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Report of Investigations 5520

SAMPLING STREAM GRAVELS FOR TIN, NEAR YORK, SEWARD PENINSULA, ALASKA

BY JOHN J. MULLIGAN

United States Department of the Interior — 1959

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SAMPLING STREAM GRAVELS FOR TIN, NEAR YORK, SEWARD PENINSULA, ALASKA[1]

by

John J. Mulligan[2]

SUMMARY

Since 1941 the Federal Bureau of Mines has been conducting an intermittent program of placer and lode investigations to evaluate the potential tin resources of the western Seward Peninsula tin belt. Previous investigations were made in the Potato, Cape, Brooks (Lost River), and Ear Mountain areas. As part of this program the Bureau made a reconnaissance of reportedly tin-bearing stream gravels in areas adjacent to the previously worked tin deposits at Lost River and Potato Mountain. The objective of the reconnaissance was to determine if additional areas might be favorable for lode or placer exploration. The work was begun late in the fall of 1956 and completed during the following summer.

The streams sampled were the Lost River and York Creek in the Brooks Mountain area and the Anikovik River and Kigezruk and Baituk Creeks in the York area. Samples were obtained by churn-drilling methods employing conventional placer-evaluation procedures. Holes were drilled at wide intervals at sites chosen as being representative of drainage areas rather than of individual gravel deposits. Minor to trace amounts of tin were found in the gravels of all these streams, but the highest grade was 0.35 pound of tin per cubic yard in the gravels of Lost River below the mouth of Tin Creek. Small amounts of gold were found on Baituk Creek and in one hole on the Anikovik River; the highest grade did not exceed 10 cents per cubic yard. Traces of scheelite and barite were found on York Creek, chromite was encountered in one hole on the Anikovik River, and minor amounts of titanium minerals (probably derived from basaltic intrusives) were found in the York area.

The reconnaissance did not eliminate the possibility that valuable lode or placer deposits may be found in the area, but the sampling data strongly indicate that the cassiterite and other heavy minerals in the stream gravels are too widely and sparsely distributed to encourage further investigations except in the Lost River drainage basin, where substantial tin lode and placer deposits are known.

1/ Work on manuscript completed May 1959.

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

INTRODUCTION

Since 1941 the Bureau of Mines has been conducting intermittent investigations of lode and placer tin deposits in the western part of the Seward Peninsula, Alaska, with the ultimate objective of evaluating the potential tin resources of the entire area. Previous work was concentrated in the Brooks (Lost River), Ear, Cape, and Potato Mountain areas. The results of these investigations have been published, and the publications are listed in the bibliography at the end of this report.

As part of this long-range program, the Bureau conducted reconnaissance churn-drill sampling of stream gravels in the areas adjacent to the known tin deposits in the vicinity of the Brooks and Potato Mountains. The project was started in the fall of 1956 and completed during the following summer. The objective was to determine the relative abundance of tin and other heavy minerals in the stream gravels as a possible guide to areas in which more detailed lode or placer investigations might be justified. Because of the heavy overburden (usually frozen) and scarcity of outcrops that characterize much of the Seward Peninsula, the examination of stream gravels provides the only quick and comparatively inexpensive method of indicating the character and distribution of metallic minerals. Sampling was confined to stream gravels known to contain some tin but for which no sampling data had been recorded. This report describes the sampling procedures and presents sample analysis data in detail.

ACKNOWLEDGMENTS

Harvard Brown, caretaker of the Lost River mine, materially assisted the field party on several occasions; his cooperation and hospitality are gratefully acknowledged.

The base maps, historical notes, and geological data were compiled principally from the Federal Geological Survey publications listed in the bibliography.

LOCATION AND ACCESSIBILITY

The Brooks Mountain and York areas are 80 to 100 miles northwest of Nome in the western part of the Seward Peninsula, Alaska (figs. 1 and 2). At the time of the investigation the area was uninhabited, except for a caretaker and his family living at the Lost River tin mine. The nearest permanently inhabited villages are Wales, about 25 miles to the west, and Teller Mission and Teller, about 30 miles to the east. York, the shipping point for the Potato Mountain tin-mining area, is uninhabited and the few buildings have fallen into disrepair.

The usual means of access to the Brooks Mountain and York areas is by bush-planes based in Nome, the distribution center for the Seward Peninsula. Four airfields were used during the investigation. The principal airfield is about 1-1/2 miles northwest of the mouth of Lost River and has been used by planes as large as the DC-3. The other fields, used only by bush-planes

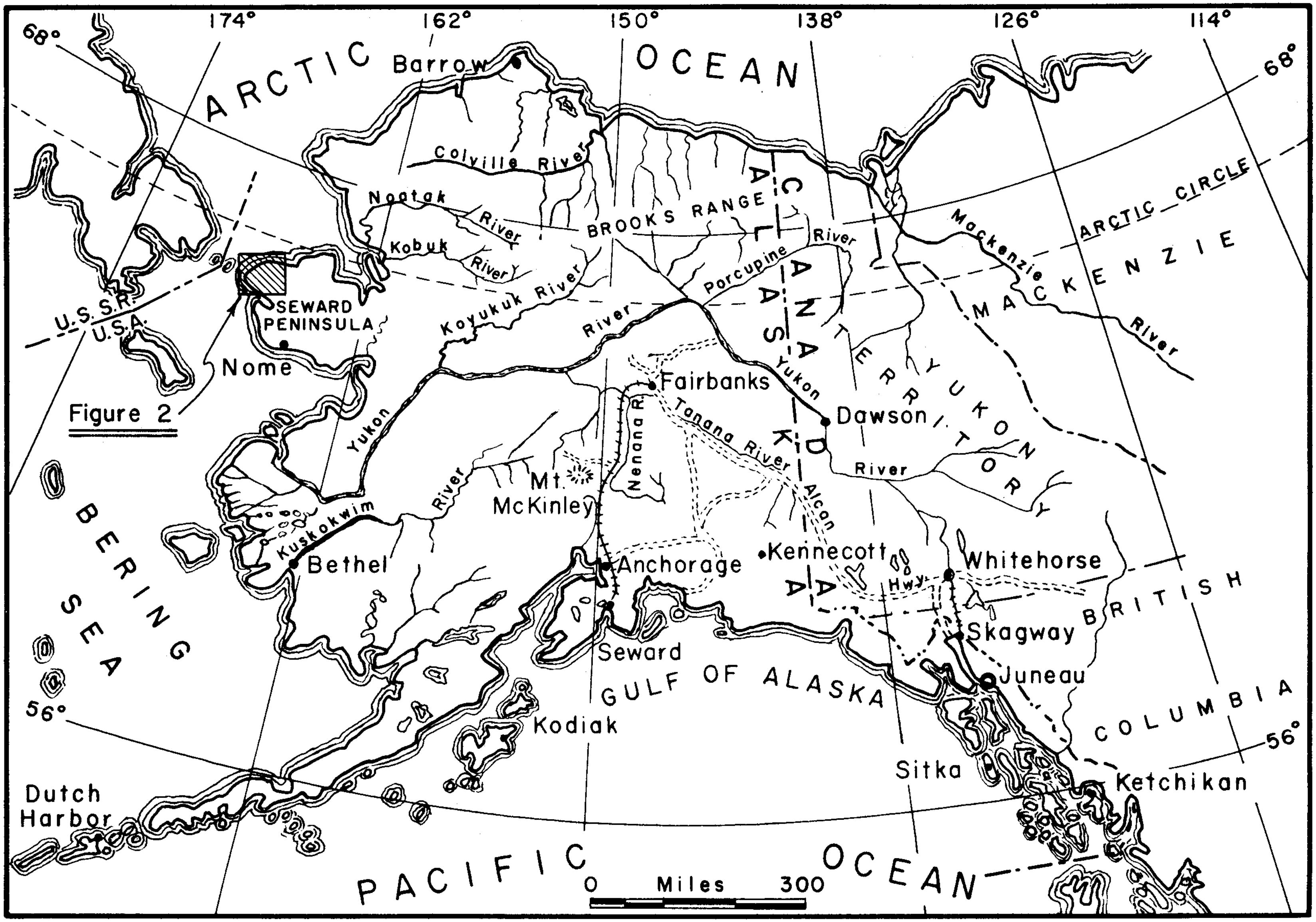

FIGURE 1. - Index Map of Alaska.

