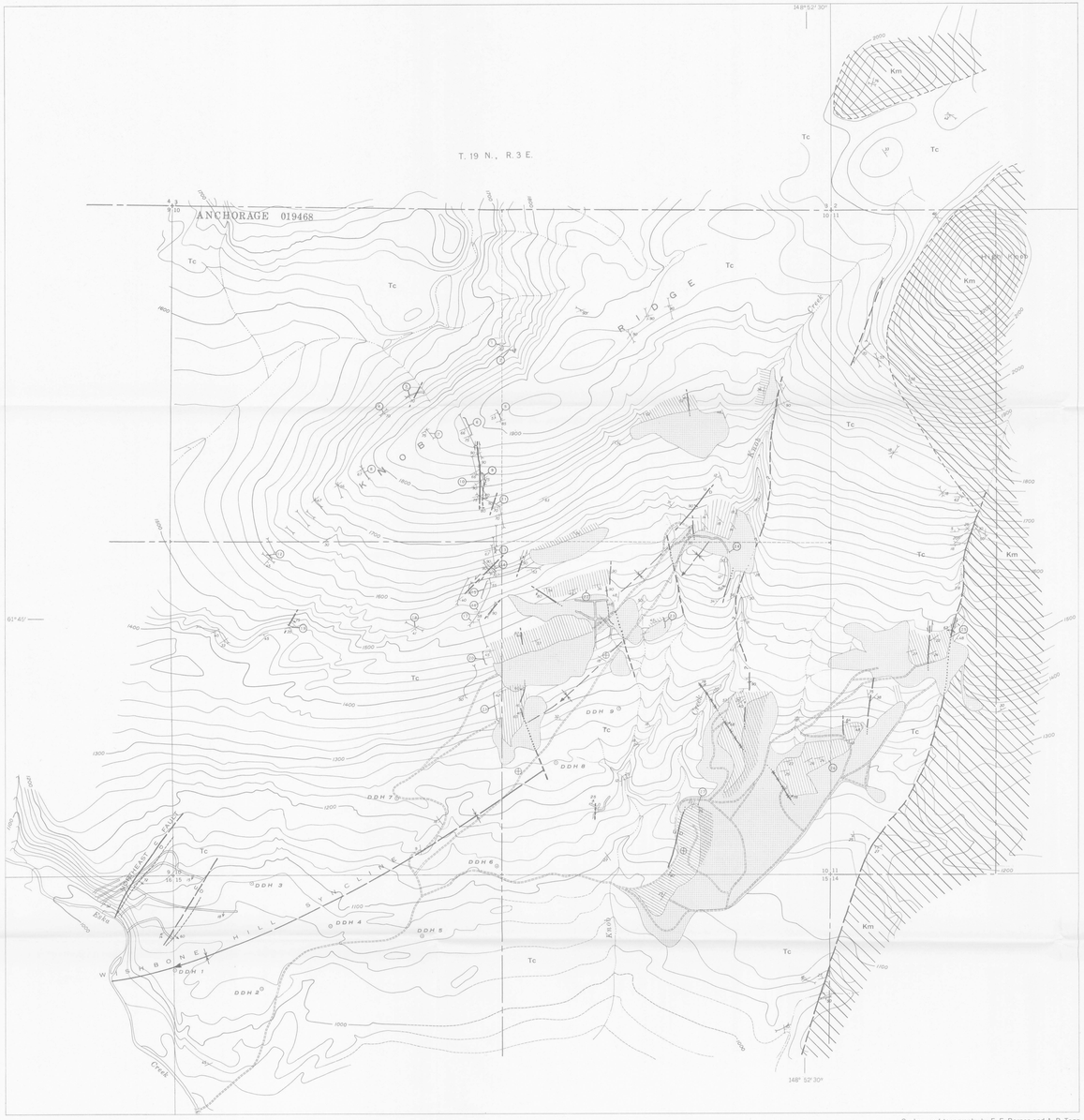


Geology and topography by F. F. Barnes and A. R. Tagg, assisted by D. W. Hinckley and E. H. Cobb. Surveyed by planetable in 1956 and 1958

