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Report of Investigations 5430

RECONNAISSANCE OF THE BELUGA RIVER COALFIELD, ALASKA

BY R. P. MALONEY

United States Department of the Interior — 1958

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RECONNAISSANCE OF THE BELUGA RIVER COALFIELD, ALASKA[1/]

by

R. P. Maloney[2/]

SUMMARY

The Bureau of Mines conducted a reconnaissance of the less accessible parts of the Beluga River coalfield in August 1957 to determine, if possible, which areas were most favorable for developing large reserves of coal suitable for open-pit mining. Several outcrops of subbituminous coal were observed within an area about 30 miles long and 3 miles wide; neither the length nor the width of the coal-bearing area was delineated by the examination.

Coal beds 30 feet thick or more outcrop at two places, and beds 5 to 20 feet thick or more outcrop fairly abundantly along the Beluga River and its tributaries The coal measures appear to occur in a series of folds. The overburden comprises glacial gravels and poorly cemented sandstones and ranges from 20 to 400 feet in depth. Few partings were seen in any of the coal beds. Samples ranged in calorific value from 6,240 to 8,246 B. t. u. on an as-received basis. Adequate water is available for stripping by hydraulic methods.

INTRODUCTION

Rapid expansion in the military and civilian solid-fuel requirements in the Anchorage area has resulted in a steadily increasing demand for more and cheaper power. Low-cost energy may be available in the Beluga River Basin, which is within easy transmission-line range (50 to 70 miles) of Anchorage. Although the region is largely unexplored, early reconnaissance along the more accessible parts of the Beluga River established the existence of coal beds as much as 30 feet thick and indicated that low-cost opencut mining, coupled with on-site generation of electricity, might be feasible. Development of these resources would have an important bearing on plans for future expansion of power-production facilities in the Anchorage area.

As part of the United States Department of the Interior's continuing program for developing Alaska's natural resources, the Bureau of Mines began preliminary investigations of the Beluga coalfield in August 1957. This work included reconnaissance of the more inaccessible areas to determine the extent of the coal deposits, the location and thickness of coal beds, and the methods believed most favorable for developing large reserves of strippable coal.

This report summarizes the findings of previous investigations in the Beluga field and describes the work done by the Bureau in August 1957.

1/ Work on manuscript completed June 1958.

2/ Mine examination and exploration engineer, Bureau of Mines, Region I, Juneau, Alaska.

ACKNOWLEDGMENTS

In consolidating available data on the Beluga coalfield, the author used various publications of the Geological Survey. Special thanks are due F. F. Barnes, of the Geological Survey, and Phil R. Holdsworth, of the Territorial Department of Mines, for pertinent information on conditions in the area and the best means of access. Acknowledgment also is made to the Office of the Alaska District Engineer, Department of the Army, for the use of maps of the area; to the Federal Fish and Wildlife Service for the use of transportation facilities not otherwise available; and to the United States Air Force for making part of the nearby bombing range available for examination.

LOCATION AND ACCESSIBILITY

The Beluga River coalfield is in the Cook Inlet-Susitna region, Redoubt district, Spurr subdistrict,[3/] and lies between latitudes 61° 30' N. and 61° 51' N., and longitudes 151° 00' W. and 151° 35' W. (See figs. 1 and 2.) The field is 10 to 15 miles east of the Triumvirate and Capps glaciers, which head in large icefields on the east slope of the Alaska Range, and about 20 miles southwest of Mount Susitna.

Beluga Lake, a large glacier-fed body of water 60 airline miles northwest of Anchorage, is a prominent landmark near the northern half of the coalfield. The Beluga River starts from the east end of this lake, flows southeast, and empties into the northern end of Cook Inlet about 35 miles west of Anchorage. Coal Creek Lake, a small lake 4 miles north of Beluga Lake, is drained by Coal Creek, which empties into the east end of Beluga Lake. The principal coal outcrops were found along the cutbanks of these two streams and along one small branch of Beluga River.

The region is uninhabited and has no roads or trails. The Beluga River can be navigated by small boats only during high water, but navigation is extremely hazardous owing to the steep gradient, many rapids, large glacial boulders, and blocks of coal. Seaplanes can operate on Beluga Lake, Coal Lake, and a wide section of Beluga River 3 miles below the outlet of Beluga Lake, and airfields suitable for small landplanes could be built without too much difficulty. Crawler-type tractors could travel over most of the coalfield.

At high tide a barge can be landed about 1 mile upstream from the mouth of the Beluga River. Part of the field is within the Cook Inlet bombing and gunnery range. (See fig. 2.)

PHYSICAL FEATURES AND CLIMATE

The Beluga River coalfield is in a gently rolling piedmont plain of low to moderate relief covered with a mantle of glacial and stream material and marked by numerous small lakes surrounded by marshes. Spruce and cottonwood trees as much as 2 feet in diameter and birch trees as much as 1 foot in diameter are common; a thick undergrowth of brush covers the grounds within the stands of timber. Luxuriant grass 7 to 8 feet high and dense stands of alders grow along the streams. Travel in the area is slow and arduous.

Beluga River and Coal Creek are the largest streams in the field. The gradient of Coal Creek is steep; in places the banks are almost vertical and more than 100 feet high. Beluga River has a moderate current for the first 6 miles of its course from

3/ Ransome, A. L., and Kerns, W. A., Names and Definitions of Regions, Districts, and Subdistricts in Alaska: Bureau of Mines Inf. Circ. 7679, 1954, p. 21.

