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GEOLOGY of the BEAR CREEK AREA, SEWARD PENINSULA, CANDLE QUADRANGLE, ALASKA

By G. Herreid

DIVISION OF MINES & MINERALS — GEOLOGIC REPORT No. 12

DIVISION OF MINES & MINERALS
DEPARTMENT OF NATURAL RESOURCES
STATE OF ALASKA

MAY 1965

STATE OF ALASKA

William A. Egan - Governor

DEPARTMENT OF NATURAL RESOURCES

Phil R. Holdsworth - Commissioner

DIVISION OF MINES AND MINERALS

James A. Williams - Director

GEOLOGIC REPORT NO. 12

Geology of the Bear Creek Area
Seward Peninsula, Candle Quadrangle, Alaska

By

Gordon Herreid

Juneau, Alaska
May 1965

CONTENTS

ILLUSTRATIONS

Geology of the Bear Creek Area
Seward Peninsula, Candle Quadrangle, Alaska

By: Gordon Herreid

ABSTRACT

The association of major structures and igneous rocks along the eastern margin of the Seward Peninsula has made that belt favorable for ore deposits. The map area is largely underlain by andesitic greenstone intruded by various acidic rocks. Olivine basalt overlies the greenstone. Dikes and small intrusives appear to be more abundant near a large fault which lies along Bear Creek, but they do not follow it. Gold, lead, and zinc deposits are associated with mafic syenite dikes and possibly with altered diorite.

Gold placers exist in the belt, one of which is closely associated with a lead-zinc-gold deposit on Bear Creek. Other similar associations are likely. Geochemical sampling indicates an extension of the Bear Creek prospect.

Mafic syenite, diorite, and probably jasper and hematite creek float are considered favorable indications of lode possibilities throughout the greenstone region. Stream sediment geochemical sampling should be effective if sampling is done at intervals of not greater than one mile in all drainages.

[redacted]

[redacted]

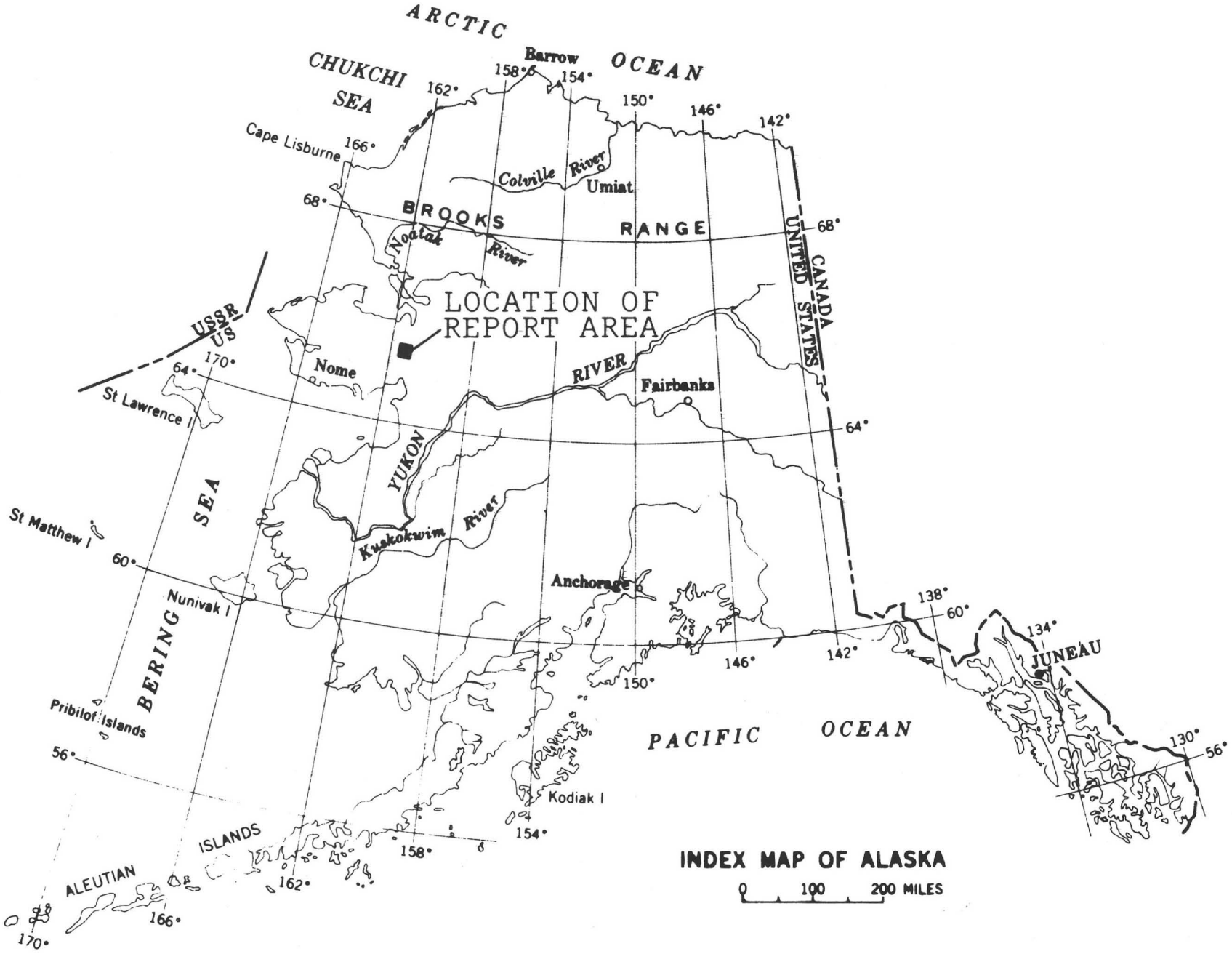
THE ALASKAMIN COMPANY,
General Partner
for
DENALI EXPLORATION LIMITED