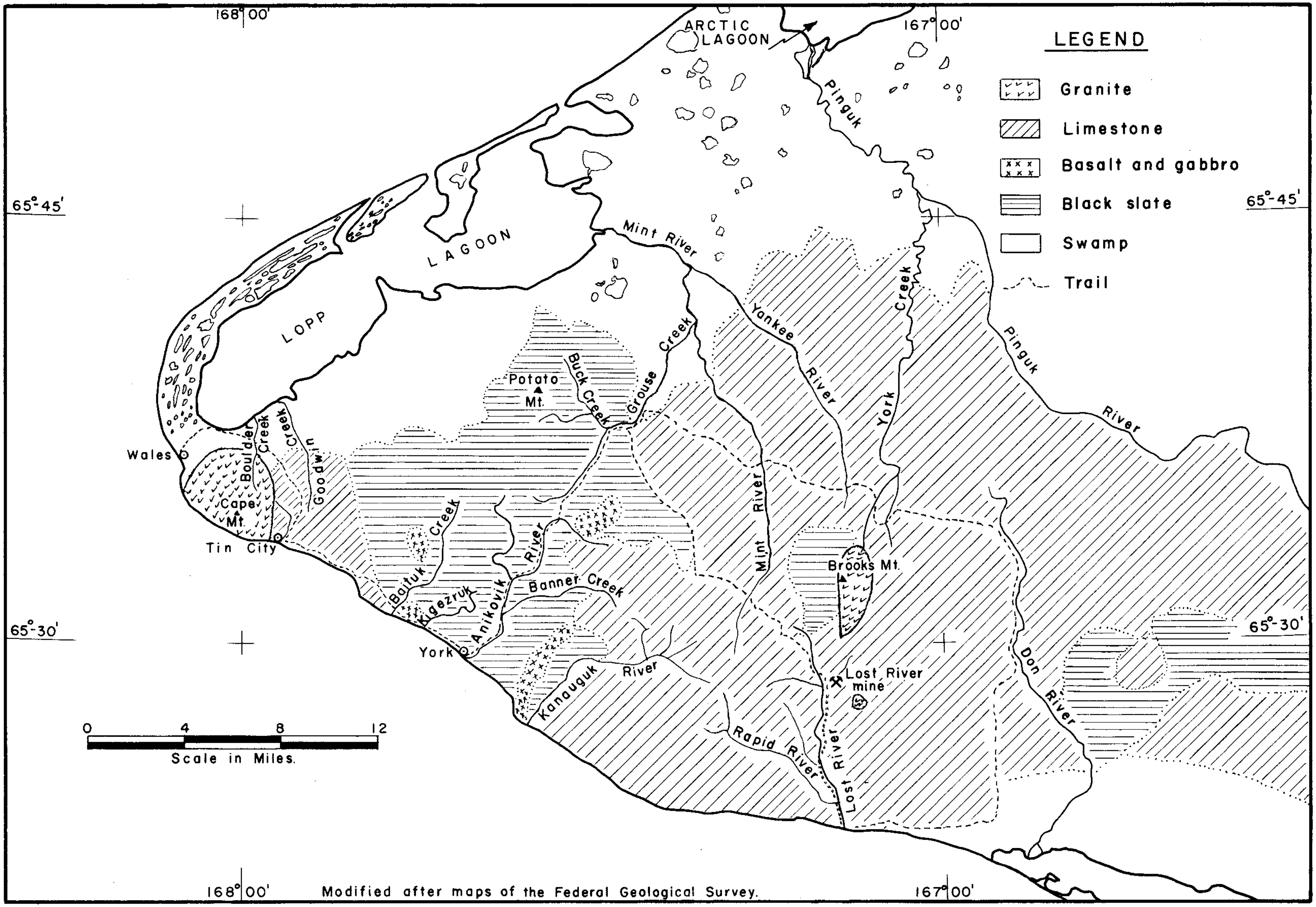

FIGURE 2. - Geologic and Location Map, Brooks Mountain and York Areas.

carrying payloads of less than 1 ton, are at the mouth of Lost River, in Lost River Valley below the mouth of Cassiterite Creek, and in Grouse Creek Valley at the mouth of Buck Creek.

Freight too heavy or too bulky for air transport is shipped by barge from Nome or lightered ashore from steamships. The more commonly used landing places are near the mouths of Lost River and the Anikovik River. No docks or freight-handling facilities are available; barges or other landing craft are beached and unloaded on the sand. Obviously, such operations are limited to periods of good weather.

There are few roads or trails in the area investigated. The principal means of transportation is by tracked vehicles; crawler-type tractors towing sleds or trailers are used most commonly. However, trucks have been used on short roads serving mining operations at Lost River and Buck Creek.

HISTORY AND PRODUCTION OF TIN PLACERS

The first prospectors to enter the western Seward Peninsula tin belt are believed to have been a group returning from the Kobuk area of northwestern Alaska in 1898. They were shipwrecked and spent the winter a few miles east of the mouth of Lost River; the stream probably derives its name from the mishap. Members of this party, and others who arrived the following spring, rapidly spread over the area and discovered gold on Buckner (Buhner) Creek, a tributary of the Anikovik River, during the summer of 1899. Other discoveries soon followed. In 1900 samples of sluicebox concentrates containing a heavy mineral were submitted to A. H. Brooks of the Federal Geological Survey by prospectors working on Buckner Creek and the Anikovik River. Subsequently, the heavy mineral was identified as cassiterite. Publicity resulting from the discovery intensified interest in the area and within the next few years prospecting had outlined, roughly, the western Seward Peninsula tin belt as it is now known.

Attempts to mine the gravels of the Anikovik River Valley by hand methods met with little success and were abandoned when prospecting disclosed the more attractive deposits on Buck Creek in the Potato Mountain area, a few miles to the north. In 1914 the American Gold Dredging Co., after prospecting with churn drills the previous season, put two floating dredges on the Anikovik River. One dredge was towed along the shore of the Bering Sea from near Nome to York, where it dug its own way across the bar and into the river. The other dredge was erected on the river about a quarter of a mile from the beach. Dredging was begun August 1, 1914, and was discontinued at the end of the 1915 season. Only one dredge was operated. It was worked a total of 123 days; 156,000 cubic yards of gravel was handled, and 1,217 ounces of crude gold and 1,600 pounds of concentrate containing 31 percent tin were produced. There has been no recorded production of tin or other metals from the Anikovik River since that time, although a number of prospect pits and trenches were noted during this reconnaissance.