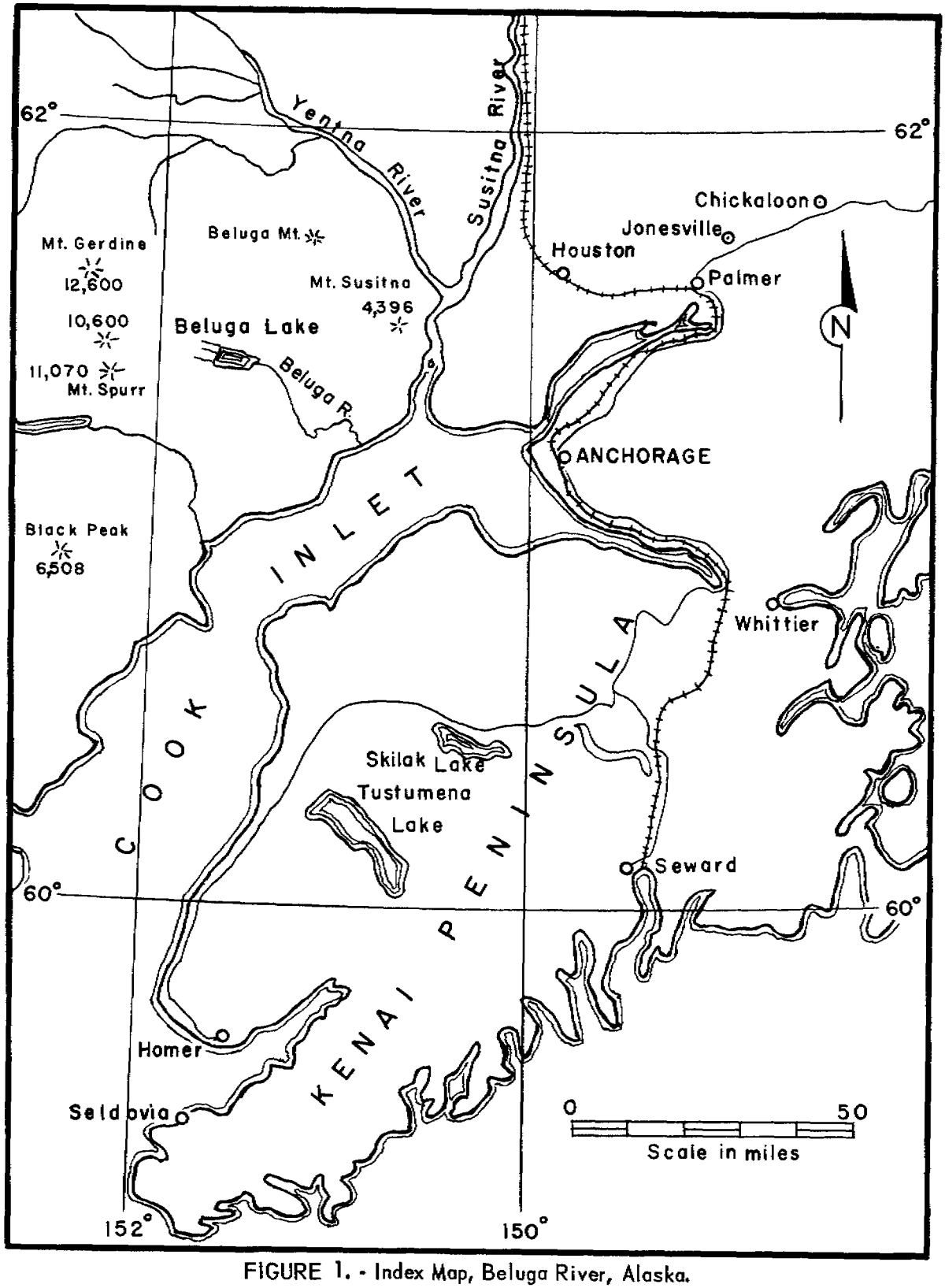

FIGURE 1. - Index Map, Beluga River, Alaska.

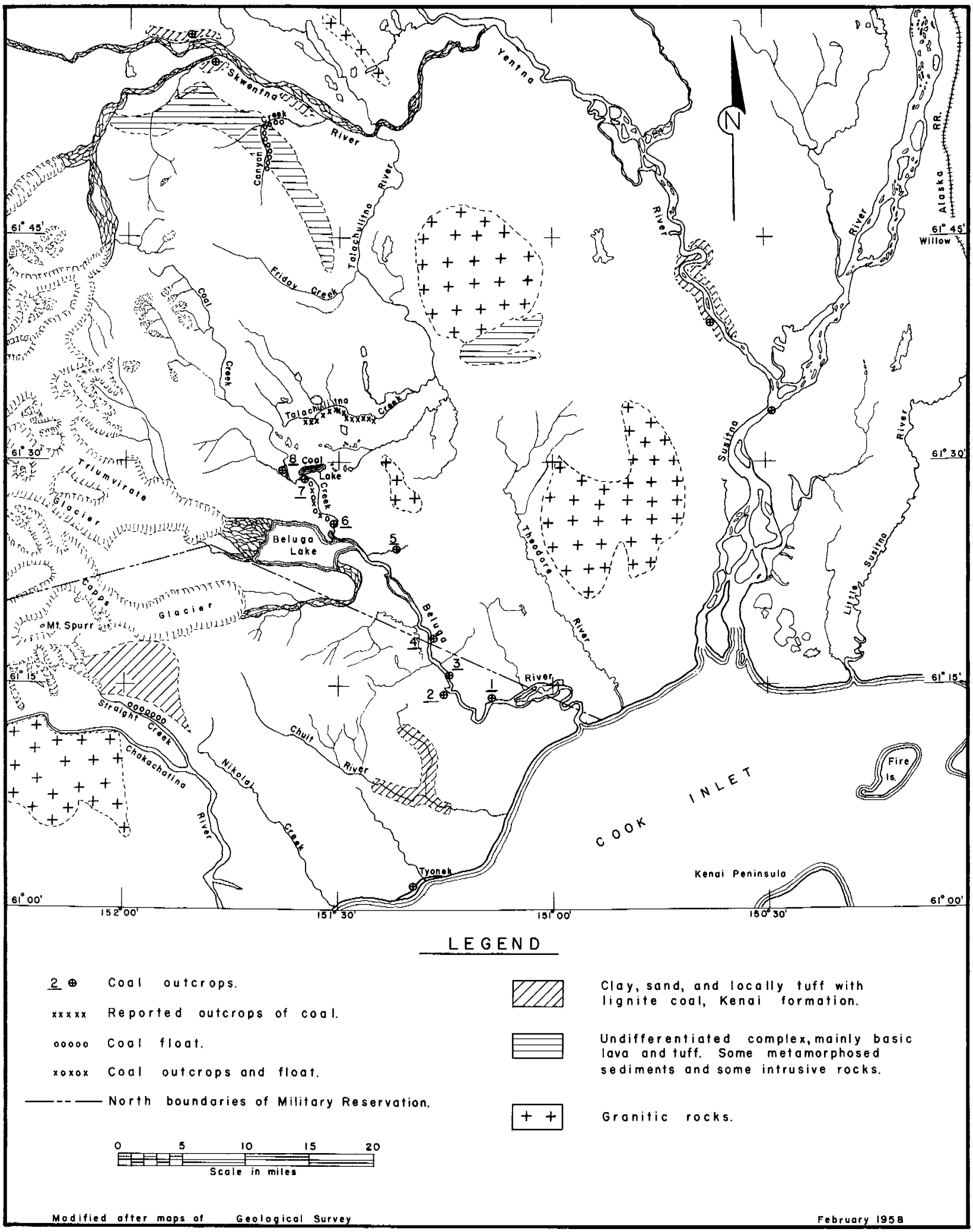

FIGURE 2. - Geologic and Location Map of Beluga River Coalfield, Alaska.

Beluga Lake to the south end of a wide section of the stream, locally called Lower Beluga Lake. From this point to the mouth the gradient becomes steeper, and in places the banks are perpendicular cliffs as much as 500 feet high. The small branch streams are generally of low gradient but occasionally have cutbanks 40 to 50 feet high.

No weather records are available, but the climate is similar to that in other parts of the Cook Inlet region; summers are mild, with many cloudy days, and winters are severe, with considerable snow. The annual precipitation probably is about 20 inches. No permafrost was evident.

GENERAL GEOLOGY

The only geological information available on the Beluga River Basin is contained in brief reports describing two coal exposures on the Beluga River. These exposures, referred to later in this paper as outcrops 1 and 3, were examined by the Geological Survey, the Bureau of Mines, and the Territorial Department of Mines.

During a study of the Cook Inlet coals in 1906, W. W. Atwood[4/] examined what is probably outcrop 1 on the Beluga River, 10 miles upstream from the point where Beluga River empties into Cook Inlet. He believed that the exposed coal beds and sediments were similar to those along the beach at Tyonek, where a section 1,000 feet thick and containing at least 36 coal beds as much as 20 feet thick had been measured. He assigned these coal-bearing sediments to the Kenai formation of upper Eocene time.

In 1954, F. F. Barnes[5/] examined outcrop 3 and reported beds nearly 30 feet thick. The Federal Bureau of Mines (in 1955) and the Territorial Department of Mines (in 1956) made brief examinations of the same outcrop.

Geological reports of adjacent areas indicate possible extension of the coal measures to areas beyond the Beluga River Basin. Capps[6/] reported coal beds as much as 15 feet thick along the Skwentna River and its tributaries. He also reported abundant lignite float on Straight and Canyon Creeks and numerous coal outcrops along the headwaters of the Talachulitna River. The headwaters of the Talachulitna River are only a few miles north of Coal Lake, but Straight and Canyon Creeks are 25 miles southwest and 30 miles north, respectively, of Coal Lake; therefore, indications are that the coal-bearing formations extend well over 50 miles.