THE RIDGE GROUP OF FORTY-FIVE LODE MINING CLAIMS
THE SLOPE GROUP OF FIFTEEN LODE MINING CLAIMS

METALLIFEROUS DEPOSITS NEAR GRANITE MOUNTAIN
EASTERN SEWARD PENINSULA, ALASKA

PRELIMINARY REPORT

Don O. Roberts Nome, Alaska May 18, 1969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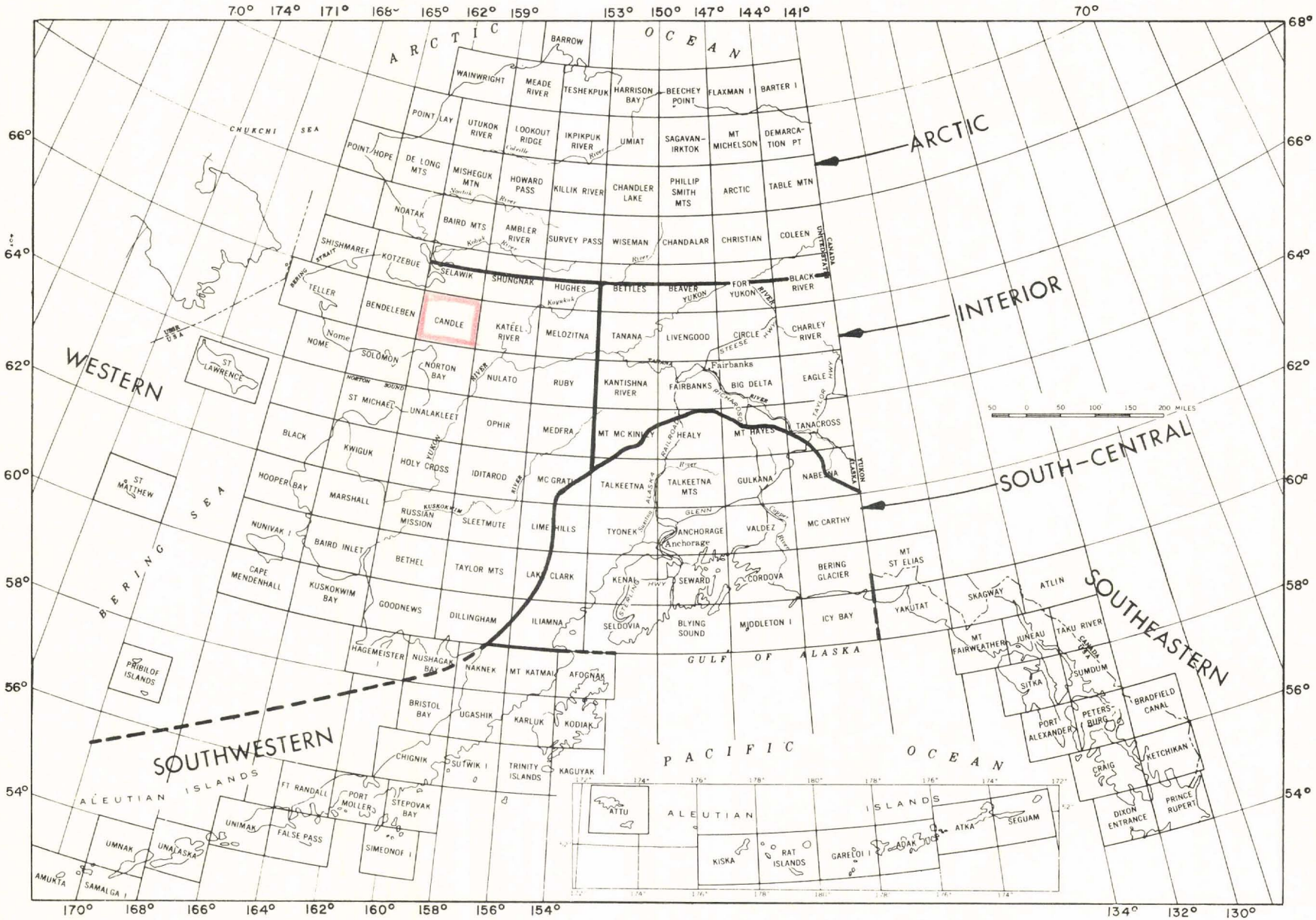
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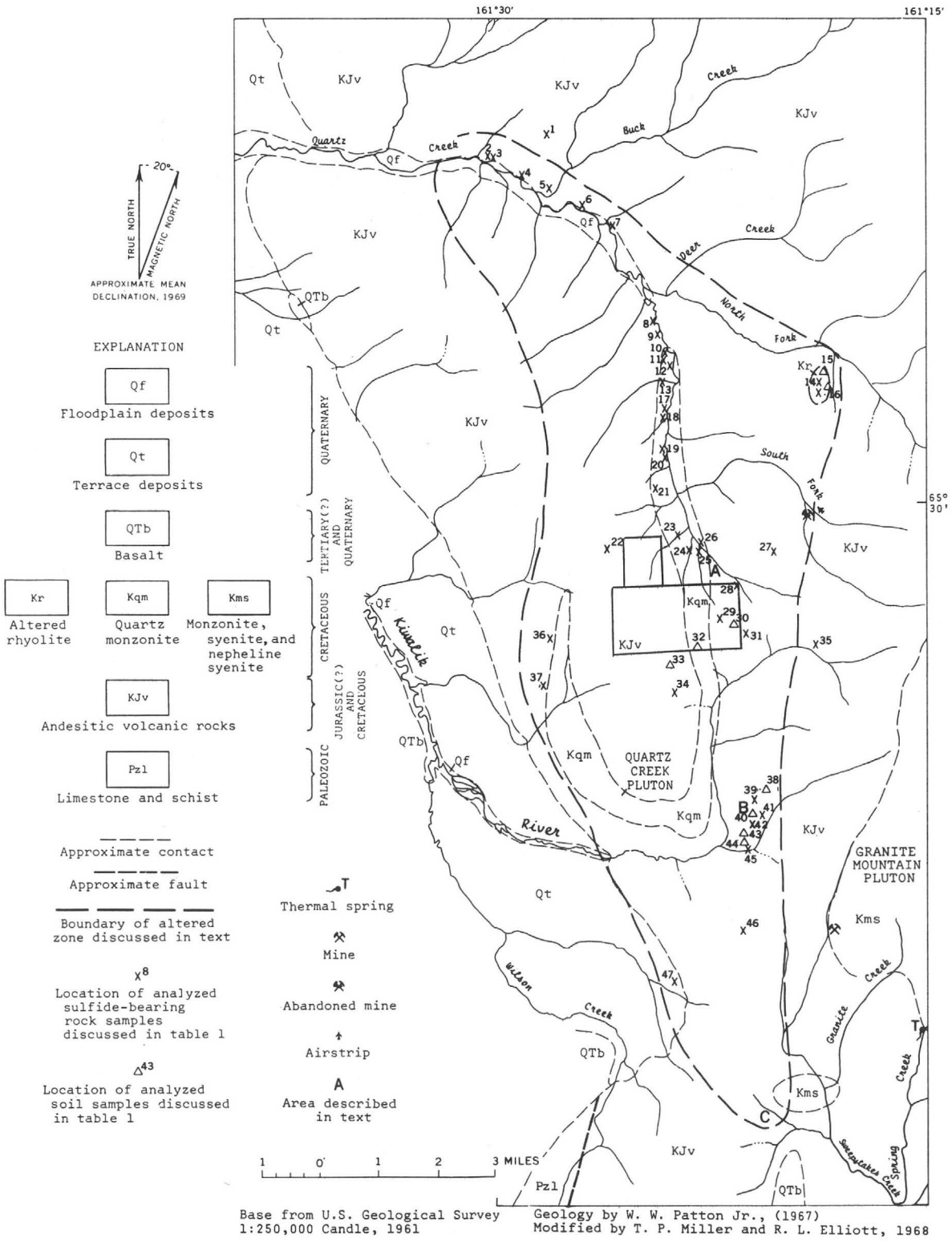
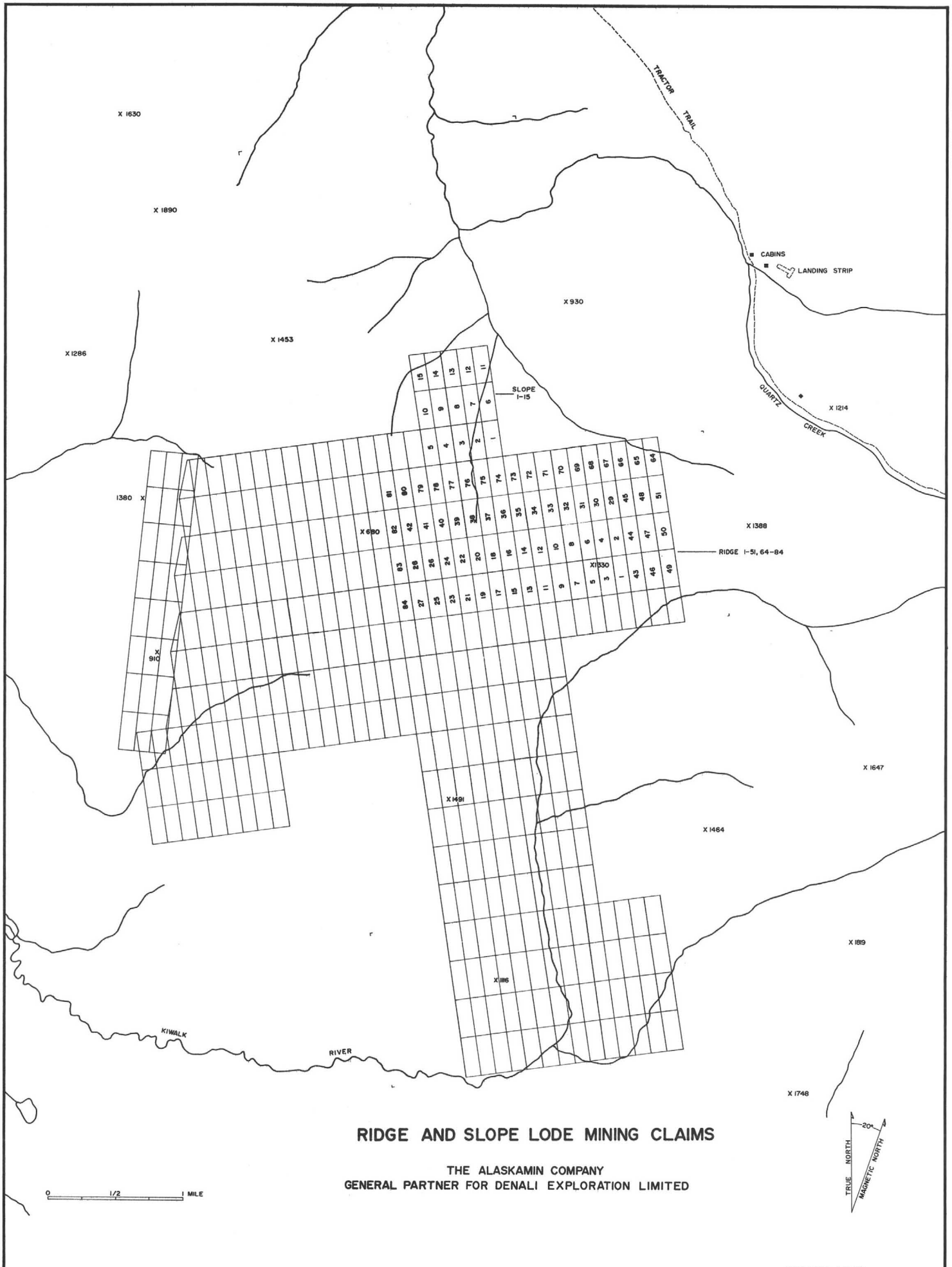