EXPLANATION

Eocene or younger

Basic dike, showing dip

Tc — Chickaloon Formation
Moderately indurated sandstone, siltstone, claystone and bituminous coal

Paleocene or Eocene

Km — Matanuska Formation
Well-indurated sandstone and dark shale

Lower and Upper Cretaceous

CRETACEOUS TERTIARY

Contact, approximately located
May include fault contacts around base of High Knob

Fault, showing dip
Dashed where approximately located; short dashed where inferred; queried where doubtful; dotted where concealed. U, upthrown side; D, downthrown side; arrows show relative direction of horizontal movement

Vertical fault

Fault in underground mine workings, showing dip

Syncline
Showing trace of axial plane and bearing and plunge of axis. Dashed where approximately located

Strike and dip of beds

Strike of vertical beds

Horizontal beds

Underground mine workings, showing dip of beds

Strip-mined area

Mine waste

Back-filled stripping

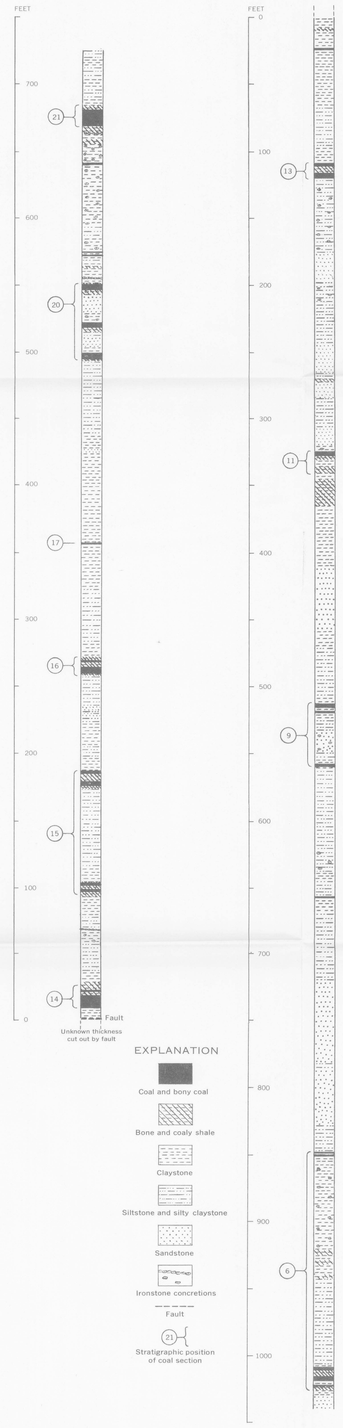
Exploratory trench

DDH 2 — Vertical diamond-drill hole
Drilled by U.S. Bureau of Mines 1947-48

Boundary of coal-leasing unit

Location of measured coal section

STRATIGRAPHIC SECTION OF SOUTH SLOPE OF KNOB RIDGE BETWEEN COAL-SECTION LOCALITIES 6 AND 21



EXPLANATION

Coal and bony coal

Bone and coaly shale

Claystone

Siltstone and silty claystone

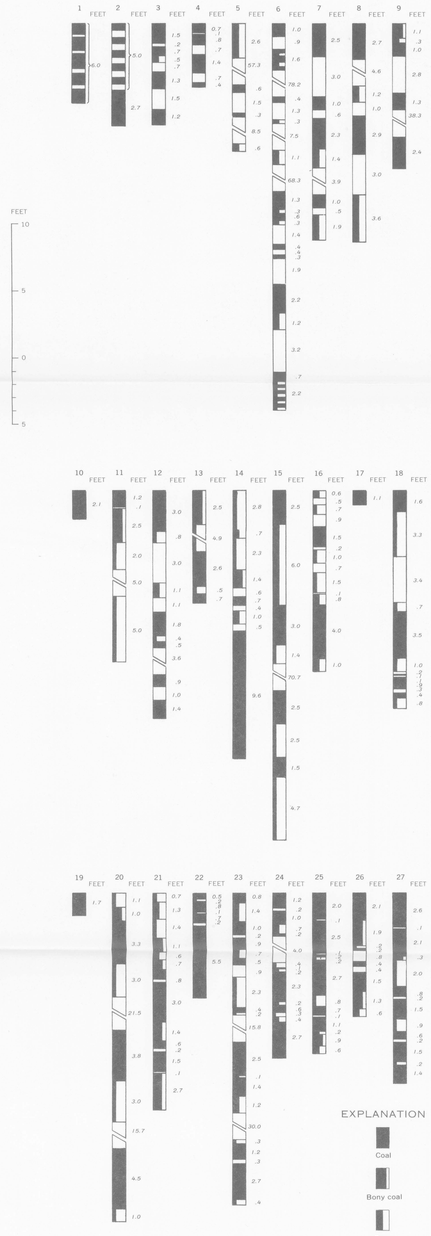
Sandstone

Ironstone concretions

Fault

Stratigraphic position of coal section

SECTIONS OF COAL BEDS IN THE KNOB CREEK AREA
(See circled numbers on map for locations)



EXPLANATION

Coal

Bony coal

Bone

Coaly shale

Claystone, siltstone, and sandstone

INTRODUCTION

The Knob Creek area is an eastern extension of the Wishbone Hill district of the Matanuska coal field, of south-central Alaska. The present map is intended as a supplement to a more comprehensive report on the Wishbone Hill district (Barnes and Payne, 1956), and includes information obtained from subsequent mine development, detailed