The Lost River tin mine on Cassiterite Creek, a tributary of Lost River (fig. 3), was discovered in 1903 and has been the most extensively developed

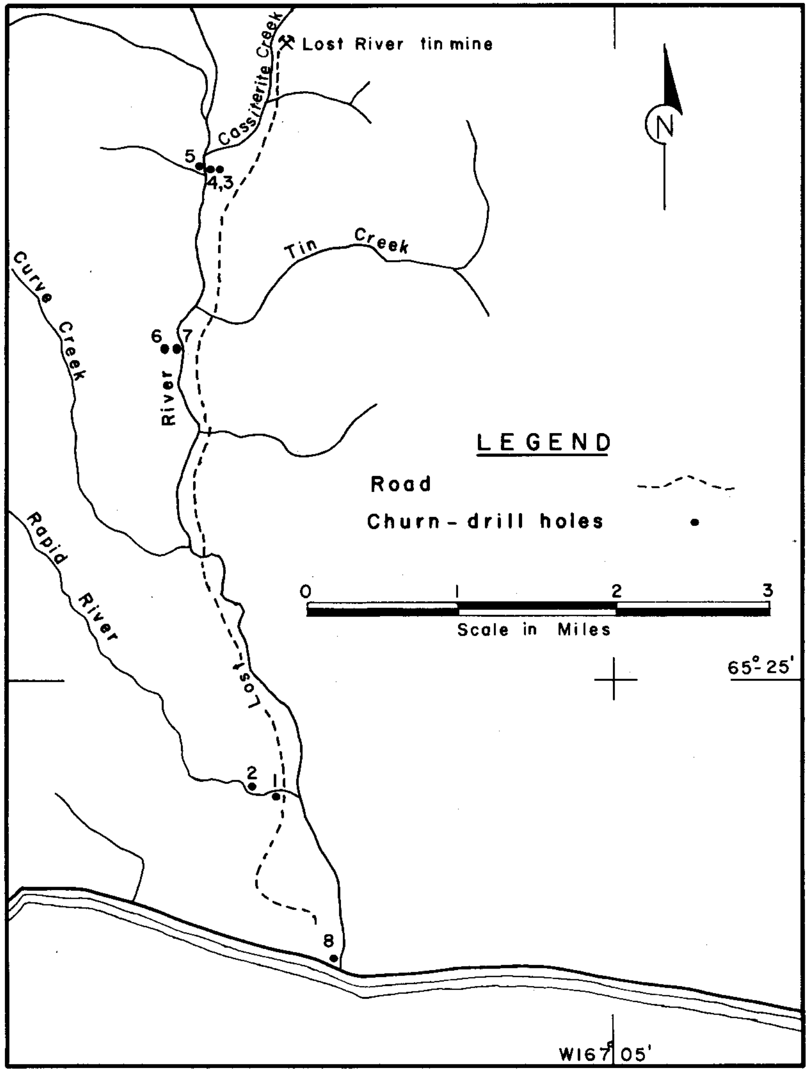

FIGURE 3. - Placer Sample Locations, Lost River.

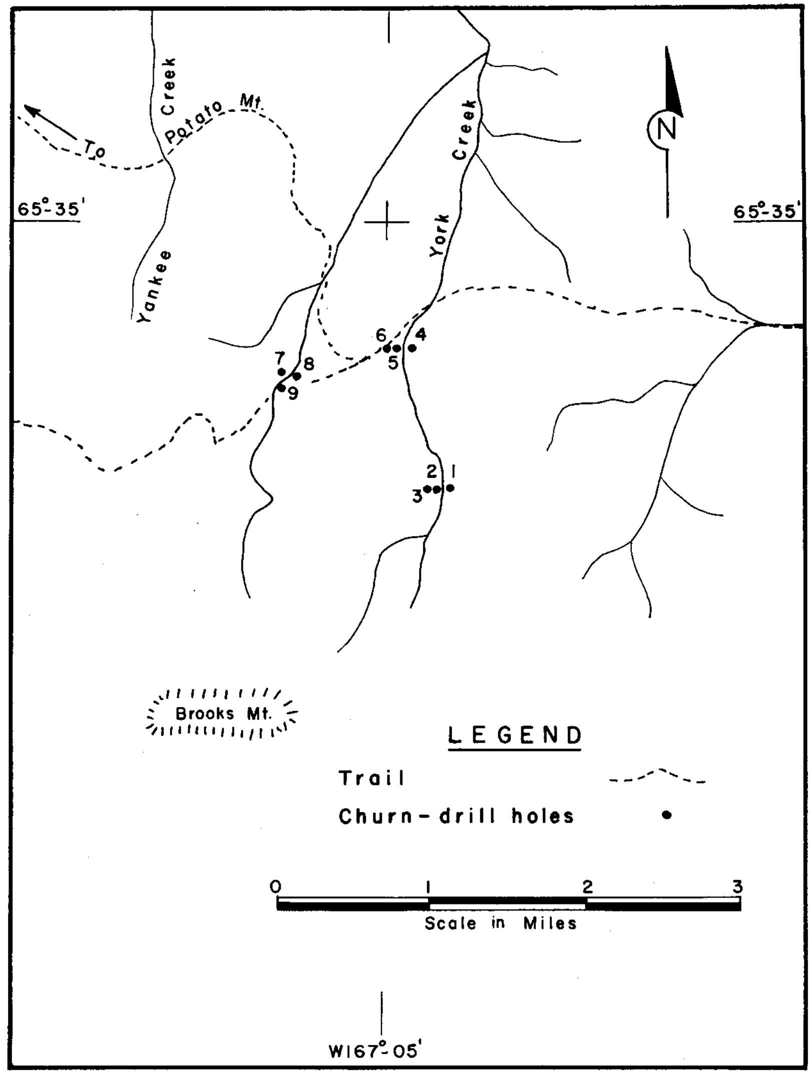

FIGURE 4. - Placer Sample Locations, York Creek.

lode mine in the Seward Peninsula tin belt. At various times during the operation of the Lost River mine, placer tin was recovered from the gravels of Cassiterite Creek. The principal production from the Cassiterite Creek placer deposit was from 1949 through 1951, when the United States Tin Corp. recovered 186,710 pounds of tin from 52,000 cubic yards of gravel. There has been no recorded production from Lost River itself or from its other tributaries.

Tin was reported in York Creek (fig. 4) in 1901 and again in 1904. Samples, reportedly from York Creek, were described as containing "cassiterite in fine grains associated with small amounts of magnetite, garnet, tourmaline and quartz." Apparently no further work was done, and no signs of mining activity were found when the stream was sampled in 1957.

During the same period prospectors discovered tin on both Kigezruk and Baituk Creeks (fig. 5). Remnants of abandoned cabins and placer-mining equipment found at various places along both streams indicate that mining had been attempted, but there has been no recorded tin production from either creek.

PHYSICAL FEATURES AND CLIMATE

The York Mountains, the principal physical feature of the area, are steep, barren, dominantly limestone hills that rise to altitudes of 2,000 to 2,500 feet. Brooks Mountain, the highest of the group, has an altitude of 2,900 feet and differs from the others in that it consists of an exposed granitic core surrounded by metasediments. Lost River rises on the south side of Brooks Mountain; with its tributaries, it drains the east-central part of the York Mountains and flows southward into the Bering Sea. York Creek rises on the north slopes of Brooks Mountain and flows northward into the Pinguk River, which in turn flows into the Arctic Lagoon and the Arctic Ocean. Except for the extreme headwaters, York Creek and the Pinguk River traverse an area of low, rounded hills that gradually merge into the Arctic coastal plain. A scant growth of tundra vegetation partially covers the claylike soil and broken rock on the hills; a heavier growth covers the valleys and the coastal plain.

The Anikovik River and the Kigezruk and Baituk Creeks rise on the plateau area extending westward from the York Mountains and flow southward into the Bering Sea. Their drainage basins are characterized by wide valleys and gently rounded hills varying in elevation from 600 to 800 feet. Unlike the barren York Mountains, the entire area is mantled by a thick cover of tundra vegetation and a scattered growth of willow brush.

The ground remains frozen throughout the area except for the top few feet, which thaws during the summer months. The depth of the summer thaw varies from 1 to 3 feet where the ground is insulated by a cover of moss; where it is not insulated the thaw may extend to much greater depths.

The only timber available locally is driftwood, which collects on the exposed beaches. The tundra mosses have furnished sustenance to reindeer, but no herds have been in the area in recent years.