FIGURE 2.—Geologic map of the Quartz Creek area.

Boundary lines of claim block of Slope and Ridge claims belonging to The Alaskamin Company, as General Partner for Denali Exploration Limited



RIDGE AND SLOPE LODE MINING CLAIMS

THE ALASKAMIN COMPANY
GENERAL PARTNER FOR DENALI EXPLORATION LIMITED

JIM NIELAND 5/23/69

REPORT ON RIDGE GROUP AND SLOPE GROUP OF LODE MINING CLAIMS

LOCATION AND ACCESS

The Ridge Group of forty-five lode claims and the contiguous Slope Group of fifteen lode claims are in the Fairhaven Recording District in the Candle Quadrangle, Eastern Part of the Seward Peninsula, Alaska. The claims can be reached from Nome, Alaska by Wien Consolidated Airline on a three days per week schedule. The distance from Nome to the Granite Mountain airstrip is approximately 150 miles. The claims lie approximately five miles northwest of the airstrip. The Ridge claims are on the divide between the Kiwalik River and Quartz Creek. The Slope claims are downstream on Quartz Creek to the north. Quartz Creek is a tributary of the Kiwalik River.

The United States Geological Survey released in February 1969, Geological Survey Circular 614, "Metalliferous Deposits Near Granite Mountain, Eastern Seward Peninsula, Alaska", by Thomas P. Miller and Raymond L. Elliott. The Government's examination of this area was made as a part of its heavy minerals program. The Geological Survey reported finding new deposits of lead, zinc and silver over a large mineralized area near Quartz Creek, west of Granite Mountain, in a large hydrothermal altered zone eighteen miles long and from two to five miles wide.

Pursuant to the instructions of The Alaskamin Company, the writer located the claims between February 28 and March 15, 1969. He was assisted by Luther Paul Nagaruk and Edwin Katongan, Eskimos. Equipment used included a 12 HP Ski-Doo, a 15 HP Ski Daddler and a 12 HP Polaris.

On our staking trip, we stayed with Charlie Moon, a local miner, and commuted eight miles to and from the property.

Our second trip to these claims was made from April 10 to May 12, 1969. About two-thirds of the snow that had covered the ground went off during our second trip. On this second trip, we established a tent camp near the center of the area claimed.

GEOLOGY

The geology of the area is shown in Figure 2, Geologic Map of the Quartz Creek Area in Circular 614. The hydrothermal altered zone shown on the map consists of altered andesitic volcanic rocks of Jurassic (?) and Cretaceous Age. The altered zone was intruded by felsic plutonic rocks. Metamorphic rocks lie to the west of the area and are reported as being of Paleozoic and Precambrian Age. Olivine basalt, Tertiary is in a few low-lying areas and caps some ridges. The Granite Mountain pluton to the east was mapped as a monzonite syenite and nepheline syenite. To the west, there is limestone and schist. The located claims are in the headwaters of the streams draining Area A, shown on Figure 2 of the map in the circular. The mineral deposits in the area are related to the plutonic rocks and occur in both the intrusive rocks and in the surrounding country rocks. (Miller and Elliott).

In the hydrothermal altered zone, there is a U-shaped pluton of quartz monzonite. The easterly part of the U extends north through the Ridge and Slope Groups of claims. The quartz monzonite intruded the andesitic volcanic rocks on the claims and is from a quarter of a mile to a half mile in width.

METALIZATION

The rocks taken from the claims and analysis of them are reported in the circular. They are numbered on the geologic map and are as follows:

Extract of Sample Table, p. 16-17
U.S.G.S. Circular 614
Samples Related to Ridge and Slope Claims

Sample	Ag	Co	Cu	Pb	Sn	Zn
23	2	10	500	7000	N	10,000
24	50	50	700	1500	H	G(10,000)
25A	20	5	200	15,000	150	G(10,000)
25B	44	--	--	22,500	--	46,700
25C	3	30	100	500	30	G(10,000)
26	150	10	1500	20,000	H	G(10,000)
27	200	100	200	G(20,000)	N	G(10,000)
28A	L	70	150	150	50	3000
28B	1	2000	500	200	30	L
29	7	7	150	1000	70	1000
30	1	20	150	1500	N	1500
31A	3	10	70	5000	H	300
31B	300	20	200	G(20,000)	H	G(10,000)
32	L	10	70	300	10	L
Anomalous	0.5	150	200	150	30	200

N=not detected, H=interference, L=below limits of detection, G=greater than

REASONS FOR EXPLORATION

The ridge and Slope Group of claims recommended by the U.S.G.S. for exploration are worthy of exploration for the following reasons:

1. Silver, lead, copper and zinc occur in a favorable environment. Of all the samples analyzed by the Government, everyone is anomalous by one or more metals.