surface mapping, and exploratory trenching. Fieldwork began in 1956 when the writer, assisted by D. W. Hinckley, started the preparation of a large-scale (1:1,800) topographic map and the plotting of all natural and artificial bedrock exposures by plane-table methods. In 1958 work was resumed with the aid of a small crawler-type tractor equipped with a bulldozer blade and power auger, for exposing and tracing coal beds or other stratigraphic units under shallow cover. During this season the writer, assisted by E. H. Cobb, geologist, and A. R. Tagg and R. C. Sickels, field assistants, completed mapping the topography and bedrock exposures, including those in natural outcrops, bulldozer trenches, and the several strip pits of the Mrak Coal Company mine.

The writer wishes to acknowledge the cooperation of William Mrak and Julius Moor of the Mrak Coal Company in furnishing information and assisting in every way possible during the investigation.

STRATIGRAPHY

The only bedrock formations exposed in the Knob Creek area are the Matanuska Formation, of marine origin and of Early and Late Cretaceous age, and the coal-bearing Chickaloon Formation, of continental origin and of early Tertiary age. A single small basic dike cuts beds of the Chickaloon Formation in the eastern part of the area.

MATANUSKA FORMATION

The Matanuska Formation, which underlies extensive areas in the Matanuska Valley (Capps, 1940, p. 77, pl. 1), is exposed in the Knob Creek area only along the eastern margin, where its contact with the Chickaloon Formation is, at least in large part, along a fault. As typically exposed in the gorge of Granite Creek, about a mile to the east of Knob Creek, the Matanuska Formation consists of well-indurated light- to dark-gray thin- to thick-bedded sandstone, dark-gray sandy shale, and dark-gray to black shale (Martin and Katz, 1912, p. 34-35). In the Knob Creek area the dominant rock types are medium-gray sandstone and dark-gray sandy shale.