The following brief outline of the geology of the region is summarized from Geological Survey reports and field observations made by the Bureau of Mines in 1957.

The Beluga River field is underlain by Tertiary coal-bearing sediments that consist of a series of beds of unconsolidated to moderately consolidated clays and sandstones, tentatively correlated with the Kenai formation exposed at Tyonek. Except where exposed by stream action, the formations are concealed by vegetation and glacial gravels. The sedimentary exposures seen by all investigators were only part of a complete section, and nowhere was the basement on which they lie observed. Granitic intrusives, however, outcropped east of Beluga Lake; probably they are of Cretaceous age,[7/] so have not altered or disturbed the coal deposits.

4/ Atwood, W. W., Mineral Resources of Southwestern Alaska: Geol. Survey Bull. 379, 1909, pp. 116-121,125-126.

5/ Barnes, F. F., Notes on a Coal Deposit on the Beluga River: Geol. Survey Open-File Rept., 1955, p. 3.

6/ Capps, Stephen R., The Skwentna Region; Mineral Resources of Alaska: Geol. Survey Bull. 797, 1929, pp. 86-87. The Southern Alaska Range: Geol. Survey Bull. 862, 1935, pp. 95-96.

7/ Work cited in second reference, footnote 6, pp. 72, 73.

In post-Eocene time the mountains surrounding the Beluga River Basin probably were uplifted, with subsequent folding of the Tertiary coal-bearing sediments. Then, erosion by streams and glaciers removed much of the upturned edges of the coal deposits and the greatly deformed sections. Later, the coal crops and beds were covered by deposits of glacial material and stream gravels, as is evident in the coal beds exposed at the lower end of Coal Creek.

Figure 2 shows the general geology of the region and the location of the known coal crops (or indications of crops).

DESCRIPTION OF DEPOSITS

During this reconnaissance, eight outcrops of coal measures were noted along the banks of the Beluga River, Coal Creek, and a small tributary of the Beluga River. To facilitate describing and locating them, the author refers to these outcrops as outcrops 1 to 8, inclusive, (See fig. 2.)

Outcrop 1, at the southern end of the field, is exposed in a 500-foot cutbank of the Beluga River and was observed by the author only from the air. Atwood[8/] examined and sampled what was probably this measure in 1906; a summary from his report follows:

> The sediments here exposed are similar in character to those at Tyonek and comprise loose sands, sandstones, clays, shales, and conglomerates. Near the base of the section and below the conglomerate are two beds of coal 10 and 12 feet thick. The strike of the beds ranges from N. 17° E. to N. 22° W., and the dip averages about 55°.

A sample of the 12-foot bed was taken by Atwood; an analysis of the sample is given in table 1.

Outcrop 2 is exposed on the west bank of the Beluga River, about 5 miles upstream from outcrop 1. It was observed by the author from the air only and is difficult to see. It is doubtful if it could be observed from the river. The bed was exposed for about 50 feet in a vertical bank and is probably a continuation of a 30-foot bed exposed in outcrop 3 farther upstream on the opposite bank (fig. 2).

At the time of this examination outcrop 3 was inaccessible, because high water prevented landing by helicopter on the river bar; moreover, the exposure could not be reached from the rim of the canyon because of the almost vertical banks of the Beluga River. The description given herein is based on aerial observation by the author and on reports of previous examinations by the Geological Survey,[9/] the Territorial Department of Mines,[10/] and the Bureau of Mines.[11/]

Two beds are exposed in the east canyon wall of the Beluga River. The top bed is 20 to 30 feet thick and the bottom bed 15 to 20 feet thick. (See figs. 3 and 4.) The top bed is exposed for approximately 4,000 feet and is about 150 feet below the canyon rim at its southern end and about 400 feet below the rim at its northern end, where it passes below water level. The strike of the top bed is about N. 35° W. and

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8/ Work cited in footnote 4.
9/ Work cited in footnote 4.
10/ Holdsworth, Phil R., Beluga River Coal Field: Territorial Dept. of Mines, Mineral Investigations Rept., March 1957, 5 pp.
11/ May, Robert R., Reconnaissance Trip to Beluga Coal Field: Bureau of Mines Letter Rept., July 1955, 4 pp.

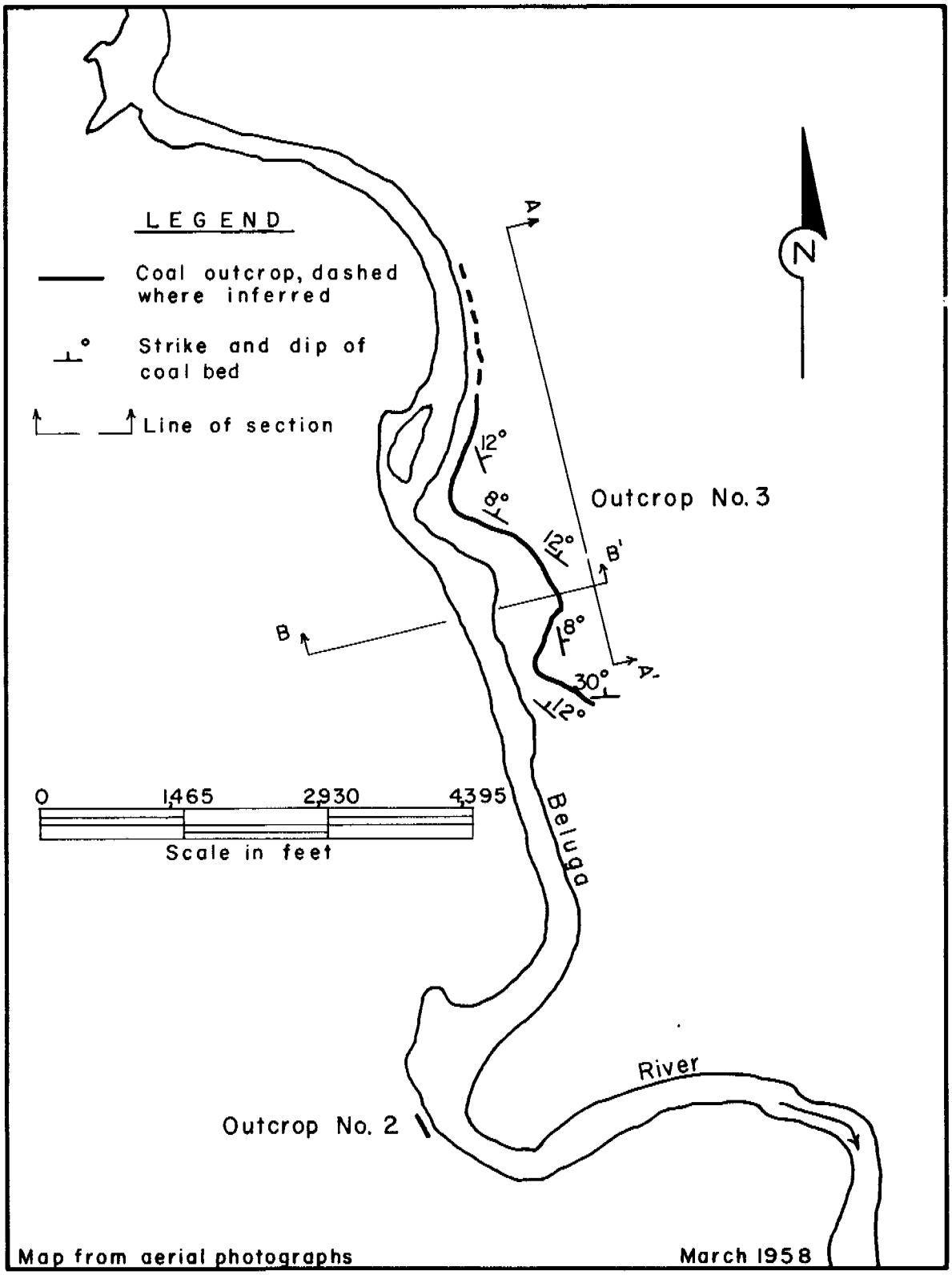

FIGURE 3. - Coal Outcrops 2 and 3 on Beluga River.