2. A large zone of hydrothermal alteration indicates large mineral deposits. The outer limits of a zone of alteration forms the outer rings of a target for exploration.

3. The reddish and orange oxidized zones and the large buff carbonatite replacement bodies within the altered limits likely form halos for mineral deposits.

4. Tourmaline and other high-temperature minerals suggest that mineralization was formed at depth and was exposed by gradation at the surface.

5. The claims loacted are in "a strongly mineralized area". (Miller and Elliott, p. 9).

RECOMMENDED EXPLORATION

1. Map alteration target zones.

2. Collect rock and soil samples on a 200-foot grid pattern for geochemical testing.

3. Trench anomalies across the monzonite and altered andesitic rock.

4. Geophysics could delineate the sulphide zones and plutonic rocks. Colored aerial photographs would help in mapping the geology and altered zones. If the cost of airborne electromagnetic fluxgate magnetometer survey, coupled with low level colored aerial photography, was prorated among the claimants to ground in the hydrothermal altered zone, the cost of doing this work over the two square miles plus of the located claims would probably not exceed $2,000.

5. Test the favorable areas delineated by the work recommended above by either churn drilling or diamond core drilling.

For the foregoing reasons, the Ridge and Slope Claims are recommended for further exploration.

Don O Roberts

Don O. Roberts
Nome, Alaska

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RESUME - DON O. ROBERTS

Born Nome, Alaska, July 9, 1930.

Ten years mining experience, both placer and lode.

Prospector in summer and student at University of Alaska in winter. Approved under Alaska Prospectors Aid Program 1967.

Located and did discovery work on asbestos claims described in U.S.G.S. Circular 611.

Completed mining extension courses University of Alaska. Courses taken at University of Alaska included: Mining Algebra and Mineralogy.

References:

Earl A. Beistline, Ph. D., Dean of College of Earth Science and Mineral Industry, University of Alaska.

Donald Cook, Ph. D., Dean of Mining and Mineral Preparation, University of Alaska.

Alaska State Bank, Fairbanks, Alaska 99701

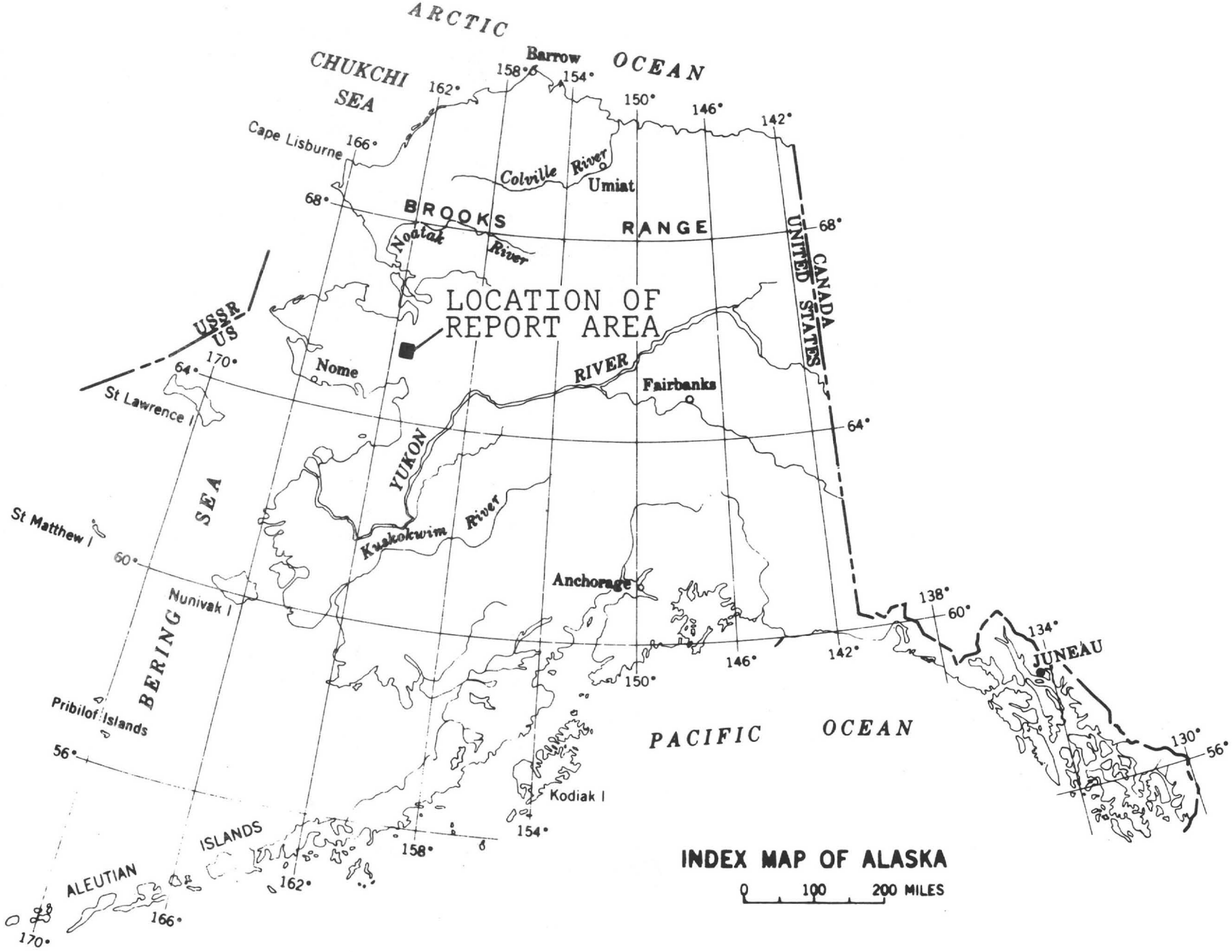
CAPITAL EXPLORATION CORPORATION
General Partner
for
CANDLE BEAR CREEK-GORDON LIMITED