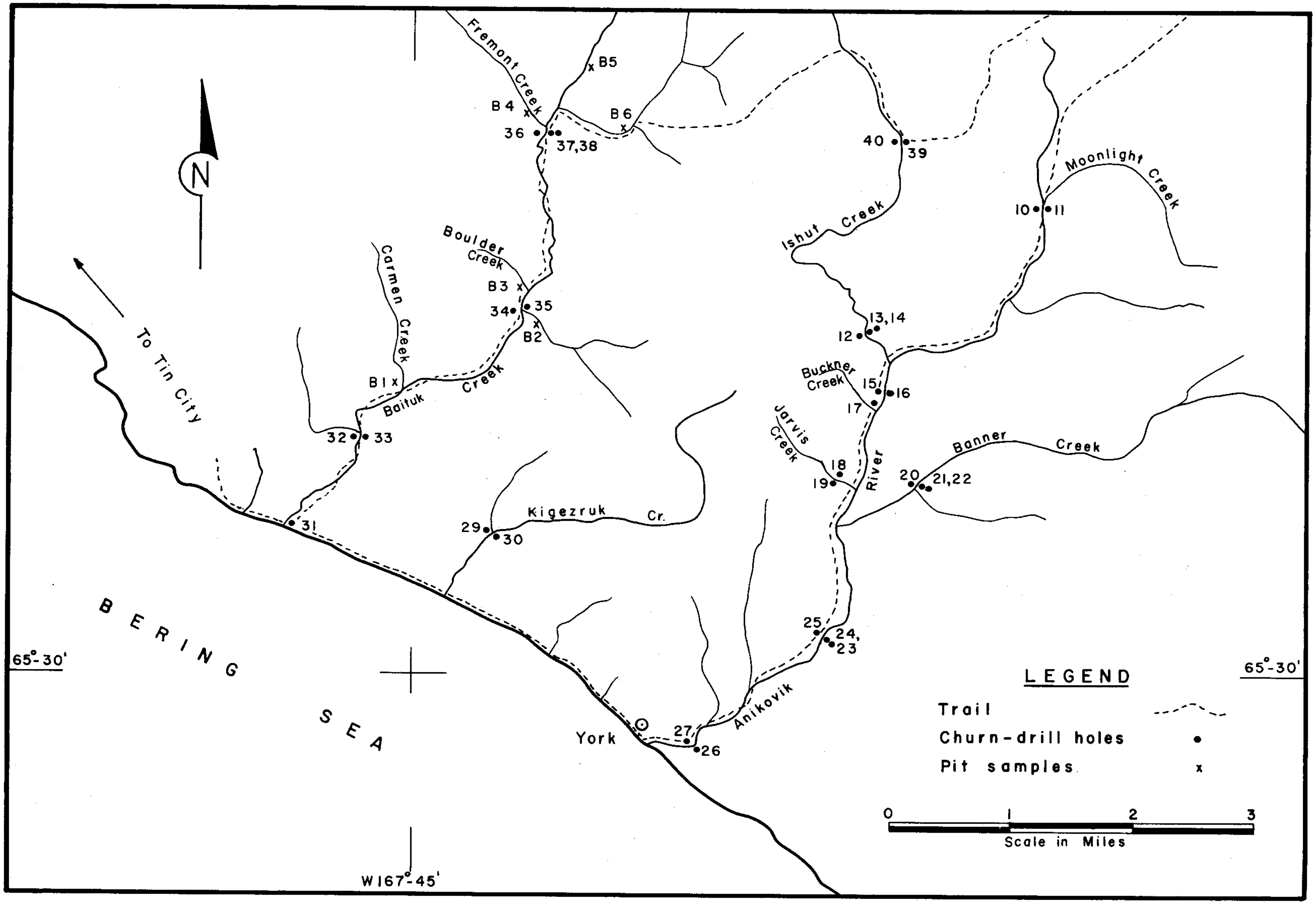

FIGURE 5. - Placer Sample Locations, York Area.

The climate is subarctic and is influenced by the area's position between the Arctic Ocean and the Bering Sea. As a consequence, high winds, fog, and mist are unpleasantly prevalent, although the total rainfall is low. A summary of weather data, collected at Wales by the U.S. Weather Bureau follows:

TABLE 1. - Weather summary, Wales, Alaska

	Average temperature, °F.	Average precipitation, inches	Average snowfall, inches
January	0.8	0.67	10.0
February	-1.7	.83	7.5
March	-2.7	.55	6.7
April	12.8	.30	4.0
May	26.6	.43	2.5
June	38.7	.58	.2
July	46.0	1.43	
August	45.9	2.74	Trace
September	40.3	1.98	.7
October	30.6	1.20	5.0
November	20.0	.63	6.9
December	4.4	.64	8.2
Annual average	21.8	11.98	51.7

The average date for the winter ice to break up in the Bering Strait is June 7, and the average date of the freezeup is November 29, although some harbors freeze about 2 weeks earlier.

The highest recorded temperature at Wales was 75° F. in July 1926 and the lowest -41° F. on February 5, 1947.

LABOR

Supervisory personnel and specialized technicians usually must be brought from other localities, but unskilled, semiskilled, and some skilled labor can be obtained from the native Eskimo and resident--white population of the Seward Peninsula. A high percentage of the population is available for employment because of the lack of industrial development. The population of the western part of the Seward Peninsula as recorded in the 1950 census is listed below.

Diomede	103
Igloo	64
Nome	1,930
Shishmaref	194
Teller	140
Teller Mission	109
Wales	141
Total	2,681

PROPERTY AND OWNERSHIP

The investigation was a preliminary reconnaissance; therefore property records were not examined. Numerous old claim stakes were seen, but the claims appeared to have been abandoned, and there were no signs of recent activity. It is believed that the Bureau work was performed on the public domain.

GENERAL GEOLOGY

The predominant types of bedrock in the area investigated are a series of schists, shales, and phyllites generally referred to as "black-slates" and a series of limestone beds (fig. 2). The black slates are believed to be of Cambrian or pre-Cambrian age. The limestones overlie the black-slates and are believed to be principally of Ordovician or Silurian age, although the upper beds may be Mississippian.

Two distinct periods of igneous activity are evident. The earliest period is represented by stocks, sills, and dikes of basalt and gabbro, which intrude the slates and probably antedate the limestones. These basic intrusives (often termed "greenstones") are a pervasive feature of the slate areas, but only the more prominent outcrops have been mapped. The second period of igneous activity followed the deposition of the limestones. Granitic stocks and acidic dikes of generally similar composition intruded both the slates and the limestones. The stocks and their associated halo of dikes and contact-metamorphosed sedimentary rocks are more resistant to erosion than the surrounding metasediments and tend to form mountains, of which Brooks Mountain is a prominent example.

Tin mineralization followed the granitic intrusion and appears to have been localized in and near the granitic stocks. Tin minerals occur in the granite, in the contact zones, and in dikes and veins in the surrounding metasediments.

A long period of erosion and several periods of uplift, the details of which have not been worked out, followed the latter period of igneous activity and subsequent mineralization. However, the gravel deposits were found to be shallower than the broad, open nature and gentle gradient of the valleys would indicate. This is particularly evident along the Anikovik River, where bedrock is exposed in the stream bottom within a few hundred feet of its mouth and at intervals along its course.

WORK BY BUREAU OF MINES

Nature and Extent

The objective of the reconnaissance sampling was to determine the character, relative abundance, and distribution of heavy minerals (particularly tin and radioactive minerals) in the stream gravels as a guide to drainage areas that might be favorable for the discovery of lode deposits. The indication of areas favorable for more detailed placer exploration was incidental to the lode investigation. The reconnaissance was based upon reports of early prospecting and mining activity in the Brooks Mountain and York areas; sampling was confined to streams in which placer tin had been reported but no sampling data recorded. In the Brooks Mountain area (figs. 2, 3, 4), samples were taken from the Lost and Rapid Rivers and York Creek. In the York area (fig. 5), samples were taken from the Anikovik River and its principal tributaries, from Kigezruk Creek, and from Baituk Creek and its principal tributaries.