CHICKALOON FORMATION

All except the extreme eastern edge of the Knob Creek area is underlain by coal-bearing rocks of the Chickaloon Formation, of Paleocene or early Eocene age. This formation typically consists of moderately indurated medium-gray to buff feldspathic sandstone, medium-gray siltstone and silty claystone, and medium- to dark-gray claystone. It also contains many beds of bituminous coal, which in the Knob Creek area are a few inches to 9½ feet thick in measured sections, although some coal more than 10 feet thick has been mined. All the strata, including the coal, tend to intergrade both along and across the bedding. The known coal beds, including those at localities 1 to 4 about 300 feet below the base of the measured stratigraphic section, are distributed through a thickness of at least 2,500 feet of strata.

In most exposures the rocks of the Chickaloon and Matanuska Formations differ lithologically: the typical shale of the Matanuska Formation is readily distinguished by its darker color, greater hardness, and platy fracture, and the sandstone is generally darker, harder, and more evenly bedded; however in certain areas, particularly near the Cretaceous-Tertiary contact, the rocks of the Chickaloon Formation tend to be harder and darker in color, so that in isolated outcrops they are distinguished with difficulty from those of the Matanuska Formation. For this reason it is possible that some of the rocks mapped as Matanuska are actually in the lower part of the Chickaloon Formation. The contact between the two formations is exposed at only one point, locality 25, where coal-bearing rocks are faulted against hard dark-gray sandstone. As platy shale typical of the Matanuska Formation was found a short distance to the east, the fault is considered to be at the contact between the two formations. The position of the contact around the base of High Knob is questionable, as the beds exposed in the trench east of the mapped contact on the southwest slope possibly represent the lower part of the Chickaloon. Bedrock exposed at the highest points on High Knob and the smaller hill to the north is typical platy shale of the Matanuska Formation, however, and coal-bearing rocks were found near the base of both hills. The most reliable criteria for distinguishing the two formations are the presence of coal in the Chickaloon Formation and of marine fossils in the Matanuska Formation.

QUATERNARY DEPOSITS

The entire Knob Creek area is covered with at least a thin veneer of unconsolidated material, except where it has been removed by recent stream erosion or strip-mining operations. This material consists in large part of residual soil but also includes deposits of gravel, sand, and clay of glacial or fluvioglacial origin. Exceptionally thick deposits were found in a few places. Stripping operations near locality 24, just west of Knob Creek, exposed at least 30 feet of sand and gravel, and a combination of trenching and auger boring 800 feet north of the southwest corner of section 10 passed through 45 feet of sand, gravel, and clay without reaching bedrock.

STRUCTURE

The strata of the Knob Creek area have been extensively deformed by both folding and faulting, as shown by many divergent dips and the large number of faults exposed by strip mining. Because of the general lack of outcrops few of the folds or faults can be traced more than short distances. The Wishbone Hill syncline, which has been traced for 6 miles under Wishbone Hill to the west, trends northeastward from the southwest corner of the Knob Creek area, where its axis is well defined by the position and attitude of coal beds in old mine workings and diamond-drill holes. It probably extends as far as Knob Creek near locality 24, but it apparently is offset and otherwise deformed by north-trending faults, several of which are exposed in strip pits on the northwest limb. The northwest limb of the syncline appears to be monoclinal, broken only by several northwest- to northeast-trending faults mostly in the eastern half of section 10. A distinctive series of thin coal beds underlain by yellow sandstone was traced in a series of bulldozer trenches along the crest of Knob Ridge from locality 6 to locality 12. The continuity, without appreciable offset, of these beds indicates that major north-ward-trending faults are absent in the western half of the section.

Southeast of the synclinal axis the attitudes of beds in strip pits and the few outcrops show that the structure is much more complex, being characterized by considerable local crumpling and several north-trending faults of large displacement. At least one more syncline may be present.