THE GORDON GROUP OF THIRTY-SIX LODE MINING CLAIMS AND ONE DISCOVERY FRACTION

METALLIFEROUS DEPOSITS NEAR GRANITE MOUNTAIN EASTERN SEWARD PENINSULA, ALASKA

PRELIMINARY REPORT

Don O. Roberts Nome, Alaska May 18, 1969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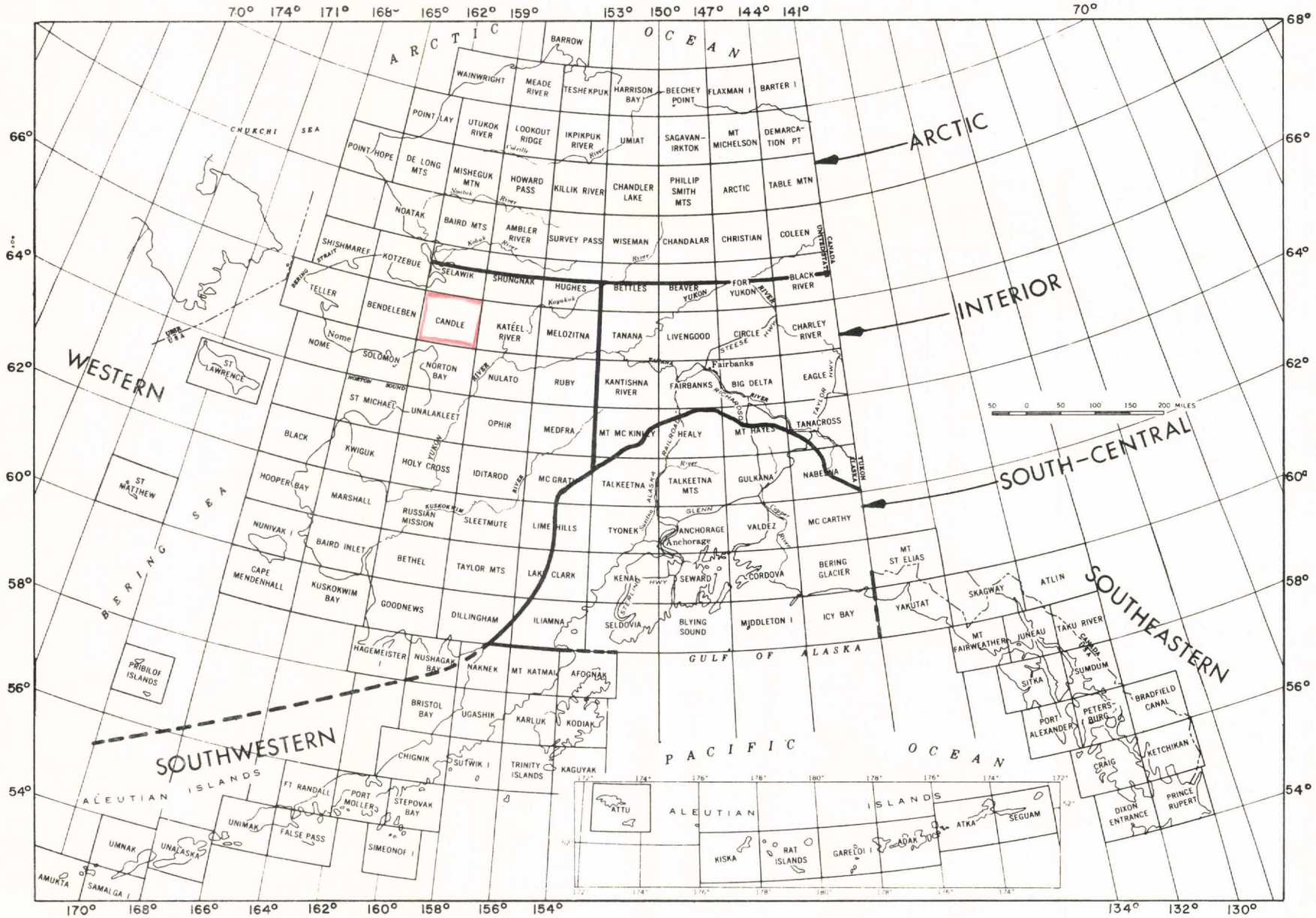
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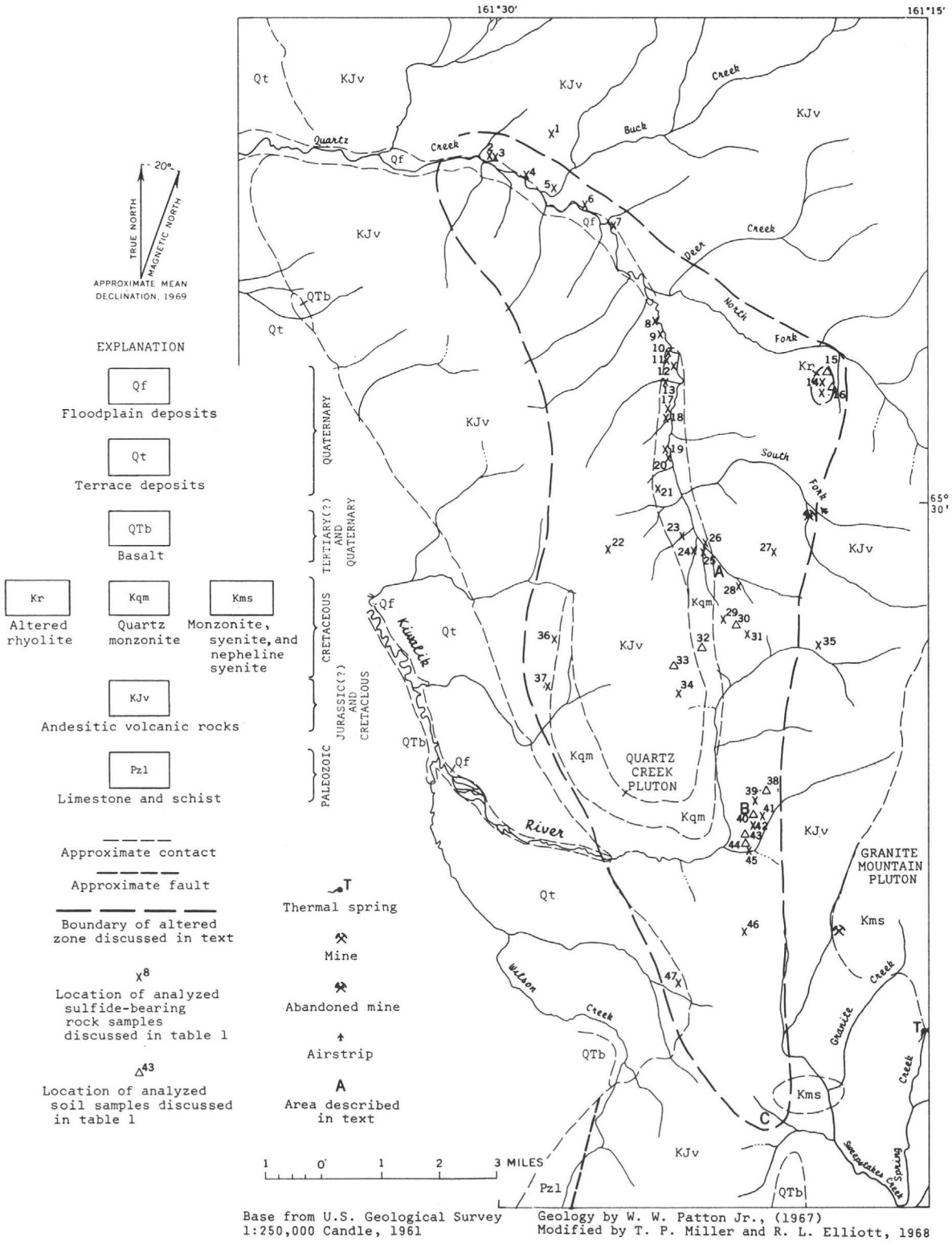
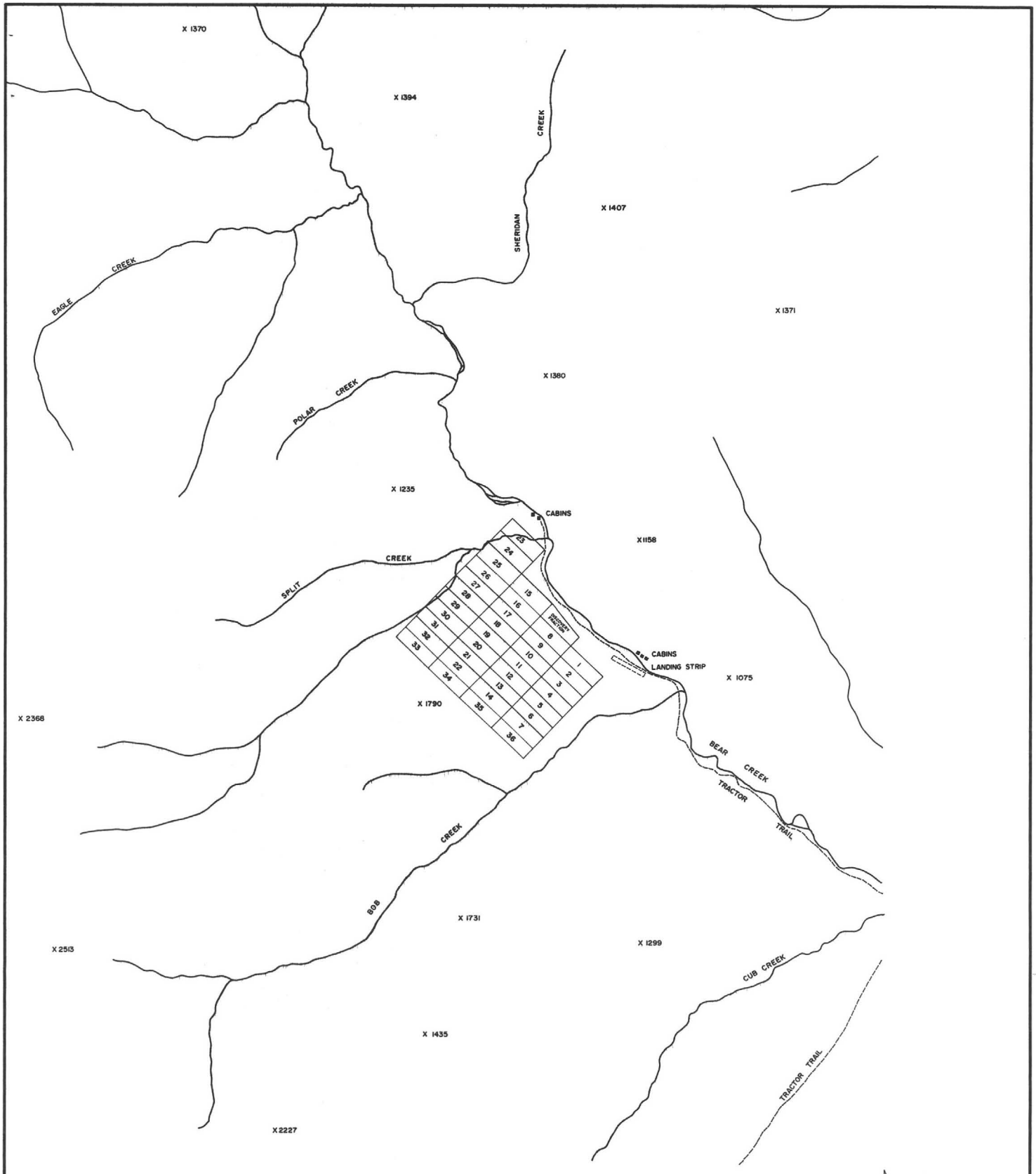


