Ft.	in.		Ft.	in.	
0	0	180	0	Glacial overburden.....	180	0	Churn drilled.
180	0	231	6	Apparently medium- to coarse-grained sandstone and Tsadaka conglomerate.	51	6	Do.
231	6	239	6	Interbedded blue-black silty claystone and black to dark-gray fine-grained sandstone, occasional iron stain.	8	0	Core badly broken.
239	6	241	6	Gray medium-grained sandstone and sticky claystone.	2	0	
241	6	266	0	Interbedded medium- to fine-grained sandstone and silty claystone.	24	6	Core has marbelized appearance.
266	0	270	6	Interbedded medium- to fine grained sandstone, silty claystone and carbonaceous shale containing occasional bands and streaks of coal.	4	6	
270	6	272	0	Black silty claystone and light-tan sandstone containing many calcite stringers.	1	6	Core badly broken.
272	0	275	0	Black to dark-gray badly fractured silty claystone.	3	0	
275	0	276	8	Light-tan medium-grained sandstone with many calcite stringers.	1	8	
276	8	277	11	Black silty claystone.....	1	3	
277	11	279	5	Carbonaceous claystone, silty claystone, and occasional thin bands of coal.	1	6	Do.
279	5	280	6	Dark-gray soft silty claystone.	1	1	Do.

Log, Hole MC-16 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
280	6	281	9	Carbonaceous claystone, silty claystone, and occasional thin bands of coal.	1	3	Core badly broken.
281	9	282	1	Bright banded COAL.....		4	) F-65120.
282	1	282	4	Shale.....		3	
282	4	284	5	Bright banded COAL.....	2	1	) 4-inch core loss.
284	5	284	7	Shale.....		2	
284	7	290	2	Interbedded black silty claystone and fine-grained sandstone with a few very small coal stringers.	5	7	
290	2	303	5	Black silty claystone and small amount fine-grained sandstone with many small coal inclusions. A few calcite stringers throughout core.	13	3	Bedding angle 20°.
303	5	306	5	Black silty claystone and fine-grained sandstone.	3	0	
306	5	317	6	Interbedded medium-grained to fine-grained light-gray sandstone with occasional bands of black fine-grained sandstone and black silty claystone.	11	1	Bedding angles: 308 feet, 20°; 313 feet, 10°.
317	6	326	5	Black silty claystone with a few coal inclusions parallel to bedding planes.	8	11	
326	5	326	6	Bone.....		1	
326	6	327	6	Bright banded COAL.....	1	0	) F-65121.
327	6	328	0	Black silty claystone with small amount coal.		6	
328	0	328	6	Soft black mass of carbonaceous shale, silty claystone and small amount coal.		6	
328	6	334	2	Interbedded fine-grained sandstone and silty claystone with a few coal inclusions.	5	8	
334	2	336	2	Bright banded COAL.....	2	0	) F-65122.
336	2	336	6	Shale.....		4	

Log, Hole MC-16 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
336	6	339	8	Fine-grained sandstone and black silty claystone.	3	2	
339	8	341	1	Bony COAL with a few small specks of resin.	1	5	No sample taken for analyses.
341	1	353	11	Interbedded silty claystone and fine-grained sandstone.	12	10	
353	11	356	2	Gray-to-black silty claystone, a few calcite stringers.	2	3	
356	2	361	4	Black silty claystone.....	5	2	
361	4	364	7	Light-gray, hard, dense fine-grained sandstone.	3	3	
364	7	364	11	Soft silty claystone or gouge.		4	
364	11	369	4	Interbedded black silty claystone and light-gray hard dense sandstone.	4	5	Bedding angle: 366 feet, 15°.
369	4	370	10	Black silty claystone.....	1	6	
370	10	373	8	Light-gray silty claystone.	2	10	Broken and checked.
373	8	378	1	Black silty claystone and carbonaceous claystone with small coal inclusions.	4	5	
378	1	380	4	Bony coal and claystone....	2	3	
380	4	386	10	Black silty claystone with a few small coal inclusions.	6	6	Core badly broken.
386	10	420	4	Light-gray to medium-gray silty claystone.	33	6	Do.
420	4	421	10	Silty claystone with a distinct rusty color.	1	6	Do.
421	10	426	6	Light-gray silty claystone.	4	8	
426	6	431	2	Dark-gray silty claystone..	4	8	
431	2	431	8	Silty claystone, rusty-to-lavender.		6	
431	8	474	8	Silty claystone, hard and dense.	43	0	Bedding angle: 462 feet, 30°.
474	8	478	0	Dark-gray silty claystone..	3	4	Core broken.
478	0	496	10	Dark-gray silty claystone..	18	10	Firm core.
496	10	507	1	Interbedded hard dense fine-grained sandstone and silty claystone. Sandstone predominates.	10	3	
507	1	511	11	Dark-gray silty claystone..	4	10	Core broken.

Log, Hole MC-16 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
511	11	512	1	Coaly claystone and bony coal.		2	
512	1	523	0	Interbedded light-gray medium-grained sandstone and black silty claystone.	10	11	
523	0	523	2	Silty claystone, iron-stained.		2	
523	2	527	1	Black silty claystone.....	3	11	Core broken.
527	1	542	6	Interbedded light-gray hard dense fine-grained sandstone and black silty claystone.	15	5	Bedding angle: 537 feet, 7°
542	6	547	6	Black silty claystone with a few bands of light-tan sandstone.	5	0	
547	6	553	6	Black silty claystone with a few small inclusions of coal and carbonaceous claystone.	6	0	
553	6	570	8	Interbedded black silty claystone and light-gray fine-grained sandstone with occasional bands and inclusions of coal. Silty claystone predominates.	17	2	Bedding angle: 565 feet, 5°
570	8	576	0	Light-gray very fine-grained sandstone.	5	4	Contact bedding angle: 570 feet 8 inches, 32°.
576	0	579	0	Silty claystone.....	3	0	Badly broken core and poor recovery.
579	0	599	5	Hard dense light-gray medium-grained sandstone.	20	5	
Bottom of hole.							

Log, Hole MC-17

Location: 2,000 feet N. and 4,597 feet W. of the SE. corner, sec. 27, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 892.4 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
0	0	67	0	Glacial overburden.....	67	0	Churn drilled.
67	0	91	0	Apparently Chickaloon formation sandstone.	24	0	Do.
		Bottom of hole.					

Log, Hole MC-18

Location: 2,990 feet N. and 360 feet W. of the SE. corner, sec. 26, T. 19 N., R. 2 E., Seward Meridian, Alaska.

Elevation: Collar of hole: 784.6 feet, mean sea level datum.

Dip of hole: Vertical.

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
0	0	73	0	Glacial overburden.....	73	0	Churn drilled.
73	0	75	4	Chickaloon formation.....	2	4	Do.
75	4	79	8	Claystone.....	4	4	
79	8	80	0	Hard gray shale cap rock...		4	
80	0	82	5	Bright banded COAL.....	2	5	) F-65123.
82	5	83	8	Coaly claystone.....	1	3	
83	8	84	5	Bony COAL.....		9	No sample taken.
84	5	90	0	Claystone with many bands, streaks, and inclusions, of coal, some calcite streaks.	5	7	
90	0	103	0	Light-green fine-grained sandstone, grades to interbedded claystone and silty claystone in lower 2 feet.	13	0	

Log, Hole MC-18 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
103	0	125	10	Interbedded claystone and silty claystone, occasional coal streaks and inclusions, occasional calcite streaks, grades to coaly claystone with many slickensides in lower 5 feet.	22	10	Bedding angle: 105 feet, 50°. Bedding angle: 110 feet, 55°.
125	10	130	6	Claystone, many streaks, bands, and inclusions of coal.	4	8	
130	6	131	6	Coaly claystone.....	1	0	
131	6	132	3	Bright banded COAL.....		9	) F-65124.
132	3	133	6	Black carbonaceous shale with thin streaks of coal.	1	3	
133	6	149	4	Silty claystone, occasional streaks and inclusions of coal, occasional fine-grained sandstone bands, occasional slickensides. Calcite on slickenside surface.	15	10	
149	4	149	9	Bone coal.....		5	Rejected.
149	9	150	8	Bright banded COAL.....		11	)
150	8	151	7	Hard gray shale.....		11	
151	7	152	10	Bright banded COAL with thin streaks of shale.	1	3	)
152	10	153	6	Bright banded COAL.....		8	)
153	6	153	10	Siltstone parting.....		4	
153	10	154	4	Mixed bone and bright coal.		6	
154	4	154	6	Bright banded COAL.....		2	) F-65125.
154	6	154	10	Siltstone parting.....		4	
154	10	155	10	Bright banded COAL.....	1	0	)
155	10	157	2	Hard black carbonaceous shale.	1	4	
157	2	159	6	Bright banded COAL.....	2	4	)
159	6	160	0	Hard black carbonaceous shale.		6	
160	0	161	0	Bright banded COAL.....	1	0	) F-65126.
161	0	162	4	Coaly claystone.....	1	4	
162	4	168	0	Silty claystone, occasional streaks and inclusions coal, occasional slickensides. Calcite on slickenside surfaces.	5	8	