The reconnaissance sampling of placer deposits was planned to produce data directly comparable with the results of the more extensive placer sampling programs conducted in the Potato, Cape, and Ear Mountain areas where lode-tin outcrops are known. Previous experience indicated that the type and amount of heavy minerals in the stream gravels would be roughly representative of the heavy mineral content of lode outcroppings in the drainage basin from which the gravels were derived. Thus the placer samples would indicate where additional investigation might be justified. This indirect method of determining the distribution of lode minerals was resorted to because most of the area is covered by a permanently frozen mantle of detritus and tundra vegetation. The samples from Lost River (H-3 through H-8) were taken, primarily, to serve as a standard for comparison, since lode-tin deposits are known in the valleys of the Cassiterite and Tin Creeks--both tributaries of the Lost River.

Sampling Procedure

Heavy mineral concentrates were obtained from the streams by churn drilling; the samples were taken at sites considered to be representative of the average grade of the stream gravels. Conventional placer-sampling methods adapted to permafrost areas were used. Holes were drilled with a skid-mounted, Fairbanks-type churn drill, using 5-inch (nominal inside diameter) casing; the outside diameter of the casing shoe was 6-1/2 inches. In thawed ground samples were obtained from cased holes; in frozen ground, from uncased holes. Sampling data were recorded on special drill-log forms developed for use in permafrost areas. The samples were panned to a rough concentrate, dried, sacked, and shipped to the Bureau experiment station in Juneau, Alaska. At Juneau the samples were weighed, assayed for tin, checked for radioactivity, and submitted for petrographic and/or spectrographic analyses.

Bedrock samples also were obtained from the drill holes, and a small bedrock sample was submitted separately for petrographic analyses.

A few small tributaries of Baituk Creek were sampled by test pitting; sample results are included, but these data are less accurate than those obtained by churn drilling.

Definition of Terms

Terms used in recording and evaluating sampling data are defined as follows:

Overburden (O B.) is a mixture of varying proportions of organic material, rock decomposition products, and ice (called muck by the Alaskan placer miners). Usually a dense mat of moss and tundra vegetation, varying in thickness from 1 to 3 feet, covers the overburden and serves as insulation, which prevents thawing.

Pay horizon (P.H.) is the section of hole from which a heavy mineral concentrate was obtained. In cased holes the sample volume is the area encompassed by the cutting edge of the casing shoe, multiplied by the depth of the pay horizon. In uncased holes the sample volume is the volume of water required to refill the pay horizon.

Mining section (M.S.) is the total depth of gravel and bedrock that would be excavated during mining; usually, it includes 1 foot of bedrock.

Method of Evaluation

The volume of the mining section, the amount of concentrate per cubic yard, and the amount of tin per cubic yard were calculated as follows:

$$(\text{Volume of P.H., cubic yards})\ \frac{\text{depth of M.S.}}{\text{depth of P.H.}}$$

$$= \text{volume of M.S., cubic yards.}$$

$$\frac{\text{Weight of concentrate, pounds}}{\text{Volume of M.S., cubic yards}}$$

$$= \text{concentrate/cubic yard, pounds.}$$

$$(\text{Concentrate/cubic yard, pounds})\ (\text{tin in concentrate, percent})$$

$$= \text{tin/cubic yard, pounds.}$$

Summary of Results

Drilling and sampling data for the various streams are summarized as follows:

Lost and Rapid Rivers

Six holes were drilled along Lost River (fig. 3), and tin was found in all samples. The best hole indicated 11 feet of mining section containing 0.35 pound of tin per cubic yard; the remaining holes indicated depths of mining section varying from 6 to 10 feet containing 0.04 to 0.27 pound of tin per cubic yard.

Two holes were drilled along Rapid River (fig. 3), but only one reached bedrock. The two holes indicated a depth of mining section varying from 24 to more than 30 feet and containing only traces of tin. The depth of gravel decreases to only a few feet a short distance upstream from the drill holes.

Cassiterite Creek was not sampled, but production data indicated that the gravels in the section mined averaged 3 to 4 pounds of tin per cubic yard. This productive section extended about 2,000 feet downstream from the Lost River lode-tin mine (fig. 3). Samples taken from Lost River a short distance below the mouth of Cassiterite Creek (samples H-3, H-4, and H-5) indicated a grade of about 0.05 pound of tin per cubic yard.

Tungsten was not detected in the samples from Lost River or Rapid River, although the production records indicate that, in addition to tin, the gravels mined from Cassiterite Creek contained 0.6 to 0.7 pound of tungsten-trioxide (WO_3) per cubic yard.

Gold was not detected in any of the drill-hole concentrates; traces of silver were found in holes H-6 and H-7, which also contained more lead (galena) than the other samples.

The gravels of Lost River are medium coarse and unconsolidated. Permafrost was encountered in hole H-6 at a depth of 6 feet; the other holes were in thawed gravel. The stream drains an area barren of vegetation and consequently subject to flash floods. Flood action on loose gravels may tend to disperse the placer minerals to a greater extent than in the other streams sampled, where flood action is moderated by a cover of tundra vegetation.

Churn-drill sampling data resulting from holes drilled along the Lost and Rapid Rivers are summarized in tables 2, 3, and 4.

TABLE 2. - Summary of churn-drilling results, Lost and Rapid Rivers

Hole No.	Drill-hole data: Depths, ft. Total	O.B.	Gravel	Bedrock	Cased	Pay horizon: Interval From, ft.	To, ft.	Depth, ft.	Volume, cu. yd.
H-1.......	30.5	-	30.5	None	29.0	-	-	-	-
H-2.......	25.0	-	23.0	2.0	25.0	-	-	-	-
H-3.......	10.5	-	9.0	1.5	10.5	4.0	9.5	5.5	0.0469
H-4.......	10.0	-	8.0	2.0	10.0	6.5	10.0	3.5	.0299
H-5.......	6.5	-	5.0	1.5	6.5	.0	6.0	6.0	.0512
H-6 1/.....	12.5	-	9.0	3.5	8.5	3.0	9.5	6.5	.0516
H-7 1/.....	11.0	-	10.0	1.0	10.5	5.0	10.0	5.0	.0427
H-8.......	7.5	-	5.5	2.0	7.5	4.0	5.5	1.5	.0128

Hole No.	Concentrate: Weight, lb.	Tin, percent	Mining section: Depth, ft.	Concentrate, lb. per cu. yd.	Tin, lb. per cu. yd.
H-1.......	1.74	Trace	-	-	Trace
H-2.......	2.05	0.06	-	-	Do.
H-3.......	.90	.40	10.0	10.55	0.04
H-4.......	.66	.70	10.0	7.68	.05
H-5.......	.29	.90	6.0	5.64	.05
H-6 1/.....	.92	2.50	10.0	11.55	.29
H-7 1/.....	1.22	2.70	11.0	13.00	2/ .35
H-8.......	1.61	.30	6.5	29.04	.09

1/ No gold detected in any samples; trace amounts of silver found in samples H-6 and H-7.

2/ H-7 also contains 0.04 pound per cubic yard of lead; other samples contain traces of lead.

TABLE 3. - Spectrographic and radiometric analyses,[1] churn-drill concentrates, Lost and Rapid Rivers

Letters indicate estimates from qualitative analysis:

A - Over 10 percent.
B - 5 to 10 percent.
C - 1 to 5 percent.
D - 0.1 to 1 percent.
E - 0.01 to 0.1 percent.
F - 0.001 to 0.01 percent.
G - Under 0.001 percent.
- - Not detected.