FIGURE 2.—Geologic map of the Quartz Creek area.

Boundary lines of claim block of Gordon claims belonging to Candle Bear Creek-Gordon Limited



BEAR CREEK-GORDON LODE MINING CLAIMS

CAPITAL EXPLORATION CORPORATION
GENERAL PARTNER FOR CANDLE BEAR CREEK-GORDON LIMITED

JIM NIELAND 5/23/69

REPORT ON THE GORDON GROUP OF LODE MINING CLAIMS

May 20, 1969

LOCATION AND ACCESS

The Gordon Group of 37 lode claims forms a contiguous group containing 740 acres of mineral land. The claims are in the Fairhaven recording district in the Candle Quadrangle, eastern part of the Seward Peninsula, Alaska. The deposits occur in the Candle Quadrangle mapped at a scale of 1:63,360. The closest towns are Candle, 38 miles northwest; Buckland, 30 miles north; and Koyuk, 42 miles south.

There is a 1,000 foot long gravel surfaced airstrip adjacent to the claims which can be serviced by small aircraft. The distance from Nome is approximately 155 miles. The claims lie approximately nine miles north of Granite Mountain microwave site. The claims are located between westerly tributaries of Bear Creek of the Buckland River. The area is mentioned in U.S.G.S. Circular 614, and is recommended by Gordon Herreid, geologist, State of Alaska in "Geology of the Bear Creek Area," Alaska Division of Mines and Minerals Report 12.

Miller and Elliott have done additional sampling and re-examined the principal mineralization confirming Herreid's work and in addition did polished section study of their samples showing arsenopyrite, bournonite, and a little gold besides the previously known sulphides, Galena, Sphalerite, Chalcopyrite, and pyrite.

Pursuant to the instructions of Capital Exploration Corporation, I located the claims between April 9 and April 25, 1969. I was assisted by Luther Nagaruk and Edwin Katongan, native labor. Equipment used included a 12 HP Ski-Doo and an 18 HP Ski Daddler, snow machines. We traveled over a cat train trail as mapped up the south fork of Quartz Creek and down Cub Creek, tributary to Bear Creek.

We stayed in the placer mining camp of Bertram Douglas with his prior permission. The cook house has been used extensively by a grizzly bear during the winter. He was not the best of housekeepers, so we stayed in the bunk-house. We were able to use the snow machines on about half of the ground and the remainder had to be traversed on foot. The claims were surveyed by tape and Brunton pocket transit.

The snow machines were indispensable in traveling to Bear Creek from Quartz Creek and back. There were no competitive stakes found, except for existing placer claims in the creek, which we did not overstake. Some of the ridge tops were windblown and we were able to collect rock samples typical of the area. Rocks were also collected from exposed gravel near the camp typical of the rock types in the area. These samples are numbered and are available for testing and inspection, which I recommend.

I have previously prospected Bear Creek while on the prospector's aid program of the State of Alaska. I was favorably impressed by the structure and the mineralization in the area. I lacked the funds to stake and trench the ground. I did obtain samples which indicated ore grade in a combination of several metals.

GEOLOGY

The geology of the Bear Creek area is described by Herreid in Alaska State Division of Mines and Minerals Report #12. Herreid infers a major fault following the present stream bed of Bear Creek. To the East of this fault there is tertiary olivine vesicular basalt. Immediately to the west there is greenstone, a metamorphosed andesite of the Cretaceous age. Further west at higher elevations nepheline syenite of mid-Cretaceous age intrudes the andesite. Its age has been determined by Patton as 100^{+}_{-} years.

Quartz Diorite is exposed in the basalt southeast of Sheridan Creek.