Log, Hole MC-18 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
168	0	168	7	Bright banded COAL.....		7	) F-65127.
168	7	168	10	Siltstone parting.....		3	
168	10	170	1	Bright banded COAL.....	1	3	)
170	1	170	2	Siltstone parting.....		1	
170	2	172	6	Bright banded COAL.....	2	4	)
172	6	172	11	Limestone parting.....		5	
172	11	174	0	Bright banded COAL.....	1	1	)
174	0	174	3	Bone coal with calcite in cleats and fractures.		3	
174	3	175	0	Bright banded COAL.....		9	)
175	0	175	7	Black carbonaceous shale with thin streaks of coal.		7	
175	7	175	8	Bright COAL with very thin streaks of shale.		1	) F-65128.
175	8	175	9	Hard black carbonaceous shale.		1	
175	9	176	6½	Black banded COAL.....		9½	)
176	6½	177	4	Black carbonaceous shale with thin streaks of coal.		9½	
177	4	178	7	Black carbonaceous shale...	1	3	
178	7	183	4½	Bright banded COAL.....	4	9½	)
183	4½	183	11	Hard black carbonaceous shale with thin streaks of coal.		6½	
183	11	185	6	Claystone, occasional streaks and inclusions of coal.	1	7	
185	6	185	10	Fine-grained sandstone.....		4	
185	10	190	2	Claystone, many slickensides. Calcite on slickenside surfaces.	4	4	
190	2	190	11	Fine-grained sandstone.....		9	
190	11	192	5	Claystone.....	1	6	
192	5	193	6	Claystone with many coal streaks and inclusions.	1	1	
193	6	193	11	Black carbonaceous shale with thin streaks of coal.		5	
193	11	196	0	Bright banded COAL.....	2	1	) F-65129. 3½-inch core loss.
196	0	196	5	Black carbonaceous shale...		5	
196	5	198	7	Silty claystone with many streaks and inclusions of coal.	2	2	
198	7	199	0	Black carbonaceous shale...		5	

Log, Hole MC-18 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
199	0	200	6	Bright banded COAL.....	1	6	) F-65130.
200	6	201	2	Bone coal with streaks of black shale.		8	
201	2	202	4	Coaly claystone.....	1	2	
202	4	202	7	Fine-grained sandstone.....		3	
202	7	205	11	Interbedded claystone and silty claystone, many slickensides.	3	4	
205	11	207	0	Hard black carbonaceous shale.	1	1	
207	0	207	1	Limestone parting.....		1	
207	1	208	8	Bright banded COAL.....	1	7	) F-65131.
208	8	208	10	Hard black carbonaceous shale.		2	
208	10	209	5	Soft weathered shale.....		7	
209	5	210	5	Bright banded COAL.....	1	0	)
210	5	220	0	Claystone, occasional streaks and inclusions of coal, occasional slickensides.	9	7	
220	0	221	3	Coaly claystone.....	1	3	
221	3	221	5	Hard black carbonaceous shale.		2	
221	5	223	9½	Bright banded COAL.....	2	4½	)
223	9½	223	11½	Hard black carbonaceous shale.		2	
223	11½	224	9	Bright banded COAL.....		9½	)
224	9	226	9	Hard black carbonaceous shale.	2	0	
226	9	227	9	Bright banded COAL.....	1	0	) F-65132.
227	9	228	0	Soft black shale.....		3	
228	0	232	0	Interbedded claystone, silty claystone and fine-grained sandstone. Occasional calcite streaks and inclusions.	4	0	
232	0	287	6	Medium- to coarse-grained sandstone, "granitized". occasional coal inclusions.	55	6	
287	6	290	0	Small cobble conglomerate, occasional inclusions coal and sandstone.	2	6	Contact bedding angle: 290 feet, 30°
290	0	293	0	Silty claystone.....	3	0	

Log, Hole MC-18 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
293	0	316	0	Predominately fine-grained sandstone with many claystone and silty claystone lenses.	23	0	Bedding angles: 297 feet, 25°; 309 feet, 40°.
316	0	317	5	Bony COAL.....	1	5	No sample taken.
317	5	321	11	Coaly claystone.....	4	6	
321	11	322	6	Soft dark-gray clayey mud.		7	
322	6	328	1	Claystone, occasional coal inclusions.	5	7	
328	1	328	4	Hard black carbonaceous shale.		3	
328	4	329	0	Bright banded COAL.....		8	) F-65132.
329	0	329	2	Hard black shale parting...		2	
329	2	329	9½	Bright banded COAL.....		7½	)
329	9½	330	3	Hard black carbonaceous shale.		5½	
330	3	332	0	Bright banded COAL.....	1	9	)
332	0	332	4	Hard black carbonaceous shale.		4	
332	4	333	0	Bright banded COAL.....		8	)
333	0	333	7	Hard black carbonaceous shale.		7	
333	7	339	10	Coaly claystone, many slickensides.	6	3	
339	10	340	10	Claystone.....	1	0	
340	10	341	4	Fire clay.....		6	
341	4	341	7	Claystone.....		3	
341	7	341	10	COAL.....		3	No sample taken.
341	10	343	7	Claystone.....	1	9	
343	7	343	10	COAL.....		3	Do.
343	10	346	7	Claystone.....	2	9	
346	7	347	0	COAL.....		5	Do.
347	0	350	2	Very fine-grained sandstone.	3	2	
350	2	352	0	Fire clay.....	1	10	Contact bedding angle: 352 feet, 40°.
352	0	384	7	Interbedded claystone and silty claystone, occasional streaks and inclusions of coal, many slickensides.	32	7	
384	7	385	4	Very fine-grained sandstone.		9	

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Log, Hole MC-18 (Con.)

Depth From- Ft.	Depth From- in.	Depth To- Ft.	Depth To- in.	Material	Thickness Ft.	Thickness in.	Remarks
385	4	406	8	Interbedded claystone and silty claystone, occasional streaks and bands of coal.	21	4	
406	8	408	1	Fine-grained sandstone.....	1	5	Bedding angle: 407 feet, 50°.
408	1	409	7	Interbedded silty claystone and fine-grained sandstone.	1	6	
409	7	416	10	Interbedded claystone and silty claystone.	7	3	
416	10	417	7	Soft clayey gougelike material, small coal inclusions.		9	
417	7	453	5	Interbedded claystone and silty claystone, (lens fine-grained sandstone 423 feet 5 inches to 423 feet 11 inches) (lens siltstone 435 feet 2 inches to 435 feet 10 inches) (lens fine-grained sandstone 438 feet 11 inches to 439 feet 2 inches), occasional slickensides.	35	10	
453	5	565	0	Interbedded claystone, silty claystone, and siltstone. Some contains reddish hematite or limonite silt (1-foot lens of fine-grained sandstone containing calcite streaks at 508 feet). Grades to fine-grained sandstone 555 feet 6 inches to 565 feet.	111	7	
565	0	566	2	Claystone.	1	2	
Bottom of hole.							