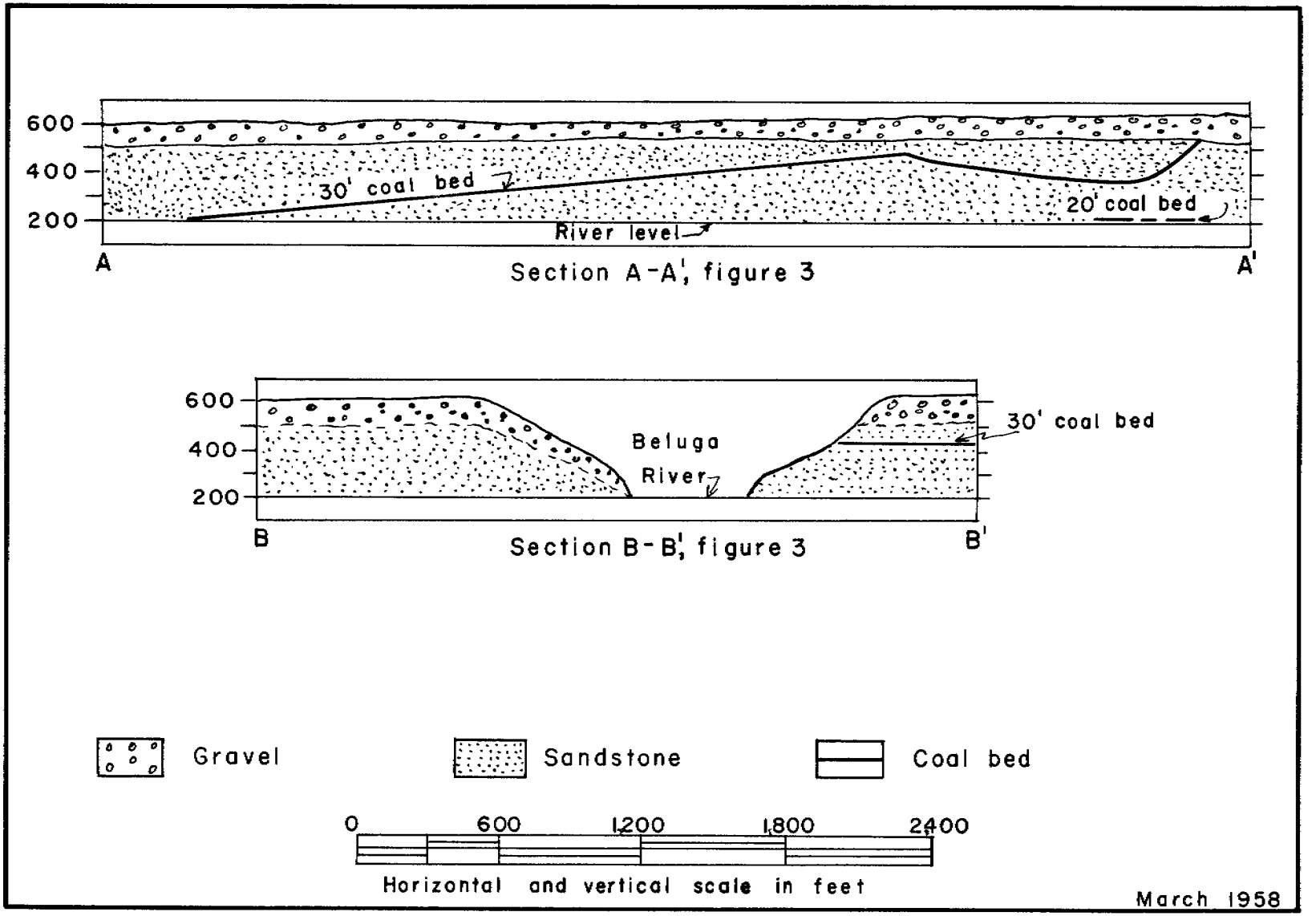

FIGURE 4. - Cross Sections of Coal Outcrop 3 on Beluga River.

the dip 8° to 12° NE. Near the southern end of the 4,000-foot exposure the bed is in an anticlinal fold that plunges gently eastward, and at the south end the bed turns up sharply to dip 31° N. and is cut off at the base of a mantle of gravel.

Directly below the south end of the upper bed, a lower bed 15 to 20 feet thick is exposed at river level; it lies about 200 feet stratigraphically below the upper bed and plunges below water level within a short distance.

No thick partings were observed in either bed. The sediments in which the beds occur are fine-grained, soft sandstones, overlain by about 100 feet of glacial gravels that appear to contain few large boulders. The river bed is about 200 feet and the canyon rim about 600 feet above sea level. Table 1 gives analyses of samples taken by Barnes and by the Territorial Department of Mines.

As observed from the air, outcrop 4 is exposed for approximately 50 feet in a bluff on the east bank of the Beluga River about 3 miles upstream from outcrop 3. Where exposed, the layered bed of coal appeared to be 20 to 30 feet thick and to dip slightly to the north.

Outcrop 5 (figs. 5 and 6) is about 3 miles east of the lower end of Beluga Lake on a small, unnamed tributary of the Beluga River. A 30-foot bed of coal with no partings is exposed above the waterline. How much of the bed was under water could not be determined. It dips 15° to 20° NE. and appears to be part of the north limb of an anticline that plunges about 20° N. 35° W. The cover comprises 15 to 20 feet of loose stream gravels with no large boulders. No other coal outcrops were observed upstream, but considerable coal float and remnants of coal outcrops were seen in the bed and along the banks for approximately 7,000 feet downstream from the point where the 30-foot bed was exposed.

The stream has a flat gradient and low sloping banks that are covered with a heavy growth of alders and brush. The outcrop was examined during a period of little rainfall, but the stream was still about 30 feet wide and 2 to 3 feet deep and flowed at a rate of about 1 foot per second. An analysis of a sample from this bed is given in table 1.

Outcrop 6 is about 1 mile upstream from the mouth of Coal Creek. At least 2 beds are exposed at intervals in both banks of the creek for about 3,000 feet, measured along the creek bed, or 1,000 feet measured in a straight line. The thickness of the top bed ranges from 6 to 20 feet and that of the bottom bed from 5 to 10 feet. (See figs. 7 and 8.)

This coal measure is folded into a syncline; the trough is below the creek bed, and both limbs are exposed in the creek banks. The syncline strikes about N. 55° W. and probably plunges gently to the northwest. Two beds are exposed in the south limb; the top bed is 20 feet thick and is separated by 200 feet of poorly cemented, soft, fine-grained sandstone and shale from a 10-foot bottom bed. Both beds are cut off at the base of a 50-foot mantle of stream gravels. The top bed dips 40° NE. at the base of the gravel deposit and 15° where it plunges below the creek bed. The bottom bed dips 40° NE. Samples 1 and 2 are from the 20-foot top bed; the bottom bed was inaccessible for sampling.