Several dikes of varying composition were mapped by Herreid, trending easterly and intersecting the Bear Creek Fault. They vary in composition from Trachyte, rhyolite, quartz diorite, mafic syenite, etc. Each dike is the source of an anomaly. A large buff colored carbonate altered zone is mapped by Herreid on the divide west of Bear Creek. Herreid reported that this represents the halo of a buried ore body. The principal target and most mineralized area is the mafic syenite dike trending northwest from a location 200 feet from the north end of the airfield at Bear Creek. Here a bedrock drain blasted by placer mining 30 years ago has exposed mineralization in the andesitic greenstone on both sides of the dike. A nearby zinc gold anomaly is interpreted to have a different source as it is uphill from the dike and covers a large area.

MINERALIZATION

Sulphide mineralization consisting of galena, sphalerite, chalcopyrite, pyrite, arsenopyrite and bournonite has been confirmed by Herreid, Miller and Elliott from rock samples adjacent to the airfield dike. Gold, arsenic and cadmium have also been noted, which are not sulphides. My own samples assayed by the State Department of Mines and Geology, spectrographic analysis, confirm the above metals plus high lithium values.

Herreid has shown a large area lead, zinc, gold anomaly uphill and west of the airfield dike which he attributes to a different source. This checks with float samples of galena found near a porphoritic rhyolite dike on claim #14. Herreid also notes that the placer gold has as its source the dike mineralization pattern. Miller and Elliott note that Bear Creek has lode gold values along with the base metals in contrast to Quartz Creek where tin and tungsten are found.

Extract of Sample Table, p. 19
U.S.G.S. Circular 614
Rock Samples Relating to Gordon Claims

Sample	Ag	Au	As	Cu	Pb	Zn
1	1.5	3.0	G(10,000)	50	200	1000
2	50	.8	2,000	500	20,000	3000
3	30	1.4	500	200	20,000	700
4	30	1.2	1,000	150	G(20,000)	G(10,000)
5	150	1.1	1,500	1000	G(20,000)	G(10,000)
6	30	.4	3,000	500	G(20,000)	G(10,000)
7	150	.7	7,000	500	G(20,000)	G(10,000)
Anomalous	0.5	0.04	L	200	150	L

The reasons why the claims offer the prospect of being developed into a paying mine or mines are as follows:

1. Documented base and precious metal mineralization at an accessible location of near ore grade. Unweathered samples should show higher values in the chemically active base metals. It should be pointed out again that this bedrock drain exposure of the dike-contact rock has been weathered for thirty years.

2. The structure is favorable for a large tonnage. It is 200 feet wide (Miller and Elliott), trends northwest and its length is unknown due to a covering of river gravel and tundra. The structure is massive and should continue to the west.

3. Substantial gold-silver values definitely correlated to the dike are favorable to making a mine.

4. The area was recommended by Herreid as a target worthy of further exploration.

RECOMMENDED EXPLORATION

1. Collect rock and soil samples on a 100 foot grid pattern for geochemical testing, both field method and total heavy metal assay.

2. Map mineralized exposures, establish target zones.

3. Trench anomalies in the target areas.

4. Delineate the sulphide zones and plutonic rocks by geophysical methods.

5. Measure the deposits by diamond core drilling.

For the foregoing reasons this property offers an excellent prospect of developing a mine or mines on the claims discussed.

Don O. Roberts, Prospector
Nome, Alaska

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RESUME - DON O. ROBERTS

Born Nome, Alaska, July 9, 1930.

Ten years mining experience, both placer and lode.

Prospector in summer and student at University of Alaska in winter. Approved under Alaska Prospectors Aid Program 1967.

Located and did discovery work on asbestos claims described in U.S.G.S. Circular 611.

Completed mining extension courses University of Alaska. Courses taken at University of Alaska included: Mining Algebra and Mineralogy.

References:

Earl A. Beistline, Ph. D., Dean of College of Earth Science and Mineral Industry, University of Alaska.

Donald Cook, Ph. D., Dean of Mining and Mineral Preparation, University of Alaska.

Alaska State Bank, Fairbanks, Alaska 99701

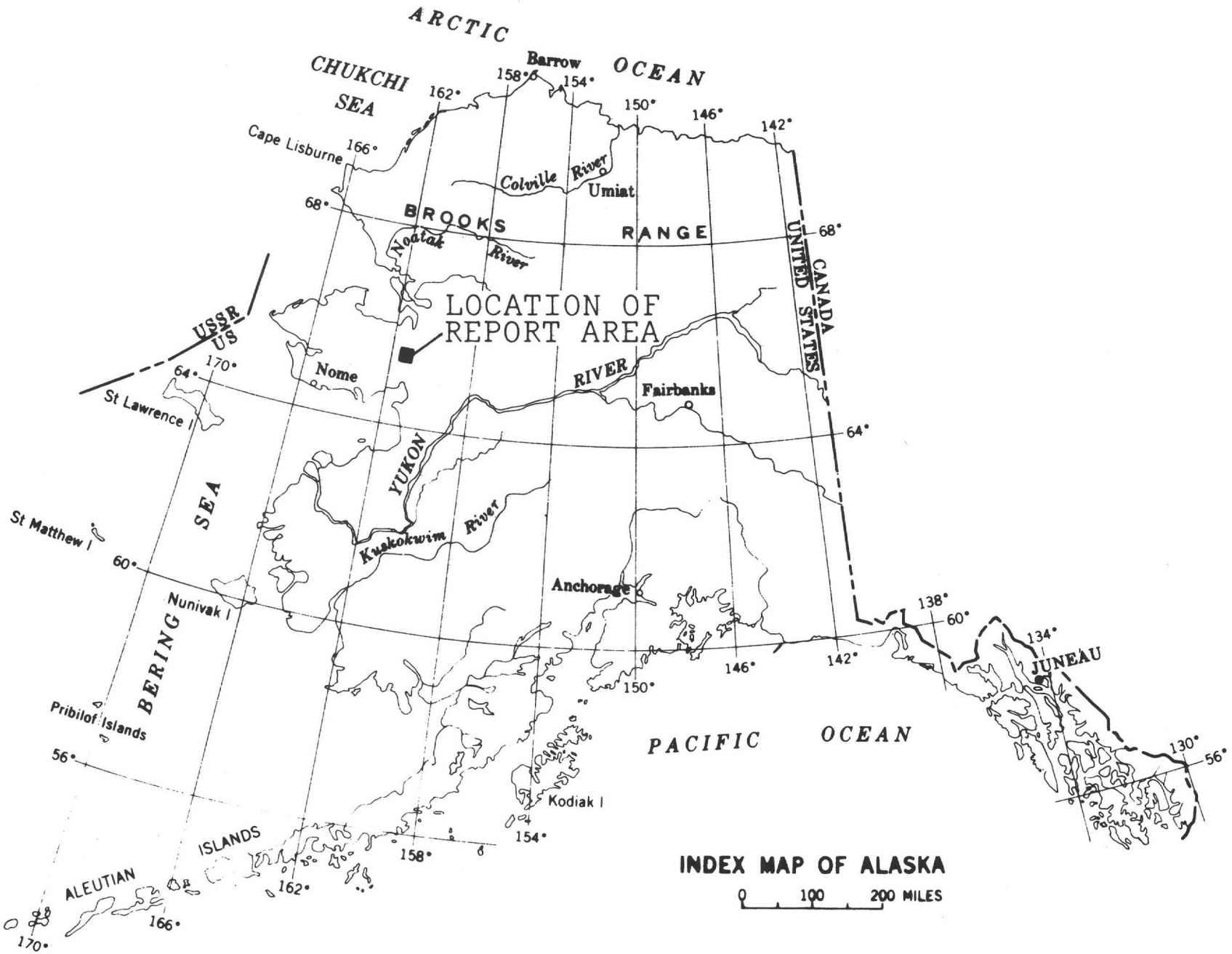
CAPITAL EXPLORATION CORPORATION
General Partner
for
CANDLE RHYOLITE LIMITED