TABLE 5. - Analyses of diamond-drill core samples, central part of the district

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-1:																					
294 ft. 6 in. to 297 ft. 0 in.	D-22381	1	3.6	40.0	45.2	11.2	0.5	5.6	68.8	1.3	12.6	12,340	2,310	2,380	2,590	1.36	2	1.4	30	5	25
		2	-	41.5	46.9	11.6	.5	5.3	71.3	1.4	9.9	12,800									
		3	-	46.9	53.1	--	.6	6.0	80.7	1.6	11.1	14,480									
298 ft. 10 in. to 301 ft. 11 in.	D-22382	1	3.6	36.1	40.1	20.2	.3	5.0	60.8	1.1	12.6	10,930	2,870	2,910+	---	1.45	1	.5	37	2-½	34-½
		2	-	37.4	41.7	20.9	.3	4.8	63.1	1.2	9.7	11,330									
		3	-	47.3	52.7	--	.4	6.1	79.8	1.5	12.2	14,330									
615 ft. 4 in. to 618 ft. 6 in.	D-22383	1	3.4	40.0	45.4	11.2	.4	5.6	69.2	1.3	12.3	12,420	2,380	2,420	2,570	1.36	4	1.2	38	--	38
		2	-	41.4	47.0	11.6	.4	5.4	71.6	1.4	9.6	12,860									
		3	-	46.8	53.2	--	.4	6.1	81.0	1.6	10.9	14,540									
626 ft. 11 in. to 631 ft. 0 in.	D-22384	1	4.1	41.0	46.0	8.9	.4	5.7	70.8	1.2	13.0	12,770	2,380	2,420	2,570	1.33	4-½	2.1	25	--	25
		2	-	42.7	48.0	9.3	.4	5.4	73.8	1.3	9.8	13,320									
		3	-	47.1	52.9	--	.4	6.0	81.3	1.4	10.9	14,680									
635 ft. 2 in. to 638 ft. 0 in.	D-22385	1	3.8	37.5	43.4	15.3	.4	5.3	65.5	1.3	12.2	11,710	2,420	2,540	2,600	1.40	3-½	1.9	30	3	27
		2	-	39.0	45.1	15.9	.5	5.0	68.1	1.3	9.2	12,170									
		3	-	46.4	53.6	--	.5	6.0	80.9	1.6	11.0	14,470									
644 ft. 6 in. to 648 ft. 8 in.	D-22386	1	4.3	39.4	46.0	10.3	.4	5.5	69.5	1.3	13.0	12,440	2,380	2,470	2,680	1.36	5	2.6	50	--	50
		2	-	41.2	48.1	10.7	.4	5.3	72.7	1.4	9.5	13,010									
		3	-	46.1	53.9	--	.4	5.9	81.4	1.6	10.7	14,570									
691 ft. 7 in. to 695 ft. 3 in.	D-22387	1	4.0	36.8	45.8	13.4	.4	5.3	66.8	1.3	12.8	11,930	2,490	2,700	2,780	1.39	3-½	1.9	44	12	32
		2	-	38.4	47.7	13.9	.4	5.1	69.6	1.4	9.6	12,420									
		3	-	44.6	55.4	--	.5	5.9	80.9	1.6	11.1	14,430									
851 ft. 8 in. to 853 ft. 8 in.	D-25051	1	3.6	36.6	50.3	9.5	.4	5.4	71.0	1.5	12.2	12,720	2,500	2,540	2,730	1.37	4	2.7	24	9	15
		2	-	38.0	52.1	9.9	.5	5.2	73.6	1.5	9.3	13,190									
		3	-	42.1	57.9	--	.5	5.8	81.7	1.7	10.3	14,630									
855 ft. 4 in. to 857 ft. 4 in.	D-25052	1	3.4	35.5	42.6	18.5	.4	5.2	63.1	1.4	11.4	11,290	2,910+	---	---	1.43	1-½	1.5	19	5	14
		2	-	36.8	44.1	19.1	.4	5.0	65.3	1.4	8.8	11,680									
		3	-	45.5	54.5	--	.5	6.2	80.7	1.8	10.8	14,450									
WH-3:																					
366 ft. 0 in. to 368 ft. 6 in.	D-22819	1	3.5	37.2	40.6	18.7	.3	5.0	62.4	1.1	12.5	11,120	2,410	2,500	2,570	1.43	2	.7	30	8	22
		2	-	38.5	42.1	19.4	.4	4.8	64.6	1.2	9.6	11,530									
		3	-	47.8	52.2	--	.4	6.0	80.2	1.5	11.9	14,310									

See footnotes at end of table.

TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-3 (Con.):																					
384 ft. 0 in. to 388 ft. 6 in.	D-22820	1	3.6	37.1	40.6	18.7	0.4	5.1	62.4	1.2	12.2	11,230	2,770	2,860	2,910+	1.39	2	1.0	41	18	23
		2	-	38.5	42.2	19.3	.4	4.9	64.7	1.3	9.4	11,650									
		3	-	47.7	52.3	--	.5	6.0	80.3	1.6	11.6	14,440									
WH-4:																					
392 ft. 3 in. to 395 ft. 9 in.	D-25130	1	3.5	36.6	48.0	11.9	.4	5.3	68.4	1.2	12.8	12,170	2,870	2,910+	---	1.39	2	1.6	42	9	33
		2	-	38.0	49.7	12.3	.4	5.1	70.9	1.3	10.0	12,610									
		3	-	43.3	56.7	--	.5	5.8	80.9	1.5	11.3	14,380									
419 ft. 9 in. to 427 ft. 6 in.	D-25456	1	4.3	37.4	45.0	13.3	.4	5.4	66.7	1.3	12.9	11,870	2,360	2,450	2,680	1.40	3	2.6	89	13	76
		2	-	39.1	47.0	13.9	.5	5.1	69.7	1.3	9.5	12,400									
		3	-	45.4	54.6	--	.5	6.0	81.0	1.5	11.0	14,410									
430 ft. 2 in. to 433 ft. 0 in.	D-25457	1	4.0	37.8	44.5	13.7	.2	5.1	66.0	1.2	13.8	11,580	2,230	2,310	2,450	1.42	3-½	2.5	34	2	32
		2	-	39.3	46.4	14.3	.2	4.8	68.8	1.2	10.7	12,060									
		3	-	45.9	54.1	--	.3	5.6	80.2	1.5	12.4	14,060									
434 ft. 6 in. to 438 ft. 3 in.	D-25458	1	4.4	35.5	37.6	22.5	.2	4.6	57.7	1.1	13.9	9,980	2,310	2,420	2,470	1.52	2	1.4	45	3-½	41-½
		2	-	37.2	39.3	23.5	.3	4.3	60.3	1.1	10.5	10,430									
		3	-	48.6	51.4	--	.3	5.7	78.9	1.4	13.7	13,640									
440 ft. 3 in. to 445 ft. 0 in.	D-24784	1	4.0	36.9	43.7	15.4	.3	5.2	64.8	1.2	13.1	11,520	2,230	2,330	2,430	1.43	3	2.1	57	12	45
		2	-	38.5	45.4	16.1	.3	4.9	67.5	1.3	9.9	12,000									
		3	-	45.8	54.2	--	.4	5.9	80.4	1.5	11.8	14,300									
461 ft. 9 in. to 463 ft. 3 in.	D-25131	1	3.0	34.7	43.2	19.1	.4	5.1	62.3	1.3	11.8	11,150	2,910+	---	---	1.45	3	2.8	18	5-½	12-½
		2	-	35.8	44.5	19.7	.4	4.9	64.3	1.4	9.3	11,500									
		3	-	44.6	55.4	--	.5	6.1	80.0	1.7	11.7	14,320									
501 ft. 8 in. to 507 ft. 4 in.	D-25132	1	2.9	40.5	47.6	9.0	.4	5.6	71.6	1.4	12.0	12,860	2,310	2,360	2,470	1.35	3-½	3.0	62	28	34
		2	-	41.7	49.1	9.2	.4	5.4	73.7	1.5	9.8	13,240									
		3	-	45.9	54.1	--	.5	6.0	81.2	1.6	10.7	14,580									
510 ft. 2 in. to 512 ft. 6 in.	D-25133	1	3.3	39.9	48.4	8.4	.3	5.6	72.1	1.4	12.2	12,970	2,310	2,360	2,730	1.34	5	-	28	1	27
		2	-	41.2	50.0	8.7	.4	5.5	74.6	1.5	9.3	13,410									
		3	-	45.2	54.8	--	.4	6.0	81.6	1.6	10.4	14,690									

See footnotes at end of table.

TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-4 (Con.):																					
527 ft. 0 in. to 532 ft. 9 in.	D-24785	1	4.0	38.3	43.2	14.5	0.3	4.9	63.8	1.1	15.4	11,130	2,380	2,410	2,440	1.46	3	2.0	69	17	52
		2	-	39.9	45.0	15.1	.3	4.6	66.5	1.2	12.3	11,590									
		3	-	47.1	52.9	--	.4	5.4	78.3	1.4	14.5	13,660									
WH-5:																					
339 ft. 5 in. to 340 ft. 10 in.	D-25176	1	5.1	37.6	55.8	1.5	.3	5.5	76.3	1.4	15.0	13,500	2,050	2,180	2,340	1.33	1-½	.2	13	-	13
		2	-	39.6	58.8	1.6	.3	5.2	80.4	1.4	11.1	14,220									
		3	-	40.3	59.7	--	.3	5.3	81.7	1.5	11.2	14,450									
342 ft. 0 in. to 348 ft. 0 in.	D-25175	1	4.0	38.8	49.8	7.4	1.2	5.6	72.0	1.5	12.3	12,800	2,360	2,420	2,500	1.35	2	.7	68	4	64
		2	-	40.4	51.8	7.8	1.3	5.3	74.9	1.5	9.2	13,330									
		3	-	43.8	56.2	--	1.4	5.8	81.2	1.7	9.9	14,450									
402 ft. 9 in. to 406 ft. 7 in.	D-25460	1	3.5	39.5	42.5	14.5	.4	5.2	65.3	1.3	13.3	11,650	2,310	2,380	2,550	1.41	2	1.7	46	5-½	40-½
		2	-	40.9	44.1	15.0	.4	5.0	67.7	1.3	10.6	12,070									
		3	-	48.1	51.9	--	.5	5.8	79.6	1.6	12.5	14,200									
407 ft. 4 in. to 408 ft. 10 in.	D-25461	1	3.6	37.6	45.0	13.8	.5	5.2	66.1	1.3	13.1	11,760	2,360	2,470	2,590	1.40	2	-	18	4	14
		2	-	39.0	46.7	14.3	.5	5.0	68.5	1.4	10.3	12,200									
		3	-	45.5	54.5	--	.6	5.8	80.0	1.6	12.0	14,240									
418 ft. 0 in. to 420 ft. 6 in.	D-25459	1	3.8	38.7	49.4	8.1	.3	5.5	72.0	1.3	12.8	12,830	2,360	2,470	2,600	1.51	2-½	1.9	27	3	24
		2	-	40.2	51.4	8.4	.3	5.3	74.8	1.4	9.8	13,330									
		3	-	43.9	56.1	--	.4	5.8	81.7	1.5	10.6	14,560									
WH-6:																					
250 ft. 0 in. to 252 ft. 0 in.	D-29671	1	3.7	39.7	50.2	6.4	.4	5.6	72.9	1.5	13,2	12,970	2,340	2,380	2,510	1.34	1-½	-	20	2	18
		2	-	41.2	52.1	6.7	.4	5.3	75.7	1.5	10.4	13,460									
		3	-	44.1	55.9	--	.5	5.7	81.1	1.6	11.1	14,430									
311 ft. 6 in. to 318 ft. 0 in.	D-27206	1	3.4	39.5	41.7	15.4	.3	5.3	64.7	1.4	12.9	11,650	2,470	2,520	2,620	1.40	1-½	1.2	77	18	59
		2	-	40.9	43.1	16.0	.4	5.1	66.9	1.4	10.2	12,050									
		3	-	48.7	51.3	--	.4	6.1	79.6	1.7	12.2	14,340									
319 ft. 3 in. to 322 ft. 9 in.	D-27207	1	4.0	37.5	46.8	11.7	.3	5.3	68.3	1.4	13.0	12,120	2,470	2,620	2,750	1.37	1	1.4	42	8	34
		2	-	39.1	48.8	12.1	.3	5.1	71.1	1.4	10.0	12,620									
		3	-	44.5	55.5	--	.4	5.8	80.9	1.6	11.3	14,360									

See footnotes at end of table.

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TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-6 (Con.):																					
381 ft. 0 in. to 383 ft. 0 in.	D-27208	1	3.7	36.3	46.4	13.6	0.5	5.3	67.1	1.3	12.2	11,980	2,470	2,730	2,860	1.39	2	1.6	24	9	15
		2	-	37.7	48.1	14.2	.5	5.1	69.6	1.4	9.2	12,440									
		3	-	43.9	56.1	--	.6	5.9	81.1	1.6	10.8	14,500									
385 ft. 9 in. to 387 ft. 2 in.	D-27209	1	25.9	25.9	31.7	16.5	.4	6.3	46.1	1.0	29.7	8,280	2,570	2,650	2,750	1.46	1-½	.4	15	-	15
		2	-	35.0	42.7	22.3	.5	4.6	62.2	1.3	9.1	11,170									
		3	-	45.0	55.0	--	.6	5.9	80.0	1.7	11.8	14,370									
WH-7:																					
585 ft. 3 in. to 586 ft. 6 in.	D-28276	1	3.0	37.9	38.9	20.2	.3	5.0	60.6	1.0	12.9	10,810	2,520	2,590	2,750	1.45	2	2.0	15	2	13
		2	-	39.1	40.1	20.8	.3	4.8	62.5	1.0	10.6	11,150									
		3	-	49.4	50.6	--	.4	6.1	78.9	1.3	13.3	14,080									
587 ft. 1 in. to 593 ft. 0 in.	D-28277	1	3.5	40.3	43.5	12.7	.3	5.4	67.3	1.1	13.2	11,990	2,440	2,490	2,590	1.38	3	2.4	71	6	65
		2	-	41.7	45.2	13.1	.3	5.2	69.7	1.2	10.5	12,420									
		3	-	48.0	52.0	--	.4	6.0	80.2	1.4	12.0	14,300									
593 ft. 2 in. to 596 ft. 10 in.	D-28278	1	3.6	38.4	46.1	11.9	.2	5.3	68.0	1.1	13.5	12,090	2,330	2,390	2,520	1.38	2-½	2.3	44	9	35
		2	-	39.9	47.7	12.4	.3	5.1	70.5	1.2	10.5	12,550									
		3	-	45.5	54.5	--	.3	5.8	80.5	1.3	12.1	14,320									
609 ft. 0 in. to 611 ft. 8 in.	D-28279	1	3.4	37.1	45.2	14.3	.3	5.2	66.4	1.2	12.6	11,890	2,700	2,750	2,840	1.39	1-½	2.1	32	8	24
		2	-	38.4	46.8	14.8	.3	5.0	68.8	1.2	9.9	12,310									
		3	-	45.1	54.9	--	.4	5.9	80.7	1.4	11.6	14,440									
885 ft. 3 in. to 886 ft. 6 in.	D-28280	1	2.9	36.6	43.9	16.6	.8	5.1	65.5	1.4	10.6	11,650	2,420	2,620	2,730	1.41	4	2.5	18	-	18
		2	-	37.7	45.2	17.1	.8	4.9	67.5	1.5	8.2	11,990									
		3	-	45.4	54.6	--	1.0	6.0	81.4	1.8	9.8	14,470									
902 ft. 7 in. to 904 ft. 7 in.	D-28281	1	3.3	37.2	44.6	14.9	.4	5.3	66.5	1.5	11.4	11,930	2,910+	---	---	1.39	3	2.6	24	2	22
		2	-	38.5	46.1	15.4	.4	5.1	68.8	1.5	8.8	12,330									
		3	-	45.5	54.5	--	.5	6.0	81.3	1.8	10.4	14,570									
WH-8:																					
445 ft. 0 in. to 450 ft. 3 in.	D-28282	1	3.9	38.5	49.3	8.3	.2	5.3	71.1	1.1	14.0	12,530	2,180	2,310	2,520	1.37	2-½	1.4	62	9	53
		2	-	40.1	51.2	8.7	.2	5.1	74.0	1.2	10.8	13,040									
		3	-	43.9	56.1	--	.3	5.6	81.0	1.3	11.8	14,270									

See footnotes at end of table.

TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-8 (Con.):																					
452 ft. 9 in. to 457 ft. 10 in.	D-28283	1	3.6	38.1	44.4	13.9	0.3	5.2	66.3	1.0	13.3	11,790	2,420	2,470	2,520	1.39	2-½	1.8	59	9	50
		2	-	39.6	46.0	14.4	.3	5.0	68.8	1.1	10.4	12,240									
		3	-	46.3	53.7	--	.3	5.8	80.4	1.3	12.2	14,300									
495 ft. 10 in. to 497 ft. 6 in.	D-29672	1	3.4	38.4	43.4	14.8	.3	5.2	65.5	1.3	12.9	11,670	2,360	2,440	2,500	1.39	2-½	-	20	3-½	16-½
		2	-	39.7	44.9	15.4	.3	5.0	67.8	1.4	10.1	12,080									
		3	-	47.0	53.0	--	.4	5.9	80.1	1.6	12.0	14,270									
WH-9:																					
1671 ft. 2-¼ in. to 1672 ft. 0-¾ in.	D-71977	1	3.7	37.0	50.3	9.0	-	-	--	-	--	----	---	---	---	--	-	-	10-½	--	10-½
		2	-	38.4	52.3	9.3	-	-	--	-	--	----									
		3	-	42.3	57.7	--	-	-	--	-	--	----									
1679 ft. 2 in. to 1680 ft. 4 in.	D-71978	1	3.3	39.4	45.4	11.9	-	-	--	-	--	----	---	---	---	--	-	-	14	--	14
		2	-	40.8	46.9	12.3	-	-	--	-	--	----									
		3	-	46.5	53.5	--	-	-	--	-	--	----									
1684 ft. 6 in. to 1686 ft. 7 in.	D-71979	1	2.9	39.3	44.3	13.5	-	-	--	-	--	----	---	---	---	--	-	-	25	2-¼	22-¾
		2	-	40.5	45.6	13.9	-	-	--	-	--	----									
		3	-	47.1	52.9	--	-	-	--	-	--	----									
1687 ft. 6 in. to 1688 ft. 9 in.	D-71980	1	3.6	36.2	41.8	18.4	-	-	--	-	--	----	---	---	---	--	-	-	12	¾	11-¼
		2	-	37.6	43.3	19.1	-	-	--	-	--	----									
		3	-	46.5	53.5	--	-	-	--	-	--	----									
1689 ft. 7 in. to 1693 ft. 1 in.	D-71981	1	2.6	38.6	45.9	12.9	-	-	--	-	--	----	---	---	---	--	-	-	35-½	2	33-½
		2	-	39.6	47.2	13.2	-	-	--	-	--	----									
		3	-	45.7	54.3	--	-	-	--	-	--	----									
WH-10:																					
1651 ft. 10 in. to 1656 ft. 8 in.	D-74888	1	3.0	38.0	46.3	12.7	0.4	5.3	68.2	1.2	12.2	12,160	2,210	2,520	2,630	1.39	-	-	58	13	45
		2	-	39.2	47.7	13.1	.4	5.1	70.3	1.2	9.9	12,530									
		3	-	45.1	54.9	--	.5	5.9	80.9	1.4	11.3	14,420									
1660 ft. 5 in. to 1664 ft. 9 in.	D-74889	1	2.9	37.1	48.4	11.6	.4	5.3	69.3	1.2	12.2	12,320	2,150	2,470	2,570	1.39	-	-	35-½	3	32-½
		2	-	38.2	49.9	11.9	.4	5.1	71.4	1.2	10.0	12,690									
		3	-	43.4	56.6	--	.5	5.8	81.0	1.4	11.3	14,410									

See footnotes at end of table.

TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-10 (Con.):																					
1801 ft. 4 in. to	E-188	1	2.1	--	--	27.2	-	-	--	-	--	----	---	---	---	--	-	-	50	--	50
1805 ft. 6 in.		2	-	--	--	27.8	-	-	--	-	--	----									
		3	-	--	--	--	-	-	--	-	--	----									
1805 ft. 6 in. to	E-189	1	2.1	36.3	47.4	14.2	.3	-	--	-	--	12,120	2,840	2,910+	---	--	-	-	11	--	11
1806 ft. 5 in.		2	-	37.0	48.5	14.5	.3	-	--	-	--	12,370									
		3	-	43.3	56.7	--	.3	-	--	-	--	14,470									
1806 ft. 5 in. to	E-190	1	1.8	--	--	25.4	-	-	--	-	--	----	---	---	---	--	-	-	12	--	12
1807 ft. 5 in.		2	-	--	--	25.9	-	-	--	-	--	----									
		3	-	--	--	--	-	-	--	-	--	----									
1809 ft. 10 in. to	E-191	1	2.1	36.5	46.4	15.0	.3	-	--	-	--	12,080	2,480	2,680	2,860	--	-	-	32	--	32
1812 ft. 6 in.		2	-	37.2	47.5	15.3	.3	-	--	-	--	12,330									
		3	-	44.0	56.0	--	.3	-	--	-	--	14,570									
WH-11:																					
1398 ft. 10 in. to	E-185	1	2.0	39.3	44.7	14.0	.3	-	--	-	--	12,110	2,450	2,510	2,680	--	-	-	108-½	29-½	79
1408 ft. 8 in.		2	-	40.1	45.6	14.3	.3	-	--	-	--	12,360									
		3	-	46.7	53.3	--	.4	-	--	-	--	14,410									
1410 ft. 3 in. to	E-186	1	2.2	37.0	41.4	19.4	.3	-	--	-	--	11,370	2,810	2,910+	---	--	-	-	44	6	38
1414 ft. 6 in.		2	-	37.8	42.3	19.9	.3	-	--	-	--	11,620									
		3	-	47.2	52.8	--	.4	-	--	-	--	14,510									
1623 ft. 11 in. to	E-187	1	2.0	36.3	42.1	19.6	.4	-	--	-	--	11,380	2,810	2,910+	---	--	-	-	131	23-¾	107-¼
1634 ft. 10 in.		2	-	37.0	43.1	19.9	.4	-	--	-	--	11,610									
		3	-	46.2	53.8	--	.4	-	--	-	--	14,500									
WH-12:																					
1991 ft. 7-½ in.	D-99652	1	2.1	34.0	41.7	22.2	.4	-	--	-	--	10,880	2,610	2,700	2,780	--	-	-	22-½	--	22-½
to		2	-	34.8	42.5	22.7	.4	-	--	-	--	11,110									
1996 ft. 0 in.		3	-	45.0	55.0	--	.6	-	--	-	--	14,370									

See footnotes at end of table.

TABLE 5. - Analyses of diamond-drill core samples, central part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
WH-12 (Con.):																					
1996 ft. 1 in. to 1998 ft. 9 in.	D-99653	1	2.3	35.9	45.5	16.3	0.3	-	--	-	--	11,980	2,910+	---	---	--	-	-	32	3-½	28-½
		2	-	36.7	46.6	16.7	.3	-	--	-	--	12,260									
		3	-	44.1	55.9	--	.4	-	--	-	--	14,710									
2001 ft. 6 in. to 2003 ft. 10 in.	D-99654	1	2.1	38.5	47.8	11.6	.3	-	--	-	--	12,760	2,910+	---	---	--	-	-	28	½	27-½
		2	-	39.4	48.7	11.9	.3	-	--	-	--	13,030									
		3	-	44.7	55.3	--	.4	-	--	-	--	14,790									
2005 ft. 9 in. to 2007 ft. 9 in.	D-99655	1	2.0	33.3	39.2	25.5	.3	-	--	-	--	10,620	2,910+	---	---	--	-	-	24	3	21
		2	-	34.0	40.0	26.0	.3	-	--	-	--	10,840									
		3	-	46.0	54.0	--	.5	-	--	-	--	14,650									
2034 ft. 11 in. to 2040 ft. 3 in.	D-99656	1	2.3	37.6	49.4	10.7	.4	-	--	-	--	12,860	2,910+	---	---	--	-	-	64	19	45
		2	-	38.4	50.7	10.9	.4	-	--	-	--	13,160									
		3	-	43.1	56.9	--	.4	-	--	-	--	14,770									
2080 ft. 3 in. to 2091 ft. 1 in.	D-99657	1	2.0	40.6	49.3	8.1	.6	-	--	-	--	13,260	2,090	2,210	2,490	--	-	-	118	36-½	81-½
		2	-	41.4	50.3	8.3	.6	-	--	-	--	13,520									
		3	-	45.1	54.9	--	.6	-	--	-	--	14,740									

[1] (1) As received; (2) Moisture-free; and (3) Moisture- and ash-free.
[2] Ratio, silicon carbide to coal, 15:1; crushing strength in kilograms.