Two beds reappear from the creek bed 600 feet upstream from the point where the 20-foot bed disappears. They are on the north limb of the syncline and dip 8° SW. Where the beds reappear the top one is 6 feet thick and is separated by 15 feet of soft, fine-grained sandstone from a 10-foot bottom bed, but in about 50 feet of strike

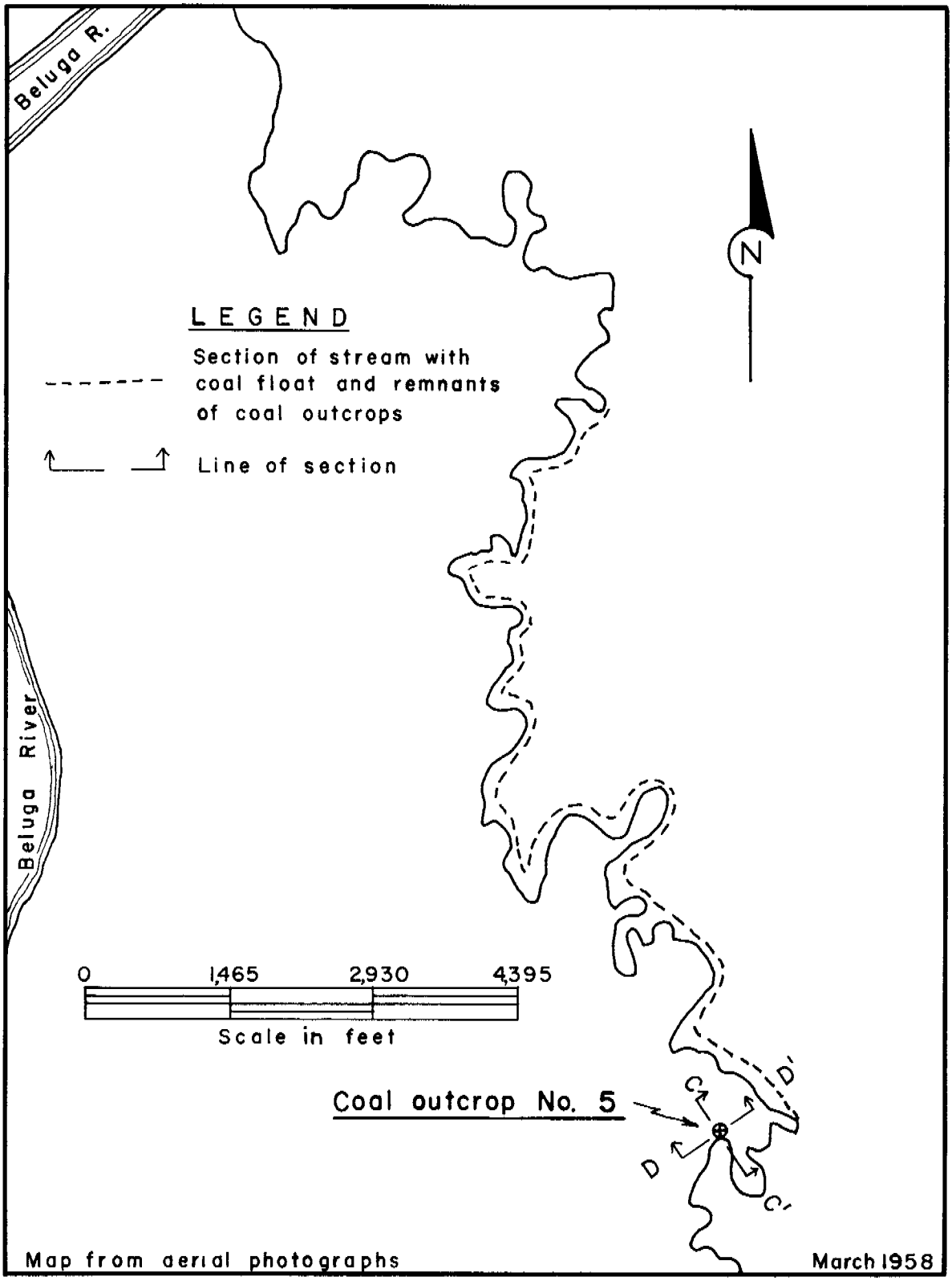

FIGURE 5. - Coal Outcrop 5, East of Beluga Lake.

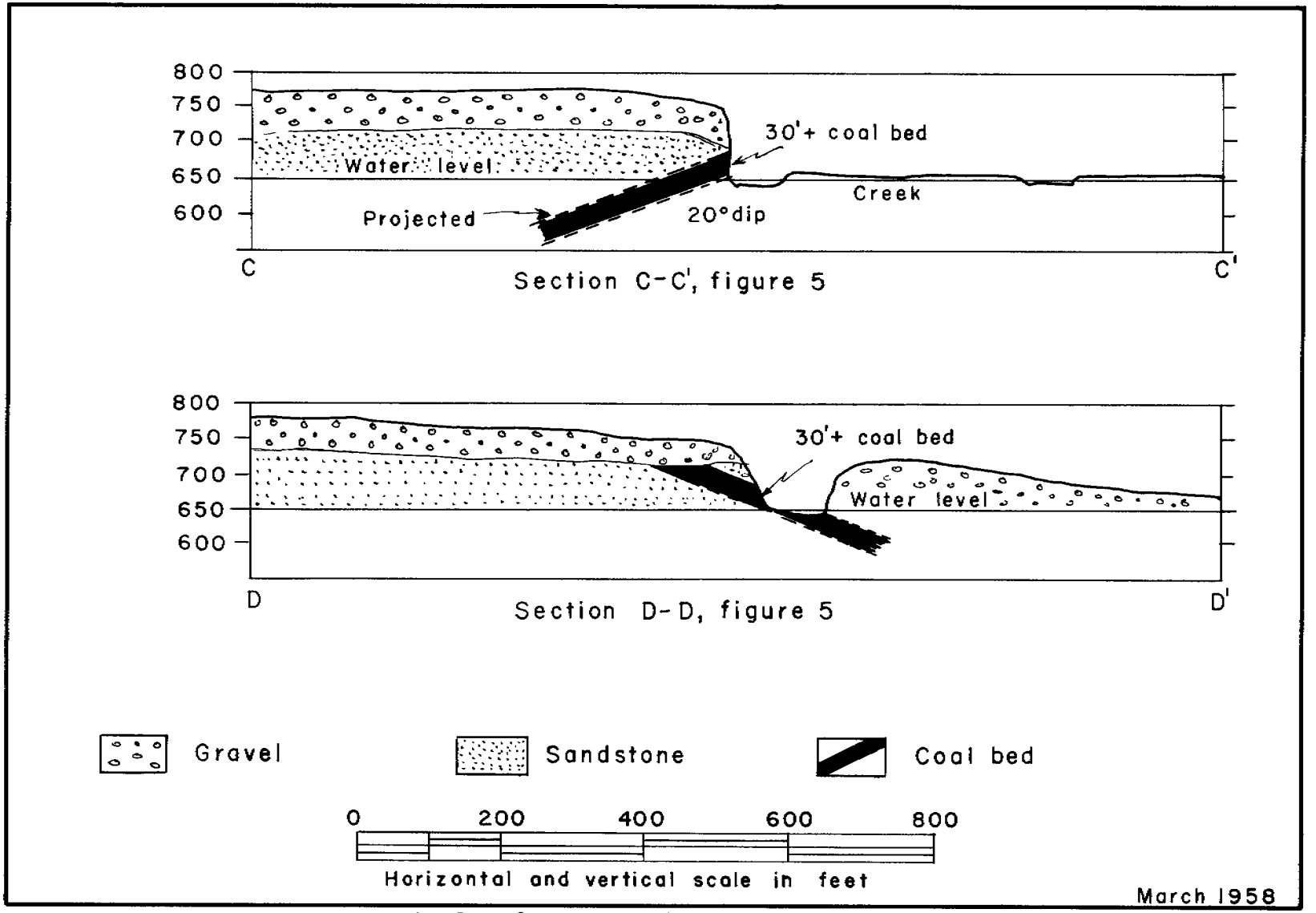

FIGURE 6. - Cross Sections of Coal Outcrop 5, East of Beluga Lake.