Radiometric uranium equivalent

Sample No.	
H1	Nil
H2	0.002
H3	Nil
H4	0.008
H5	Nil
H6	0.002
H7	Nil
H8	0.005

	Composite H1-H2	Composite H3-H5	Composite H6-H7	Sample 8
Ag	-	-	F	-
Al	C	B	B	C-
As	-	-	D	-
Au	-	-	-	-
B	F	E	E	F
Ba	E	E	E	E
Be	G	F	F	F
Bi	-	-	-	-
Ca	A	A	A	A
Cd	-	-	-	-
Co	-	-	-	-
Cr	-	-	-	-
Cu	F	F	E	F
Fe	C	B	A	C
Ga	-	-	-	-
Ge	-	-	-	-
In	-	-	-	-
Li	-	-	-	-
Mg	C	B	B	C
Mn	E	E	D	E
Mo	-	-	-	-
Na	D	D	D	D
Nb	-	-	-	-
Ni	E	E	E	E
P	-	-	-	-
Pb	D	D	D	E
Pd	-	-	-	-
Sb	-	-	-	-
Si	C	C	C	C
Sn	D	C	C	D
Sr	E	E	F	F
Ta	-	-	-	-
Te	-	-	-	-
Ti	E	E	E	E
V	F	E	E	E
W	-	-	-	-
Zn	-	-	-	-
Zr	F	F	E	F

1/ Samples H1 and H2 are from Rapid River; samples H3 through H8 are from Lost River.

TABLE 4. - Identification of bedrock samples, Lost River

Hole No.	Stream	Type of bedrock
H-4..................	Lost River	Impure limestone.
H-7..................	do.	Dolomite with chlorite, fluorite, and a trace of pyrite. Traces of lead and zinc are present, but the minerals could not be identified.
H-8..................	do.	Limestone.

York Creek

Nine holes were drilled in the gravels of York Creek (fig. 4). Holes 1, 2, and 3 were drilled in a line near the head of the east fork of York Creek. Traces of cassiterite were found, and consequently another line (holes 4, 5, and 6) was drilled about 1 mile downstream. Holes 7, 8, and 9 were drilled near the head of the west fork of York Creek.

Trace amounts of tin were found in all samples from York Creek, but cassiterite was identified only in samples from holes 1, 2, and 3. Gold and silver were not detected. Minor to trace amounts of scheelite and barite were found in most of the samples, and traces of powellite were found in samples from the west fork.

The gravels of York Creek vary in depth from 6.0 to 12.5 feet and consist principally of fragments of schist and shale. The bedrock is dominantly shale and limey shale containing some quartz and disseminated pyrite. The stream was drilled in early July; the gravels underlying the stream were not frozen, but those overlain by vegetation were frozen.

Sampling data from York Creek are summarized in tables 5, 6, and 7.

Anikovik River Valley

Twenty holes were drilled in the gravels of the Anikovik River and its principal tributaries (fig. 5). Traces of tin were found in all holes, but in most instances the tin mineral was not identified. Cassiterite was recognized in the gravels of Buckner Creek (hole 17), Banner Creek (hole 21), and the Anikovik River (hole 24).

The only gold noted occurred as bright, thin flakes, one-thirty-second of an inch in diameter and smaller, in hole 24. Based upon the number and size of "colors," the gold value of this hole was estimated at 8 cents per cubic yard.

Angular fragments of chromite were found in samples from hole 23 on the Anikovik River; chemical analyses indicated slightly less than one-fourth pound of chromite per cubic yard. Samples from adjacent holes contained no chromite.

TABLE 5. - Summary of churn-drilling results, York Creek

Hole No.	Drill-hole data: Depths, ft. Total	O.B.	Gravel	Bedrock	Cased	Pay horizon: Interval From, ft.	To, ft.	Depth, ft.	Volume, cu. yd.
1.........	11.5	-	10.0	1.5	10.5	-	-	-	-
2.........	16.0	2.0	11.0	3.0	12.0	-	-	-	-
3.........	12.0	-	10.0	2.0	10.0	-	-	-	-
4.........	14.5	-	12.5	2.0	10.0	-	-	-	-
5.........	10.8	-	8.0	2.8	10.0	-	-	-	-
6.........	8.5	-	6.0	2.5	6.0	-	-	-	-
7.........	10.5	-	7.5	3.0	8.5	-	-	-	-
8.........	14.5	4.0	8.0	2.5	3.0	-	-	-	-
9.........	15.0	-	12.0	3.0	10.0	-	-	-	-

Hole No.	Concentrate: Weight, lb.	Tin, percent	Mining section: Depth, ft.	Concentrate, lb. per cu. yd.	Tin, lb. per cu. yd.
1.........	1.58	Trace	-	-	Trace
2.........	1.77	do.	-	-	Do.
3.........	2.20	do.	-	-	Do.
4.........	2.16	do.	-	-	Do.
5.........	1.86	do.	-	-	Do.
6.........	1.92	do.	-	-	Do.
7.........	1.82	do.	-	-	Do.
8.........	1.56	do.	-	-	Do.
9.........	2.09	do.	-	-	Do.

TABLE 6. - Petrographic and radiometric analyses of churn-drill concentrates, York Creek

Hole Nos.	Light minerals and rocks	Heavy minerals
1, 2, 3	Dolomite, calcite, quartz, an unidentified clay mineral, and small amounts of chlorite, epidote, diopside, and vesuvianite.	Pyrite, limonite pseudomorph after pyrite, garnet, tourmaline, apatite, barite, augite, traces of cassiterite, and scheelite.
4, 5, 6	Carbonaceous shale, schistose limestone, dolomite, calcite, quartz, epidote, and actinolite.	Pyrite, limonite pseudomorph after pyrite, barite, tourmaline, garnet, and zircon.
7, 8, 9	Carbonaceous shale, schistose limestone, dolomite, quartz, calcite, epidote, chlorite, and biotite.	Pyrite, limonite pseudomorph after pyrite, garnet, barite, tourmaline, scheelite, and powellite.
	Radiometric-equivalent uranium	
	No significant radioactivity detected in any samples.	

TABLE 7. - Identification of bedrock samples, York Creek

Hole No.	Stream	Type of bedrock
4....................	East Fork	Limey shale with quartz and pyrite.
9....................	West Fork	Shale and quartz, with calcite and traces of limonite and pyrite.

The gravels of the Anikovik Valley vary in depth from a few inches to 5 feet and are composed principally of angular fragments of shale with lesser amounts of basalt and quartz. When the deposits were drilled in July the bare gravels were thawed to bedrock, but those covered by soil or vegetation were frozen.

The bedrock is dominantly carbonaceous or limey shales. Abundant disseminated pyrite and limonite pseudomorph after pyrite occurs in some beds. An andesine dike or sill (sample 26-A) forms a prominent outcrop across the bed of the Anikovik River a few feet upstream from holes 26 and 27. A dike or sill, lighter in color than the greenstones common throughout the area and composed largely of plagioclase feldspar and quartz with minor amounts of sulfide minerals (sample 20-A), is exposed on the north bank of Banner Creek about 15 feet downstream from hole 20. The relationship of these intrusives to the more prominent basaltic greenstones of the area is not known.

Sampling data from the Anikovik River Valley are summarized in tables 8, 9, and 10.

Kigezruk and Baituk Creeks

Two holes were drilled in Kigezruk Creek, and eight holes in Baituk Creek (fig. 5). In addition, six panned concentrates were taken from the principal tributaries of Baituk Creek. Minor to trace amounts of tin were found in all drill holes; cassiterite was most abundant in hole 35 on Baituk Creek, but the tin content of the gravels did not exceed a few hundredths of a pound per cubic yard.

Gold, in amounts estimated to range from traces to 10 cents per cubic yard, was found in holes 31, 32, 34, and 37 on Baituk Creek and in sample pit B6 on the East Fork of Baituk Creek. The gold occurs as thin flakes one-thirty-second of an inch and less in diameter on bedrock and in bedrock crevices.