TABLE 6. - Analyses of diamond-drill core samples, western part of the district

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-1:																					
111 ft. 4 in. to	E-18650	1	3.6	40.3	40.9	15.2	0.3	5.0	63.9	1.1	14.5	11,200	2,210	2,330	2,540	1.45	--	--	132	--	132
122 ft. 4 in.		2	--	41.8	42.4	15.8	.3	4.8	66.3	1.1	11.7	11,620									
		3	--	49.7	50.3	--	.4	5.7	78.7	1.3	13.9	13,790									
691 ft. 4 in. to	No. 8	1	2.3	--	--	33.5	--	--	--	--	--	8,820	--	--	--	--	--	--	204	48	156
708 ft. 4 in.		2	--	--	--	34.3	--	--	--	--	--	9,020									
		3	--	--	--	--	--	--	--	--	--	13,730									
709 ft. 7 in. to	No. 9	1	2.5	--	--	11.3	--	--	--	--	--	12,360	--	--	--	--	--	--	81	4	77
716 ft. 4 in.		2	--	--	--	11.6	--	--	--	--	--	12,680									
		3	--	--	--	--	--	--	--	--	--	14,340									
720 ft. 10 in. to	No. 10	1	2.6	--	--	15.4	--	--	--	--	--	11,780	--	--	--	--	--	--	75	24	51
722 ft. 10 in.		2	--	--	--	15.8	--	--	--	--	--	12,090									
		3	--	--	--	--	--	--	--	--	--	14,360									
730 ft. 7 in. to	No. 11	1	2.4	--	--	9.0	--	--	--	--	--	12,620	--	--	--	--	--	--	225	44	181
749 ft. 4 in.		2	--	--	--	9.2	--	--	--	--	--	12,930									
		3	--	--	--	--	--	--	--	--	--	14,230									
799 ft. 6 in. to	No. 12	1	2.3	--	--	12.2	--	--	--	--	--	12,180	--	--	--	--	--	--	95	--	95
807 ft. 5 in.		2	--	--	--	12.5	--	--	--	--	--	12,470									
		3	--	--	--	--	--	--	--	--	--	14,250									
817 ft. 8 in. to	No. 13	1	2.5	--	--	14.4	--	--	--	--	--	11,670	--	--	--	--	--	--	128	36	92
828 ft. 4 in.		2	--	--	--	14.8	--	--	--	--	--	11,970									
		3	--	--	--	--	--	--	--	--	--	14.050									
MC-2:																					
393 ft. 6 in. to	No. 14	1	2.6	--	--	16.3	--	--	--	--	--	11,090	--	--	--	--	--	--	443	151	292
430 ft. 5 in.		2	--	--	--	16.7	--	--	--	--	--	11,390									
		3	--	--	--	--	--	--	--	--	--	13.680									
534 ft. 11 in. to	No. 15	1	2.7	--	--	18.7	--	--	--	--	--	11,060	--	--	--	--	--	--	138	67	71
546 ft. 5 in.		2	--	--	--	19.3	--	--	--	--	--	11,370									
		3	--	--	--	--	--	--	--	--	--	14,080									
944 ft. 0 in. to	No. 16	1	2.2	--	--	15.1	--	--	--	--	--	11,790	--	--	--	--	--	--	491	160	331
984 ft. 11 in.		2	--	--	--	15.4	--	--	--	--	--	12.050									
		3	--	--	--	--	--	--	--	--	--	14,250									

See footnotes at end of table.

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-2 (Con.)																					
991 ft. 5 in. to 995 ft. 5 in.	No. 17	1	2.2	--	--	7.8	--	--	--	--	--	13,080	--	--	---	---	--	--	48	1	47
		2	--	--	--	8.0	--	--	--	--	--	13,370									
		3	--	--	--	--	--	--	--	--	--	14,540									
1030 ft. 3 in. to 1061 ft. 6 in.	No. 18	1	2.2	--	--	12.6	--	--	--	--	--	12,180	--	--	--	--	--	--	339	172	167
		2	--	--	--	12.8	--	--	--	--	--	12,460									
		3	--	--	--	--	--	--	--	--	--	14,300									
1167 ft. 6 in. to 1173 ft. 5 in.	No. 19	1	2.5	--	--	15.2	--	--	--	--	--	11,650	--	--	--	--	--	--	47	--	47
		2	--	--	--	15.6	--	--	--	--	--	11,940									
		3	--	--	--	--	--	--	--	--	--	14,140									
1363 ft. 9 in. to 1367 ft. 4 in.	No. 20	1	2.4	--	--	11.2	--	--	--	--	--	12,360	--	--	--	--	--	--	43	--	43
		2	--	--	--	11.4	--	--	--	--	--	12,660									
		3	--	--	--	--	--	--	--	--	--	14,300									
P-1:																					
247 ft. 3 in. to 251 ft. 0 in.	No. 1	1	2.9	--	--	18.3	--	--	--	--	--	10,970	--	--	--	--	--	--	45	--	45
		2	--	--	--	18.9	--	--	--	--	--	11,300									
		3	--	--	--	--	--	--	--	--	--	13,930									
254 ft. 6 in. to 267 ft. 8 in.	No. 2	1	2.6	--	--	24.5	--	--	--	--	--	9,850	--	--	--	--	--	--	158	63	95
		2	--	--	--	25.2	--	--	--	--	--	10,110									
		3	--	--	--	--	--	--	--	--	--	13,510									
271 ft. 4 in. to 277 ft. 10 in.	No. 3	1	3.1	--	--	8.9	--	--	--	--	--	12,490	--	--	--	--	--	--	78	2	76
		2	--	--	--	9.2	--	--	--	--	--	12,890									
		3	--	--	--	--	--	--	--	--	--	14,190									
309 ft. 10 in. to 311 ft. 10 in.	No. 4	1	3.2	--	--	11.5	--	--	--	--	--	12,040	--	--	--	--	--	--	24	--	24
		2	--	--	--	11.9	--	--	--	--	--	12,440									
		3	--	--	--	--	--	--	--	--	--	14,120									
322 ft. 10 in. 50 326 ft. 4 in.	No. 5	1	3.2	--	--	5.9	--	--	--	--	--	12,870	--	--	--	--	--	--	42	--	42
		2	--	--	--	6.1	--	--	--	--	--	13,290									
		3	--	--	--	--	--	--	--	--	--	14,150									

See footnotes at end of table.

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
P-1 (Con.):																					
332 ft. 0 in. to 339 ft. 4 in.	No. 6	1	3.1	--	--	8.9	--	--	--	--	--	12,390	--	--	--	--	--	--	88	--	88
		2	--	--	--	9.2	--	--	--	--	--	12,800									
		3	--	--	--	--	--	--	--	--	--	14,090									
428 ft. 10 in. to 436 ft. 1 in.	No. 7	1	3.1	--	--	16.4	--	--	--	--	--	11,190	--	--	--	--	--	--	87	--	87
		2	--	--	--	16.9	--	--	--	--	--	11,540									
		3	--	--	--	--	--	--	--	--	--	13,890									
MC-8:																					
471 ft. 7 in. to 481 ft. 0 in.	F-64479	1	3.2	36.9	46.0	13.9	0.3	5.1	66.4	1.1	13.2	11,770	--	--	--	--	--	--	113	17	96
		2	--	38.1	47.5	14.4	.3	4.9	68.6	1.2	10.6	12,160									
		3	--	44.5	55.5	--	.4	5.7	80.1	1.4	12.4	14,190									
481 ft. 0 in. to 490 ft. 10 in.	F-64480	1	3.1	36.9	47.1	12.9	.3	5.2	67.9	1.2	12.5	12,050	--	--	--	--	--	--	111	39	72
		2	--	38.1	48.6	13.3	.3	5.0	70.1	1.2	10.1	12,440									
		3	--	43.9	56.1	--	.4	5.8	80.8	1.4	11.6	14,340									
492 ft. 4 in. to 501 ft. 2-½ in.	F-64481	1	3.2	37.6	47.1	12.1	.3	5.2	68.3	1.2	12.9	12,080	--	--	--	--	--	--	106-½	67-½	39
		2	--	38.9	48.6	12.5	.4	5.0	70.6	1.3	10.2	12,470									
		3	--	44.4	55.6	--	.4	5.7	80.7	1.5	11.7	14,260									
515 ft. 4 in. to 523 ft. 8 in.	F-64482	1	2.9	39.2	47.4	10.5	.3	5.3	70.1	1.3	12.5	12,410	--	--	--	--	--	--	100	19	81
		2	--	40.4	48.8	10.8	.4	5.1	72.2	1.3	10.2	12,780									
		3	--	45.3	54.7	--	.4	5.7	80.9	1.5	11.5	14,330									
531 ft. 10 in. to 535 ft. 6 in.	F-64483	1	3.3	38.0	50.9	7.8	.8	5.3	71.7	1.2	13.2	12,740	--	--	--	--	--	--	41-½	4-½	37
		2	--	39.3	52.7	8.0	.8	5.1	74.1	1.3	10.7	13,170									
		3	--	42.7	57.3	--	.9	5.5	80.6	1.4	11.6	14,320									
MC-9:																					
429 ft. 5 in. to 434 ft. 3 in.	F-33782	1	2.3	38.6	30.7	28.4	--	--	--	--	--	--	--	--	--	--	--	--	56	10-½	45-½
		2	--	39.5	31.4	29.1	--	--	--	--	--	--									
		3	--	55.7	44.3	--	--	--	--	--	--	--									
442 ft. 8 in. to 444 ft. 8 in.	F-33783	1	2.7	36.9	43.6	16.8	--	--	--	--	--	--	--	--	--	--	--	--	24	--	24
		2	--	37.9	44.9	17.2	--	--	--	--	--	--									
		3	--	45.8	54.2	--	--	--	--	--	--	--									

See footnotes at end of table.