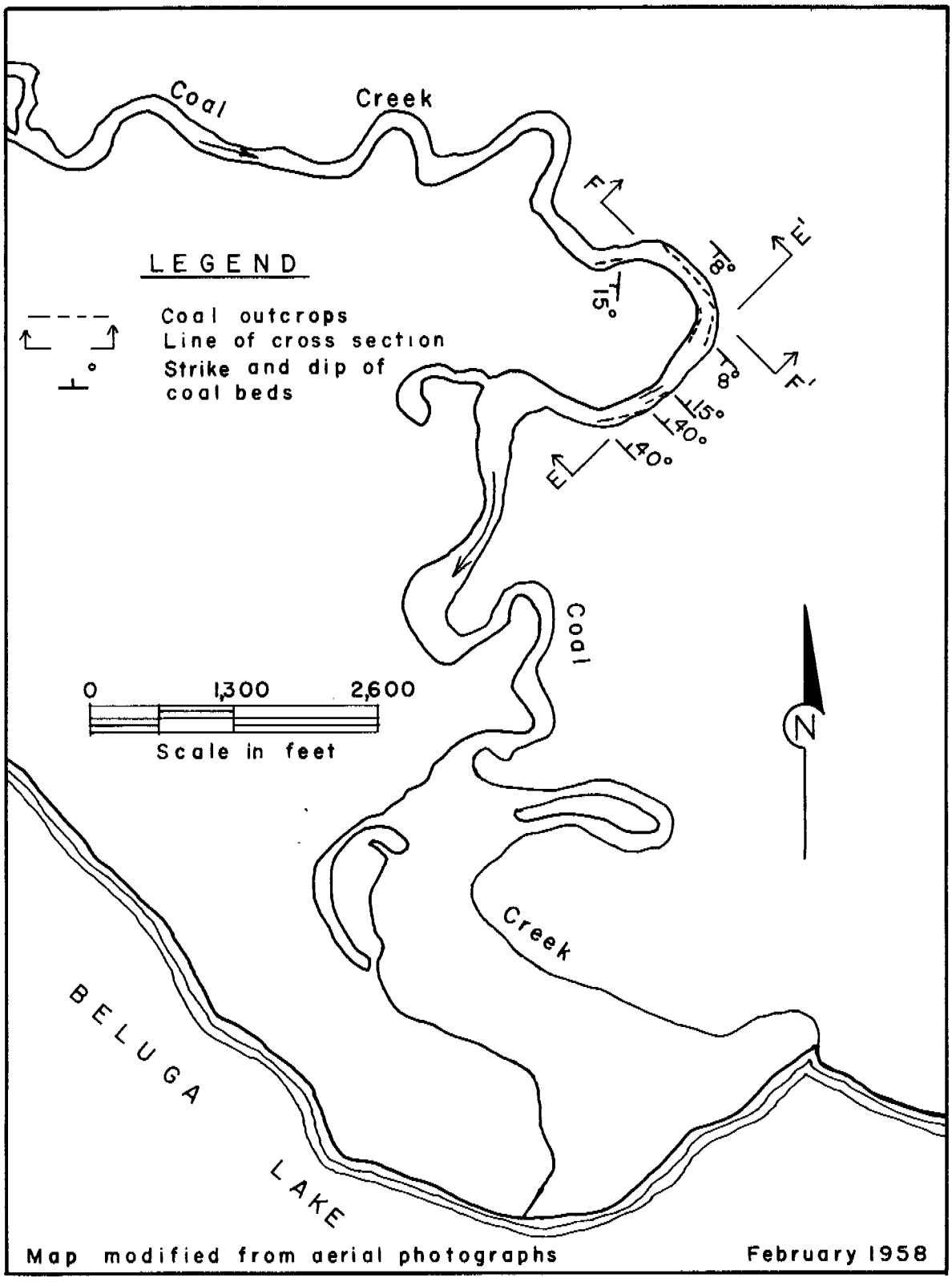

FIGURE 7. - Coal Outcrop 6, Near Mouth of Coal Creek.

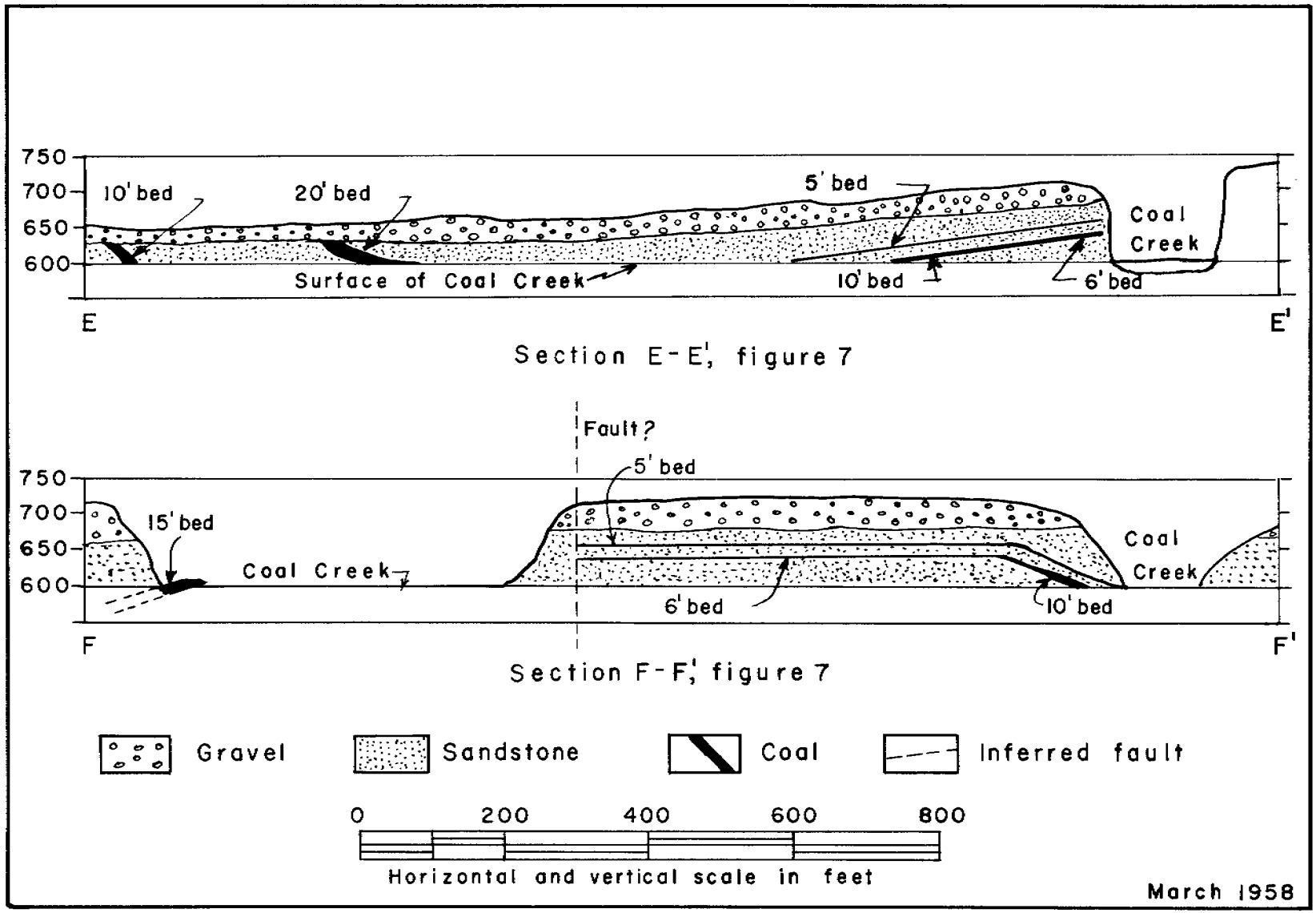

FIGURE 8. - Cross Sections of Coal Outcrop 6, Near Mouth of Coal Creek.