The gravel on Kigezruk Creek is composed largely of fragments of shale and phyllite with some quartz. When the holes were drilled August 1 the bare gravel was thawed to bedrock, but the gravel overlain by soil and vegetation was frozen.

The gravel on Baituk Creek varies in depth from 4 to 15 or more feet and is composed largely of fragments of shale, phyllite, and basalt, with lesser amounts of quartz. During the first week in August when the stream was drilled, the gravel was frozen everywhere except under the stream channels.

TABLE 8. - Summary of churn-drilling results, Anikovik River Valley

Hole No.	Drill-hole data: Depths, ft. Total	O.B.	Gravel	Bedrock	Cased	Pay horizon: Interval From, ft.	To, ft.	Depth, ft.	Volume, cu. yd.	Concentrate: Weight, lb.	Tin, percent	Mining section: Depth, ft.	Concentrate, lb. per cu. yd.	Tin, lb. per cu. yd.
10	9.5	-	5.0	4.5	8.5	-	-	-	-	2.13	Trace	-	-	Trace
11	8.0	-	4.0	4.0	5.7	-	-	-	-	2.97	do.	-	-	Do.
12	8.5	-	5.0	3.5	1.5	-	-	-	-	2.89	do.	-	-	Do.
13	8.8	3.5	3.0	2.3	.0	-	-	-	-	1.77	do.	-	-	Do.
14	11.0	3.5	4.5	3.0	3.0	-	-	-	-	1.29	do.	-	-	Do.
39	8.0	3.0	3.0	2.0	6.5	-	-	-	-	.52	do.	-	-	Do.
40	6.0	-	4.0	2.0	4.6	-	-	-	-	.67	do.	-	-	Do.
15	6.5	-	4.0	2.5	5.5	-	-	-	-	1.60	do.	-	-	Do.
16	6.1	-	3.0	3.1	5.0	-	-	-	-	.78	do.	-	-	Do.
17	8.0	-	3.5	4.5	5.5	-	-	-	-	.96	do.	-	-	Do.
18	9.0	-	4.0	5.0	3.0	-	-	-	-	.80	do.	-	-	Do.
19	7.5	-	4.0	3.5	4.0	-	-	-	-	1.48	do.	-	-	Do.
20	8.0	-	5.0	3.0	5.5	-	-	-	-	1.75	do.	-	-	Do.
21	9.0	-	5.0	4.0	5.0	-	-	-	-	1.81	do.	-	-	Do.
22	10.5	2.5	4.5	3.5	.0	-	-	-	-	.88	do.	-	-	Do.
23	8.2	-	5.0	3.2	.0	-	-	-	-	1.85	do.	-	-	Do.
24	7.0	-	4.0	3.0	5.0	-	-	-	-	.97	do.	-	-	Do.
25	5.0	-	1.5	3.5	3.0	-	-	-	-	1.60	do.	-	-	Do.
26	5.7	-	4.0	1.7	4.2	-	-	-	-	1.03	do.	-	-	Do.
27	6.5	-	3.0	3.0	5.8	-	-	-	-	1.27	do.	-	-	Do.

1/ The only heavy mineral occurring in greater than trace amounts in this hole was chromite. For analysis see table 11.

2/ The only hole in which gold was observed; no assay was made. Based upon the size and the number of "colors," the gold content of the mining section is estimated to be 8 cents per cubic yard.

TABLE 9. - Petrographic and radiometric analyses of churn-drill concentrates, Anikovik River Valley

Hole Nos.	Light minerals and rocks	Heavy minerals
10, 11	Shale, phyllite, about 5 percent quartz, smaller amounts of dolomite, calcite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, augite, ankerite, and zircon.
12, 13, 14	Shale, about 5 percent quartz, lesser amounts of basalt fragments containing augite, phyllite fragments, chlorite, dolomite, oligoclase, and magnesite.	Pyrite, limonite pseudomorph after pyrite, augite, ankerite, and zircon.
39, 40	Phyllite, quartz, chlorite, limestone, and calcite.	Pyrite, limonite pseudomorph after pyrite, magnetite, apatite, tourmaline, zircon, and traces of scheelite. Titanium was present but was not identified.
15, 16	Shale, phyllite, about 10 percent quartz, lesser amounts of limestone, dolomite, calcite, chlorite, and biotite.	Pyrite, limonite pseudomorph after pyrite, augite, zircon, and garnet.
17	Shale, phyllite, minor amounts of quartz, limestone, dolomite, calcite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, hematite, augite, zircon, and cassiterite.
18, 19	Shale, phyllite, a basic igneous rock containing ilmenite, altered plagioclase, quartz, chert, calcite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, augite, ankerite, and magnesite.
20, 21, 22	Shale, phyllite, quartz, limestone, dolomite, calcite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, ilmenite, tourmaline, zircon, augite, hematite, hypersthene, and cassiterite.
23, 24, 25	Shale, phyllite, about 5 percent quartz, and smaller amounts of limestone, calcite, and chlorite.	Chromite (hole 23 only), pyrite, limonite pseudomorph after pyrite, olivine, augite, apatite, cassiterite, and gold. Analysis of sample from hole 23 indicated 0.23 pound of chromite per cubic yard containing 48 percent Cr_2O_3.
26, 27	Shale, about 5 percent quartz, limestone, and chlorite.	Pyrite, limonite pseudomorph after pyrite, augite, ilmenite, magnetite, ankerite, and zircon.
	Radiometric equivalent uranium	
	No significant radioactivity detected in any samples.	

TABLE 10. - Identification of bedrock samples, Anikovik River Valley

Hole No.	Stream	Type of bedrock
10........	Anikovik River	Dolomitic shale with pyrite and limonite.
11........	do.	Shale with pyrite, quartz, a trace of calcite, chlorite, and biotite.
12........	Ishut Creek	Shale with traces of hematite, limonite, and calcite.
13........	do.	Shale with fine quartz and traces of calcite, pyrite, limonite, and chlorite.
14........	do.	Shale and quartz with ankerite and traces of limonite, pyrite, and siderite.
39........	do.	Shale with limonite and quartz.
40........	do.	Shale with chlorite and a trace of limonite.
15........	Anikovik River	Shale with traces of calcite, quartz, pyrite, and limonite.
16........	do.	Shale with traces of quartz and pyrite.
17........	Buckner Creek	Shale with traces of limonite, calcite, and quartz.
18........	Jarvis Creek	Shale with traces of calcite, pyrite, and quartz.
20........	Banner Creek	Limey shale with pyrite.
21........	do.	Shale with traces of pyrite, quartz, and calcite.
22........	do.	Carbonaceous shale with traces of quartz, calcite, and limonite.
23........	Anikovik River	Limey shale with quartz.
24........	do.	Carbonaceous shale.
25........	do.	Carbonaceous shale with pyrite and quartz.
26........	do.	Carbonaceous shale with ankerite, quartz, and traces of chlorite and tourmaline.
27........	do.	Limey shale.

Sample No.	Stream	Miscellaneous bedrock samples
20-A......	Banner Creek	Typical sample of outcrop exposed on north bank of Banner Creek 15 feet downstream from drill hole 20. Outcrop has vertical or near-vertical dip and apparent strike of N. 20° E. Sample composed chiefly of altered plagioclase, quartz, calcite, ankerite, pyrite, apatite, and limonite. Semiquantitative spectrographic analyses data follow:

Spectrographic analyses, sample 20-A

Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe
G	B	-	-	F	-	-	-	B	-	F	E	E	A

Ga	Ge	Hg	In	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Pd
—	—	—	—	E	C	D	E	C	-	E	-	-	-

Pt	Sb	Si	Sn	Sr	Ta	Te	Ti	V	W	Zn	Zr
-	-	A	-	E	-	-	C	D	-	-	E

Legend:
A - More than 10 percent.
B - 5 to 10 percent.
C - 1 to 5 percent.
D - 0.1 to 1 percent.
E - 0.01 to 0.1 percent.
F - 0.001 to 0.01 percent.
G - Less than 0.001 percent.
- - Not detected.