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-9 (Con.):																					
446 ft. 0 in. to 448 ft. 10 in.	F-33784	1	3.0	40.0	49.0	8.0	--	--	--	--	--	--	--	--	--	--	--	--	32	--	32
		2	--	41.2	50.6	8.2	--	--	--	--	--	--									
		3	--	44.9	55.1	--	--	--	--	--	--	--									
455 ft. 8 in. to 461 ft. 6 in.	F-33785	1	2.9	38.4	45.0	13.7	--	--	--	--	--	--	--	--	--	--	--	--	50	9	41
		2	--	39.5	46.4	14.1	--	--	--	--	--	--									
		3	--	46.0	54.0	--	--	--	--	--	--	--									
476 ft. 7 in. to 479 ft. 11 in.	F-33786	1	2.8	40.2	44.0	13.0	--	--	--	--	--	--	--	--	--	--	--	--	39	--	39
		2	--	41.3	45.3	13.4	--	--	--	--	--	--									
		3	--	47.7	52.3	--	--	--	--	--	--	--									
567 ft. 5 in. to 574 ft. 10 in.	F-33787	1	3.1	40.0	51.8	5.1	--	--	--	--	--	--	--	--	--	--	--	--	86	6	80
		2	--	41.3	53.4	5.3	--	--	--	--	--	--									
		3	--	43.6	56.4	--	--	--	--	--	--	--									
MC-14:																					
267 ft. 9 in. to 268 ft. 9 in.	F-64484	1	3.2	36.8	43.6	16.4	0.8	5.1	64.1	1.3	12.3	11,530	--	--	--	--	--	--	12	--	12
		2	--	38.0	45.0	17.0	.8	4.9	66.2	1.3	9.8	11,920									
		3	--	45.8	54.2	--	1.0	5.9	79.7	1.6	11.8	14,360									
MC-15:																					
184 ft. 10 in. to 190 ft. 5 in.	F-64485	1	3.1	38.4	45.4	13.1	1.3	5.2	66.6	1.3	12.5	11,930	--	--	--	--	--	--	67	24	43
		2	--	39.6	46.8	13.6	1.3	5.0	68.7	1.3	10.1	12,310									
		3	--	45.9	54.1	--	1.5	5.8	79.5	1.5	11.7	14,240									
208 ft. 7 in. to 213 ft. 4 in.	F-64486	1	3.7	33.9	45.1	17.3	.5	4.6	62.4	1.1	14.1	10,930	--	--	--	--	--	--	51	11	40
		2	--	35.2	46.9	17.9	.5	4.4	64.7	1.2	11.3	11,340									
		3	--	42.8	57.2	--	.6	5.3	78.9	1.4	13.8	13,820									
214 ft. 11 in. to 224 ft. 11 in.	F-64487	1	3.5	38.0	46.8	11.7	.8	5.2	67.9	1.3	13.1	12,060	--	--	--	--	--	--	120	--	120
		2	--	39.4	48.5	12.1	.8	5.0	70.3	1.4	10.4	12,500									
		3	--	44.9	55.1	--	.9	5.7	80.0	1.5	11.9	14,220									
224 ft. 11 in. to 228 ft. 5 in.	F-64488	1	3.3	38.3	45.0	13.4	.4	5.2	66.9	1.4	12.7	11,930	--	--	--	--	--	--	30	--	30
		2	--	39.6	46.6	13.8	.5	5.0	69.2	1.4	10.1	12,330									
		3	--	46.0	54.0	--	.5	5.8	80.3	1.6	11.8	14,310									

See footnotes at end of table.

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-15 (Con.):																					
233 ft. 6 in. to 236 ft. 8 in.	F-64489	1	3.4	34.3	38.9	23.4	0.4	4.8	58.0	1.2	12.2	10,350	--	--	--	--	--	--	38	4	34
		2	--	35.5	40.3	24.2	.4	4.5	60.0	1.2	9.7	10,720									
		3	--	46.8	53.2	--	.5	6.0	79.2	1.6	12.7	14,140									
236 ft. 8 in. to 239 ft. 11 in.	F-64490	1	3.6	35.1	42.2	19.1	.4	4.8	61.7	1.1	12.9	10,910	--	--	--	--	--	--	39	--	39
		2	--	36.4	43.8	19.8	.4	4.6	63.9	1.2	10.1	11,310									
		3	--	45.4	54.6	--	.5	5.7	79.7	1.5	12.6	14,110									
239 ft. 11 in. to 243 ft. 7 in.	F-64491	1	3.2	38.4	44.2	14.2	.4	5.3	66.2	1.3	12.6	11,820	--	--	--	--	--	--	44	--	44
		2	--	39.7	45.6	14.7	.4	5.1	68.3	1.3	10.2	12,210									
		3	--	46.5	53.5	--	.5	5.9	80.1	1.6	11.9	14,320									
243 ft. 7 in. to 247 ft. 0 in.	F-64492	1	3.4	39.0	46.7	10.9	.4	5.4	68.9	1.3	13.1	12,300	--	--	--	--	--	--	41	--	41
		2	--	40.4	48.3	11.3	.4	5.2	71.3	1.4	10.4	12,730									
		3	--	45.5	54.5	--	.4	5.8	80.4	1.6	11.8	14,350									
247 ft. 0 in. to 248 ft. 1 in.	F-64493	1	3.2	42.0	47.9	6.9	.4	5.6	72.4	1.5	13.2	12,980	--	--	--	--	--	--	13	--	13
		2	--	43.4	49.5	7.1	.4	5.4	74.8	1.5	10.8	13,410									
		3	--	46.7	53.3	--	.5	5.9	80.5	1.7	11.4	14,440									
248 ft. 1 in. to 249 ft. 10 in.	F-64494	1	3.4	37.3	45.9	13.4	.4	5.2	66.8	1.3	12.9	11,890	--	--	--	--	--	--	21	--	21
		2	--	38.6	47.6	13.8	.4	5.0	69.1	1.4	10.3	12,310									
		3	--	44.8	55.2	--	.5	5.8	80.2	1.6	11.9	14,290									
249 ft. 10 in. to 252 ft. 11 in.	F-64495	1	3.0	30.9	31.5	34.6	.3	4.2	48.7	1.0	11.2	8,690	--	--	--	--	--	--	37	--	37
		2	--	31.8	32.5	35.7	.3	4.0	50.2	1.0	8.8	8,960									
		3	--	49.5	50.5	--	.4	6.2	78.1	1.6	13.7	13,930									
252 ft. 11 in. to 254 ft. 8 in.	F-64496	1	3.6	35.7	43.2	17.5	.4	4.9	63.5	1.2	12.5	11,230	--	--	--	--	--	--	21	--	21
		2	--	37.0	44.9	18.1	.4	4.7	65.8	1.2	9.8	11,650									
		3	--	45.2	54.8	--	.5	5.7	80.4	1.5	11.9	14,230									
258 ft. 0 in. to 260 ft. 0 in.	F-64497	1	3.3	37.2	40.7	18.8	.3	5.0	62.4	1.3	12.2	11,140	--	--	--	--	--	--	24	--	24
		2	--	38.4	42.1	19.5	.4	4.8	64.6	1.3	9.4	11,520									
		3	--	47.7	52.3	--	.4	6.0	80.2	1.6	11.8	14,300									
963 ft. 7 in. to 964 ft. 10 in.	F-65119	1	2.4	30.3	32.1	35.2	.3	4.2	48.7	1.1	10.5	8,690	--	--	--	--	--	--	15	--	15
		2	--	31.0	33.0	36.0	.3	4.0	49.9	1.1	8.7	8,900									
		3	--	48.5	51.5	--	.5	6.3	78.0	1.8	13.4	13,910									