length the top bed decreases in thickness to 5 feet and the bottom bed to 6 feet. The same 15-foot interval separates the beds, and they maintain this interval and size for about 700 feet in a vertical sandstone and shale bank of the creek and end abruptly at the northwest end of the exposure by faulting; 15 feet of sandstone comprises the roof rock of the top bed, and about 50 feet of stream gravels overlies this roof rock. Samples 3 and 4 were taken from the top and bottom beds, respectively, near the water level. Table 1 includes analyses of samples from outcrop 6.

About 500 feet upstream from the northwest end of this outcrop a 15-foot bed is exposed at water level. It dips under the creek about 20° NW. Considerable coal float and remnants of coal outcrops near water level are found along Coal Creek between this point and Coal Lake.

Outcrop 7 is on Coal Creek about 1/4 mile south of Coal Lake. A coal bed at least 15 feet thick is exposed at water level for about 500 feet along the north bank of the creek. (See figs. 9 and 10.) The bed strikes S. 10° E. and dips 15° S.; it goes under the creek bed at midstream. At high water this bed probably would be completely covered. A 1-foot parting of fine-grained clay lies 14 inches below the top of the bed. The immediate roof rock is soft, fine-grained sandstone with a minimum cover of 200 feet of sandstone and stream gravels. Large granite boulders are found in the bed of the creek at this point. Samples 6, 8, and 9 were taken from this bed, and analyses of these samples are given in table 1.

Outcrop 8 was observed from the air. It appears to be the remnant of a coal bed approximately 10 feet thick and is exposed near water level along the south bank of Coal Creek about 1 mile north of Coal Lake. Approximately 50 feet of sandstone, shale, and gravel covers the outcrop, which was the most northerly one seen.

CONCLUSIONS

During this reconnaissance, exposed coal beds ranging from 5 to 30 feet or more in thickness were found at infrequent intervals for more than 25 miles along the Beluga River and its tributaries. There is strong evidence that the coal-bearing formations extend from Tyonek (on Cook Inlet) northward to the Skwentna River, or more than 65 miles. Except where occasionally exposed by stream action, the coal measures are hidden by overburden and/or a thick cover of vegetation. The most favorable place for the development of strip coal appears to be near outcrop 5. (See p. 9 and figs. 5 and 6.) At this outcrop, 15 to 20 feet of loose stream gravel overlies a 30-foot bed of coal. Other areas considered favorable for developing strip coal are near outcrops 3 and 4. Although the overburden appears to be heavier in these areas than near outcrop 5, the coal measures occur in a series of gentle folds, suggesting that the depth of cover may vary considerably. Therefore, the possibility of locating additional areas of shallow cover by core drilling or other method of subsurface exploration appears to be favorable.

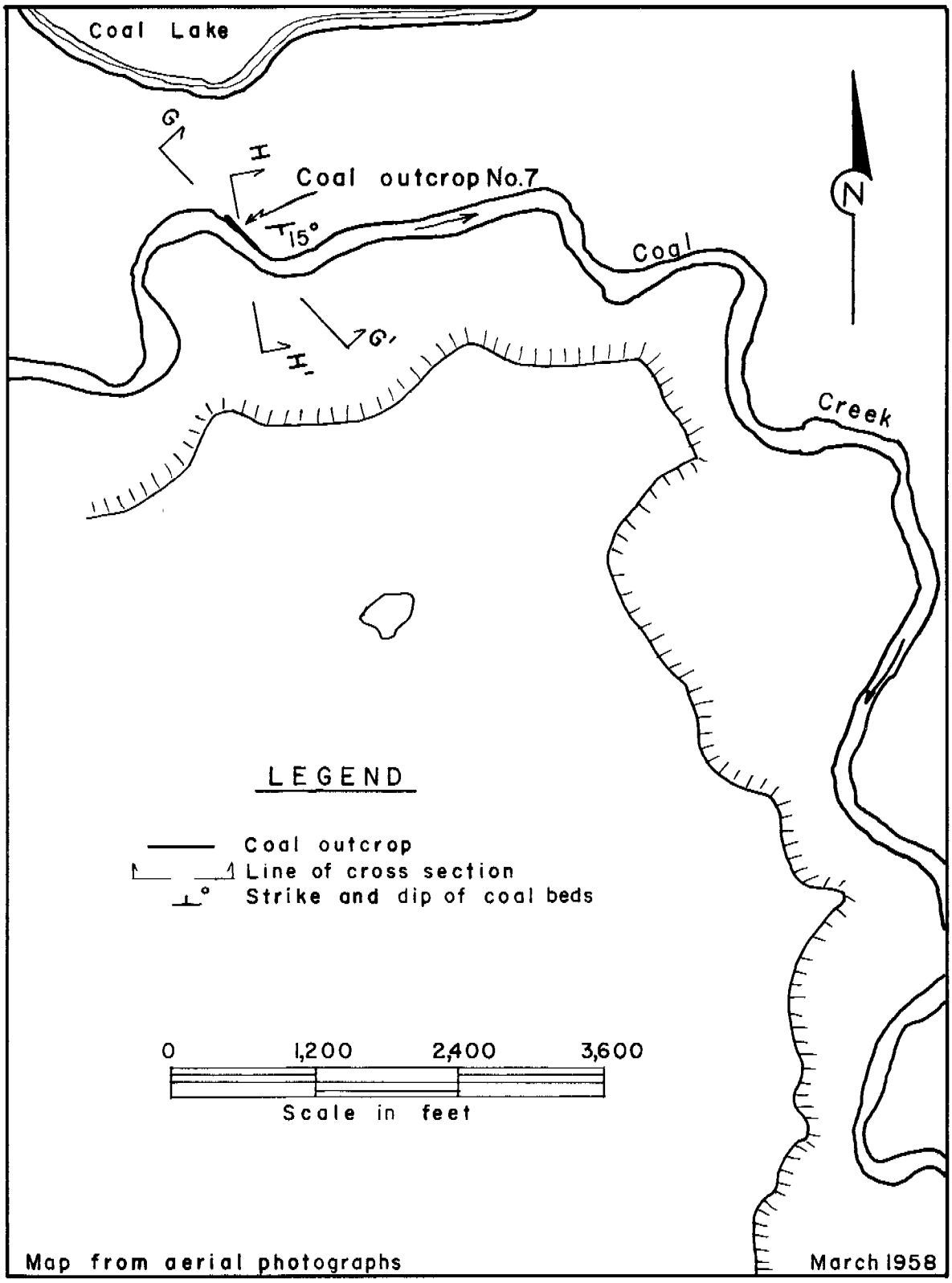

FIGURE 9. - Coal Outcrop 7 at Coal Lake.