Sample No.	Stream	Miscellaneous bedrock samples
26-A......	Anikovik River	Typical sample of dike or sill that outcrops in bed of Anikovik River a few feet upstream from holes 26 and 27. Intrusive has apparent strike of N. 50° W., but dip could not be determined. Sample composed chiefly of andesite with phenocrysts of andesine and biotite, some chlorite, and a trace of hornblende.

The bedrock of both streams is dominantly shale with quartz inclusions and usually contains disseminated pyrite and limonite pseudomorph after pyrite. One hole (33) encountered a basic rock composed of plagioclase feldspar with augite, chlorite, hornblende, and apatite.

Sampling data from Kigezruk and Baituk Creeks are summarized in tables 11, 12, 13, and 14.

TABLE 11. - Summary of churn-drilling results, Kigezruk and Baituk Creeks

Hole No.	Drill-hole data, Depths, ft.					Pay horizon			
						Interval			
	Total	O.B.	Gravel	Bedrock	Cased	From, ft.	To, ft.	Depth, ft.	Volume, cu. yd.
29.......	6.0	-	4.5	1.5	5.0	-	-	-	-
30.......	4.5	-	3.0	1.5	4.2	2.5	4.0	1.5	0.0128
31.......	20.7	-	15.3	5.4	15.3	-	-	-	-
32.......	7.5	-	5.0	2.5	5.5	-	-	-	-
33.......	12.0	0.5	8.5	3.0	2.5	-	-	-	-
34.......	13.0	4.5	5.5	3.0	2.5	-	-	-	-
35.......	8.5	-	5.5	3.0	7.0	4.0	5.5	1.5	.0128
36.......	8.5	.5	5.0	3.0	2.3	-	-	-	-
37.......	11.2	1.0	5.0	5.2	4.5	-	-	-	-
38.......	8.8	2.0	4.3	2.5	6.3	-	-	-	-

Hole No.	Concentrate		Mining section			
	Weight, lb.	Tin, percent	Depth, ft.	Concentrate, lb. per cu. yd.	Tin, lb. per cu. yd.	Gold,1/ cents per cu. yd.
29.......	0.74	Trace	-	-	Trace	-
30.......	.99	0.05	4.0	28.94	0.01	-
31.......	.74	Trace	-	-	Trace	1
32.......	.80	do.	-	-	do.	5
33.......	.72	do.	-	-	do.	-
34.......	1.06	do.	-	-	do.	10
35.......	1.80	.06	6.5	32.43	.02	-
36.......	1.70	Trace	-	-	Trace	-
37.......	1.12	do.	-	-	do.	Trace
38.......	1.10	do.	-	-	do.	-

1/ Estimate based upon number and size of "colors" observed.

TABLE 12. - Analyses of miscellaneous concentrates,1/ Baituk Valley

Sample No.	Creek	Gravel depth, ft.	Assay, percent		Gold,2/ cents per cu. yd.
			Sn	Eu	
B-1...........	Carmen................	3	<0.05	Trace	Nil
B-2...........	Eureka................	3	< .05	Nil	Nil
B-3...........	Boulder...............	3/ 4	< .05	Nil	Nil
B-4...........	Fremont...............	3/ 3	< .05	Nil	Nil
B-5...........	Baituk:				
	Center Fork.........	3/ 4	< .05	Nil	Nil
B-6...........	East Fork...........	4	< .05	0.003	4/ 10

1/ Samples were panned concentrates taken from bulldozer pits in stream channel.
2/ Estimate based upon size and number of "colors" present.
3/ No bedrock encountered.
4/ Sample taken near bedrock; entire gravel section may average considerably less.

TABLE 13. - Petrographic and radiometric analyses of churn-drill concentrates, Kigezruk and Baituk Creeks

Hole Nos.	Light minerals and rocks	Heavy minerals
29, 30	Shale, quartz, phyllite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, magnetite, ilmenite, and tourmaline.
31	Shale, phyllite, quartz, feldspar, dolomite, andesine, and calcite.	Garnet, limonite pseudomorph after pyrite, pyrite, ilmenite, magnetite, augite, tourmaline, hornblende, zircon, epidote, sphene, hypersthene, staurolite, cassiterite, and gold.
32, 33	Shale, basalt, phyllite, quartz, sericite (with phyllite), and chlorite.	Pyrite, limonite pseudomorph after pyrite, augite, magnetite, ilmenite, apatite, hornblende, and cassiterite.
34, 35	Shale, quartz, phyllite, sericite, and chlorite.	Pyrite, limonite pseudomorph after pyrite, augite, magnetite, ilmenite, apatite, zircon, tourmaline, cassiterite, and gold.
36, 37	Shale, phyllite, basalt, quartz, sericite, chlorite, ankerite, and epidote.	Pyrite, limonite pseudomorph after pyrite, augite, cassiterite, and gold.
	Radiometric equivalent uranium	
	No significant radioactivity detected in any samples.	

TABLE 14. - Identification of bedrock samples, Kigezruk and Baituk Creeks

Hole No.	Creek	Type of bedrock
29...............	Kigezruk	Shale.
30...............	do.	Shale and sandstone with pyrite and limonite.
31...............	Baituk	Do.
32...............	do.	Carbonaceous shale with pyrite and traces of hematite, limonite, and chlorite.
33...............	do.	Dominantly carbonaceous shale with ankerite, limonite after pyrite, pyrite, and a trace of chlorite. One fragment is a basalt composed of plagioclase with augite, chlorite, and traces of hornblende and apatite.
34...............	do.	Shale with quartz and traces of limonite and pyrite.
35...............	do.	Shale with traces of limonite, chlorite, and ankerite.
36...............	do.	Shale with pyrite, quartz, and limonite.
37...............	do.	Shale and quartz with chlorite and ankerite.
38...............	do.	Shale and quartz with calcite and ankerite.

Conclusions

The samples from Lost River contained more tin than the samples from the other streams investigated during this reconnaissance. The tin in Lost River gravels undoubtedly was derived largely from the known tin-bearing outcrops on the Tin and Cassiterite Creeks. Except for the small deposit in the gravels of Cassiterite Creek, there was no indication of placer deposits of a size and grade comparable with the placer deposits that have been mined or explored in the Potato and Cape Mountain areas. The lack of organic cover and the consequent flash floods, which frequently disturb the gravels of Lost River, make this stream less favorable for the accumulation of placer deposits than the streams of the Potato and Cape Mountain areas. The gravel samples from Lost River therefore do not constitute a reliable indication of the relative abundance of lode outcrops in the Lost River area as compared with the Potato and Cape Mountain areas. However, these samples do indicate that, even under unfavorable conditions, measurable amounts of tin will be found in placer gravels derived from areas containing significant lode tin outcroppings such as those in the Lost River drainage basin.

The samples from gravels of the Anikovik River, and of the Kigezruk, York, and Baituk Creeks all contained traces of tin, but none more than trace amounts. Insofar as was determinable by Bureau reconnaissance, the conditions for the formation of placer deposits in these streams are substantially similar to the conditions at the Potato and Cape Mountains; therefore, it is believed that the widespread distribution of sparse amounts of tin indicates that it was derived from scattered or low-grade sources.

None of the samples contained enough gold or valuable heavy minerals other than tin to encourage additional exploration with the objective of developing placer reserves. In this respect Baituk Creek, which contained some gold in every line of drill holes, appeared to be the most favorable of the streams sampled.

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