See footnotes at end of table

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-16:																					
281 ft. 9 in. to 284 ft. 5 in.	F-65120	1	2.2	35.0	45.6	17.2	0.4	5.1	65.6	1.5	10.2	11,660	--	--	--	--	--	--	28	3	25
		2	--	35.7	46.7	17.6	.4	4.9	67.0	1.5	8.6	11,920									
		3	--	43.4	56.6	--	.5	6.0	81.4	1.8	10.3	14,470									
326 ft. 6 in. to 327 ft. 6 in.	F-65121	1	2.1	33.0	39.7	25.2	.3	4.7	58.6	1.4	9.8	10,420	--	--	--	--	--	--	12	--	12
		2	--	33.7	40.6	25.7	.3	4.5	59.8	1.5	8.2	10,650									
		3	--	45.3	54.7	--	.5	6.1	80.5	2.0	10.9	14,330									
334 ft. 2 in. to 336 ft. 2 in.	F-65122	1	2.1	33.4	37.6	26.9	.5	4.6	56.6	1.4	10.0	10,120	--	--	--	--	--	--	24	--	24
		2	--	34.1	38.4	27.5	.5	4.5	57.8	1.4	8.3	10,330									
		3	--	47.0	53.0	--	.7	6.1	79.7	1.9	11.6	14,250									
MC-18:																					
80 ft. 0 in. to 82 ft. 5 in.	F-65123	1	2.6	35.0	36.1	26.3	.3	4.7	56.6	1.2	10.9	10,090	--	--	--	--	--	--	29	--	29
		2	--	35.9	37.2	26.9	.3	4.5	58.1	1.2	9.0	10,360									
		3	--	49.2	50.8	--	.4	6.2	79.5	1.6	12.3	14,170									
131 ft. 6 in. to 132 ft. 3 in.; 149 ft. 9 in. to 153 ft. 6 in.	F-65124	1	2.2	28.5	26.9	42.4	.2	3.9	42.7	.9	9.9	7,590	--	--	--	--	--	--	9	--	9
		2	--	29.1	27.5	43.4	.2	3.7	43.6	.9	8.2	7,760									
		3	--	51.4	48.6	--	.4	6.5	77.0	1.6	14.5	13,700	--	--	--	--	--	--	45	11	34
154 ft. 4 in. to 159 ft. 6 in.	F-65125	1	2.9	37.2	42.9	17.0	.4	5.1	64.4	1.1	12.0	11,420	--	--	--	--	--	--	62	20	42
		2	--	38.3	44.2	17.5	.4	4.9	66.3	1.1	9.8	11,760									
		3	--	46.5	53.5	--	.5	5.9	80.4	1.3	11.9	14,260									
160 ft. 0 in. to 161 ft. 0 in.	F-65126	1	2.8	34.7	41.0	21.5	.3	4.8	60.3	1.0	12.1	10,750	--	--	--	--	--	--	12	--	12
		2	--	35.7	42.2	22.1	.3	4.6	62.0	1.1	9.9	11,060									
		3	--	45.8	54.2	--	.4	5.9	79.6	1.4	12.7	14,200									
168 ft. 0 in. to 175 ft. 0 in.	F-65127	1	2.5	38.0	39.0	20.5	.3	5.0	61.5	1.1	11.6	11,020	--	--	--	--	--	--	84	12	72
		2	--	38.9	40.1	21.0	.3	4.9	63.0	1.1	9.7	11,290									
		3	--	49.3	50.7	--	.4	6.2	79.7	1.5	12.2	14,300									

See footnotes at end of table

TABLE 6. - Analyses of diamond-drill core samples, western part of the district (Con.)

Drill hole	Laboratory No.	Condition[1]	Proximate, percent				Ultimate, percent					Calorific value, B.t.u.	Fusibility of ash			Real specific gravity	Free swelling index	Agglutinating index[2]	Core received, inches	Core rejected, inches	Core analyzed, inches
			Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen		Initial deformation temperature, °F	Softening temperature, °F	Fluid temperature, °F						
MC-18 (Con.):																					
175 ft. 7 in. to 183 ft. 4-½ in.	F-65128	1	2.6	34.2	35.4	27.8	0.4	4.6	54.8	1.1	11.3	9,750	--	--	--	--	--	--	93-½	25-½	68
		2	--	35.1	36.4	28.5	.4	4.4	56.3	1.1	9.3	10,010									
		3	--	49.1	50.9	--	.6	6.1	78.8	1.6	12.9	14,000									
193 ft. 11 in. to 196 ft. 0 in.	F-65129	1	2.9	35.8	44.1	17.2	.4	4.8	63.5	1.3	12.8	11,070	--	--	--	--	--	--	21-½	--	21-½
		2	--	36.9	45.4	17.7	.4	4.6	65.4	1.3	10.6	11,400									
		3	--	44.9	55.1	--	.5	5.6	79.5	1.6	12.8	13,860									
199 ft. 0 in. to 200 ft. 6 in.	F-65130	1	2.8	38.0	43.8	15.4	.3	5.2	66.1	1.4	11.6	11,750	--	--	--	--	--	--	18	--	18
		2	--	39.1	45.1	15.8	.3	5.0	68.0	1.4	9.5	12,090									
		3	--	46.5	53.5	--	.3	6.0	80.8	1.7	11.2	14,360									
207 ft. 1 in. to 224 ft. 9 in.	F-65131	1	3.0	37.7	43.8	15.5	.4	5.0	65.6	1.3	12.2	11,620	--	--	--	--	--	--	212	143	69
		2	--	38.9	45.1	16.0	.4	4.8	67.7	1.3	9.8	11,980									
		3	--	46.3	53.7	--	.4	5.7	80.5	1.5	11.9	14,260									
226 ft. 9 in. to 227 ft. 9 in	F-65132	1	2.8	36.0	41.6	19.6	.4	5.0	62.2	1.3	11.5	11,050	--	--	--	--	--	--	12	--	12
328 ft. 4 in. to 333 ft. 0 in.		2	--	37.0	42.9	20.1	.4	4.8	63.9	1.3	9.5	11,350									
		3	--	46.3	53.7	--	.5	6.0	80.0	1.7	11.8	14,220	--	--	--	--	--	--	56	44-½	11-½

[1] (1) As received; (2) Mositure-free, and (3) Moisture- and ash-free.
[2] Ratio, silicon carbide to coal, 15:1; crushing strength in kilograms.

Contracts

Core Drilling

Diamond-core drilling contact with Boyles Brothers Drilling Co., Salt Lake City, Utah

(Drilling conducted during 1953 and 1954)

		Estimated quantity	Unit	Unit price
1.	Drilling and setting standpipe through overburden to accomodate continued drilling:			
	(a) 0 to 50 feet depth.....	150	feet	$12.00
	(b) Footage over 50 feet depth.....	150	do.	18.00
2.	Drilling, NX core			
	(a) From bottom of standpipe to 500 feet...	1,200	do.	9.00
	(b) From 500 to 1,000 feet.....	900	do.	11.00
	(c) From 1,000 to 1,500 feet.....	500	do.	13.50
	(d) From 1,500 but not exceeding 2,000 feet.....	100	do.	16.00
3.	Reaming for NX casting	500	do.	2.50
4.	Drilling with mud (additional to 2, a-d)	1,000	do.	1.00
5.	Drilling conglomerate (additional to 2, a-d)	100	do.	8.00
6.	Cementing	100	do.	5.00
7.	Surveying and other delay	5	hours	17.00
8.	Plugging holes with cement	450	feet	2.00
9.	Discount for drilling over minimum of 3,000 to a maximum of 20,000 feet including the minumum, 10 percent.			

Churn Drilling

Churn drilling contract with Penn Jersey Drilling Co., Spenard, Alaska

(Drilling accomplished during field seasons of 1956 and 1957)

		Estimated quantity	Unit	Unit price
1.	Churn drilling and setting standpipe to depths as required (depth per hole was not expected to exceed 200 feet, but maximum depth was not specifically specified).....	500	feet	$12.00
2.	Same as above but to maximum of 2,000 feet (including the minimum).....	1,500	do.	12.00
3.	Supply and set standpipe of not less than 3 inches or more than $3\frac{1}{2}$ inches inside diameter (at the discretion of the Government, standpipe remained in the hole to accommodate subsequent core drilling).....	--	do.	1.00

Tractor Rental

Tractor rental contract with C. J. McMahan, Palmer, Alaska

(Work performed during field season of 1953)

	Estimated quantity	Unit	Unit price
1. Rental on tractor (Caterpillar D-8 or equivalent) equipped with heavy-duty blade and extra wide track; fully operated, including operator, fuel, supplies, maintenance, etc.:			
Minimum of	100	hours	$13.85
Over minimum to maximum of	400	do.	13.85
2. Rental of carryall of not less than 6-cubic-yard capacity:			
Minimum of	5	do.	5.00
Over minimum to maximum of	80	do.	5.00
3. Transportation of tractor from Palmer, Alaska to and from such projects as directed by the Government:			
Minimum of	5	do.	20.00
Over minimum to maximum of	20	do.	20.00
4. Transportation of carryall from Palmer, Alaska to and from such projects and at such times as ordered by the Government:			
Minimum of	5	do.	20.00
Over minimum to maximum of	20	do.	20.00

Dragline Trenching

Dragline trenching contract with Oneco, Inc., Anchorage, Alaska

(Work performed during 1955 field season)

	Estimated quantity	Unit	Unit price
Dragline excavation of trenches to a width of 4 feet on bedrock with sides sloped to natural angle of repose:			
Minimum	5,000	cubic yard	$ .60
Additional to maximum of 25,000 cubic yards	20,000	do.	.45

Note. - Work performed with a $\frac{3}{4}$-cubic-yard crawler-type machine.

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