Neither the direction nor the amount of displacement could be determined on most of the faults, but the relative direction of movement was determined on a few. Drag and slickenside surfaces along several faults on the south slope of Knob Ridge and the large fault south of High Knob indicate left-lateral displacement. Similarly, near the center of the map area, the apparent offsets of the synclinal axis by the north-trending faults exposed in strip pits on the north limb indicate that these faults also are left-lateral. On the other hand, the apparent displacement of the northeasterrmost segment of the synclinal axis suggests the presence of a fault with right-lateral displacement, and the basic dike east of Knob Creek also appears to have been offset by right-lateral movement of a north-trending fault.

COAL

Measured sections on the north and south slopes of Knob Ridge indicate that at least 14 coal beds containing 2 to 9⅜ feet of coal are included in about 2,000 feet of strata on the north limb of the Wishbone Hill syncline in this area. (See stratigraphic section and detailed coal sections.) This sequence is equivalent to strata exposed in the Eska-Jonesville area to the west, but because of dissimilarities resulting from lateral changes in thickness and lithology, no positive correlation of individual beds in the two areas could be made. However, it is reasonably certain that the Premier and Eska groups of coal beds, which were identified in mine workings and diamond-drill holes in the southwest corner of the Knob Creek area (Barnes and Payne, 1956, p. 67-69), are also present in the upper part of the Knob Ridge section, probably between localities 15 and 21. All the strip pits west of Knob Creek are undoubtedly on coal beds included in this sequence, and it is possible that those east of Knob Creek are also; however, the scarcity of exposures, lack of recognizable beds, and the prevalence of faults permitted only those beds in the pits close to the measured section to be located stratigraphically.

The coal of the Knob Creek area, like that of the rest of the Wishbone Hill district, is high-volatile B bituminous in rank. A representative analysis of a tipple sample from the Mrak mine gave the following results, on the as-received basis (Aresco and others, 1956, p. 49):

Moisture	5.3
Volatile matter	38.6
Fixed carbon	44.5
Ash	16.9
Sulfur	.4
B.t.u.	11,390

The detailed coal sections show that many of the coal units are multiple beds, consisting of two or more benches of clean coal separated by partings of rock or impure coal. Lateral changes in both thickness and character are typical of both coal beds and partings, so that a unit consisting of thin coal benches separated by dirty coal or bone not uncommonly grades into a thick bed of relatively clean coal within a short distance along the bedding.

Detailed estimates of coal reserves contained in specific beds or in different parts of the Knob Creek area cannot be made because of lack of detailed data on structure and correlations. However it is apparent from the number and distribution of coal beds of minable thickness that the reserves are comparatively large. An estimate of the order of magnitude of original reserves was made by assuming that the total thickness of coal in beds 2 feet or more in thickness on the south slope of Knob Ridge is representative of the total area underlain by those beds, which is estimated roughly at somewhat less than one-half square mile, or 300 acres. As the total coal thickness is about 50 feet, and the average weight of bituminous coal in the ground is about 1,800 tons per acre-foot, the original reserves in the Knob Creek area on this basis would be 27 million tons, most of which would be recoverable only by underground methods. Data are insufficient for estimating the amount that might be recoverable by stripping.

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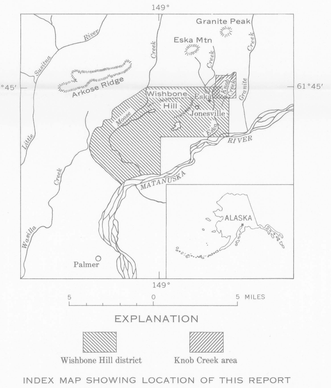

EXPLANATION

Wishbone Hill district

Knob Creek area

INDEX MAP SHOWING LOCATION OF THIS REPORT

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—62018

TOPOGRAPHIC AND GEOLOGIC MAP OF THE KNOB CREEK AREA OF THE WISHBONE HILL DISTRICT, MATANUSKA COAL FIELD, ALASKA

By

F. F. Barnes

SCALE 1:6000

500 0 500 1000 FEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

1962

COAL INVESTIGATIONS
MAP C-51

For sale by U. S. Geological Survey, price 50 cents