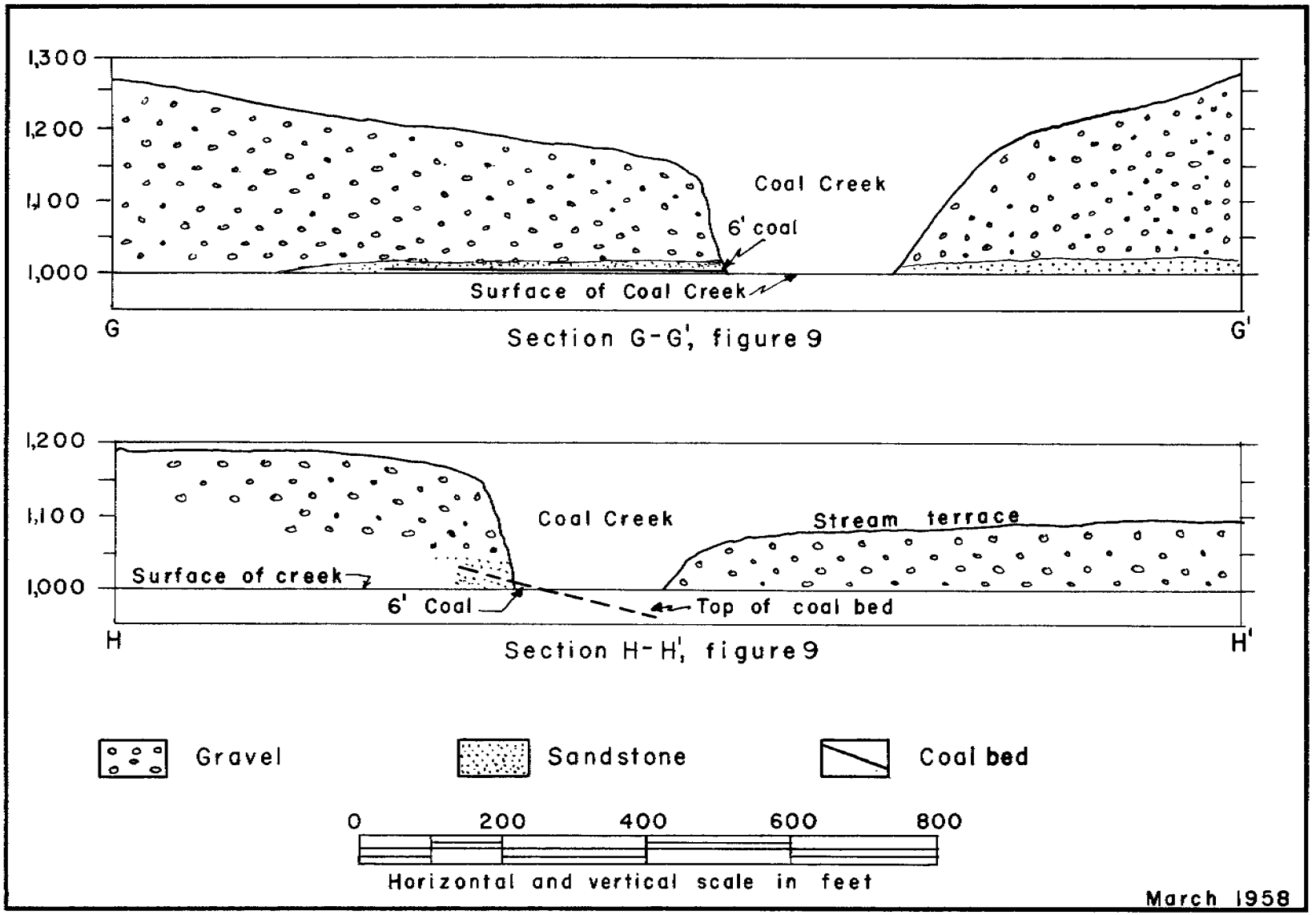

FIGURE 10. - Cross Sections of Coal Outcrop 7, Near Coal Lake.

TABLE 1. - Analyses of samples from Beluga River, Coal Creek, and Tyonek beds

Location	Sample No.	Width of bed, feet	Condition[1]	Proximate, percent				Ultimate, percent				Calorific value, B. t. u.
				Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	
Tyonek.....	44652/	20	1	22.3	40.5	28.0	9.2	0.3	6.2	44.2	0.8	7,785
			4	10.7	46.8	32.2	10.6	.3	5.5	50.8	.9	8,948
Do.	44642/	20	1	20.7	41.8	29.1	8.4	.3	6.1	45.7	.8	7,992
			4	12.3	46.2	32.2	9.3	.3	5.6	50.5	.8	8,840
Outcrop 1....	44342/	12	1	19.45	34.4	29.8	16.4	.2	5.5	44.7	.8	7,990
			4	11.9	37.6	32.6	17.9	.2	5.0	48.9	.9	8,752
Do.	44562/	12	1	17.44	38.2	28.9	15.4	1.6	5.6	45.2	1.1	8,246
			4	11.8	40.9	30.9	16.5	1.7	5.2	48.3	1.2	8,809
Outcrop 3....	TDM3/	30	1	27.6	32.1	29.5	10.8	.1	6.3	42.1	.8	7,240
			2	-	44.3	40.8	14.9	.2	4.5	58.1	1.1	10,000
			3	-	52.1	47.9	-	.2	5.3	68.3	1.3	11,750
Do.	A-14/	28	1	30.1	37.7	25.5	6.7	.1				7,611
			2	-	53.9	36.5	9.6	.1				10,888
Outcrop 5....	5	30	1	18.4	29.4	28.3	23.9	.2	5.2	40.6	.7	6,810
			2	-	36.1	34.6	29.3	.2				8,350
			3	-	51.0	49.0	-	.2				11,810
Outcrop 6....	1	20	1	18.5	37.2	31.2	13.1	.6	5.9	47.2	.9	8,140
			2	-	45.6	38.3	16.1	.7				9,980
			3	-	54.4	45.6	-	.8				11,900

See footnotes at end of table.

TABLE 1. - Analyses of samples from Beluga River, Coal Creek, and Tyonek beds (Con.)

Location	Sample No.	Width of bed, feet	Condition[1]	Proximate, percent				Ultimate, percent				Calorific value, B. t. u.
				Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	
Outcrop 6....	2	20	1	25.0	34.5	30.5	10.0	0.5	6.3	45.5	0.9	7,790
			2	-	46.1	40.6	13.3	.6				10,390
			3	-	53.2	46.8	-	.7				11,990
Do.	3	6	1	18.7	34.6	29.7	17.0	.4	5.6	43.8	.9	7,530
			2	-	42.6	36.5	20.9	.5				9,260
			3	-	53.9	46.1		.6				11,720
Do.	4	10	1	24.9	35.7	34.4	5.0	.4	6.4	48.7	.9	8,280
			2	-	47.5	45.8	6.7	.6				11,030
			3	-	50.9	49.1	-	.6				11,820
Outcrop 7....	6	1.2	1	22.5	28.9	24.6	24.0	.6	5.5	36.6	.9	6,240
			2	-	37.3	31.7	31.0	.7				8,050
			3	-	54.1	45.9	-	1.0				11,670
Do.	8	6	1	21.5	32.8	24.0	21.7	.4	5.8	39.3	.9	6,870
			2	-	41.8	30.6	27.6	.5				8,740
			3	-	57.7	42.3	-	.7				12,080
Do.	9	2	1	23.8	35.8	33.3	7.1	.7	6.4	47.4	.9	8,200
			2	-	46.9	43.8	9.3	.9				10,760
			3	-	51.8	48.2	-	1.0				11,870

1/ 1, Sample as-received; 2, moisture-free; 3, moisture-and-ash-free; 4, air-dried.
2/ Sample and analysis by Geological Survey.
3/ Sample by Territorial Department of Mines.
4/ Sample by Geological Survey.

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