THE RHYOLITE GROUP OF SIXTY-SEVEN LODE MINING CLAIMS

METALLIFEROUS DEPOSITS NEAR GRANITE MOUNTAIN EASTERN SEWARD PENINSULA, ALASKA

PRELIMINARY REPORT

Don O. Roberts Nome, Alaska May 18, 1969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Barrow
Cape Lisburne
Colville River
Umiat
BROOKS RANGE
Noatak River
LOCATION OF REPORT AREA
USSR
US
CANADA
UNITED STATES
Nome
YUKON RIVER
Fairbanks
St Lawrence I
St Matthew I
BERING SEA
Kuskokwim River
Anchorage
Nunivak I
JUNEAU
Pribilof Islands
PACIFIC OCEAN
Kodiak I
ALEUTIAN ISLANDS
INDEX MAP OF ALASKA
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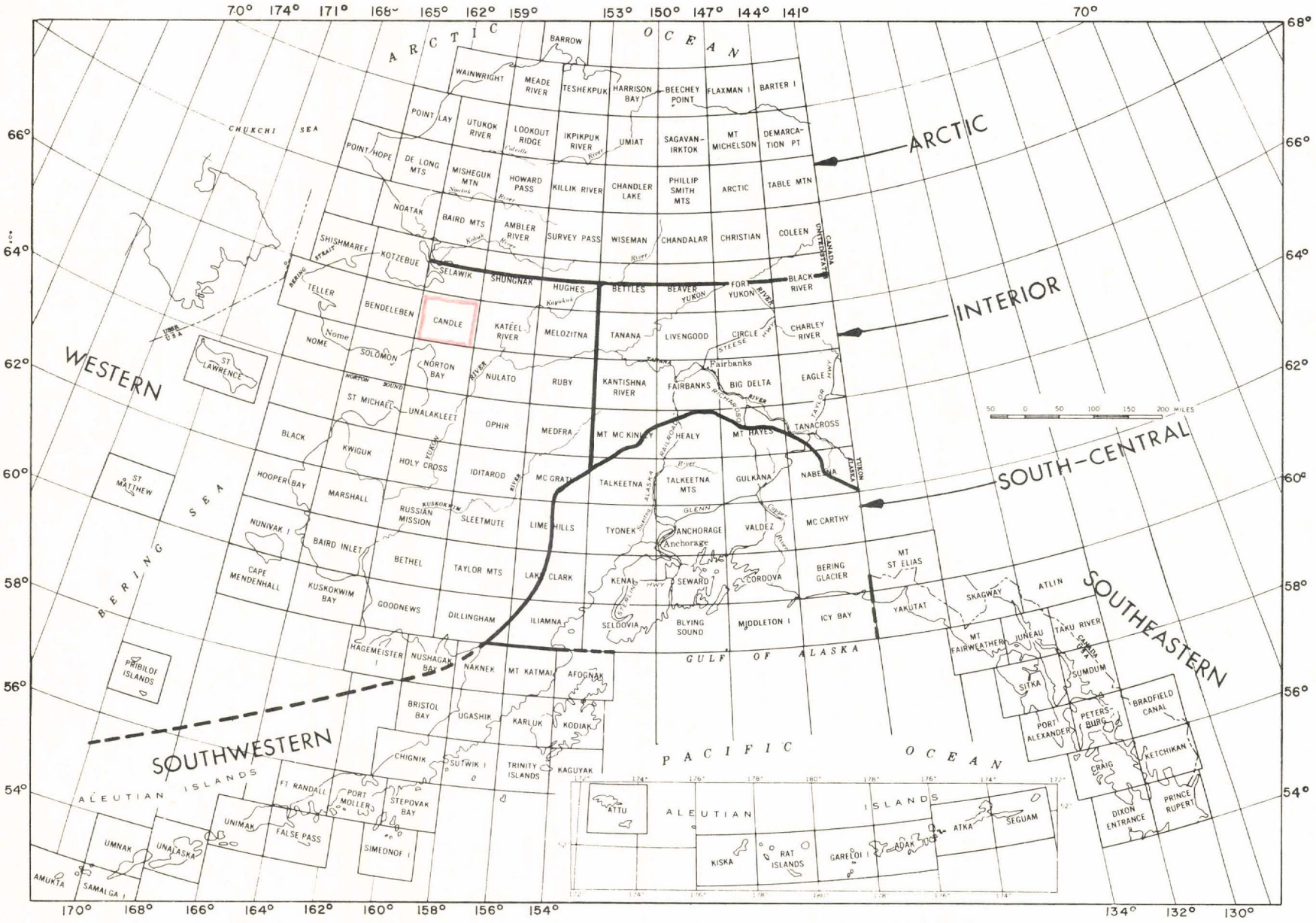
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CHUKCHI SEA
ALEUTIAN ISLANDS
BARROW
WAINWRIGHT
MEADE RIVER
TESHEKPUK
HARRISON BAY
BEECHEY POINT
FLAXMAN I
BARTER I
POINT LAY
UTUKOK RIVER
LOOKOUT RIDGE
IKPIKPUK RIVER
UMIAT
SAGAVANIRKTOK
MT MICHELSON
DEMARCATION PT
POINT HOPE
DE LONG MTS
MISHEGUK MTN
HOWARD PASS
KILLIK RIVER
CHANDLER LAKE
PHILLIP SMITH MTS
ARCTIC
TABLE MTN
NOATAK
BAIRD MTS
AMBLER RIVER
SURVEY PASS
WISEMAN
CHANDALAR
CHRISTIAN
COLEEN
SHISHMAREF
KOTZEBUE
SELAWIK
SHUNGNAK
HUGHES
BETTLES
BEAVER
FORT YUKON
BLACK RIVER
TELLER
BENDELEBEN
CANDLE
KATEEL RIVER
MELOZITNA
TANANA
LIVENGOOD
CIRCLE
CHARLEY RIVER
Nome
NOME
SOLOMON
NORTON BAY
NULATO
RUBY
KANTISHNA RIVER
FAIRBANKS
BIG DELTA
EAGLE
ST LAWRENCE
ST MICHAEL
UNALAKLEET
OPHIR
MEDFRA
MT MC KINLEY
HEALY
MT HAYES
TANACROSS
BLACK
KWIGUK
HOLY CROSS
IDITAROD
MC GRATH
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ST MATTHEW
HOOPER BAY
MARSHALL
RUSSIAN MISSION
SLEETMUTE
LIME HILLS
TYONEK
ANCHORAGE
Anchorage
VALDEZ
MC CARTHY
NUNIVAK I
BAIRD INLET
BETHEL
TAYLOR MTS
LAKE CLARK
KENAI
SEWARD
CORDOVA
BERING GLACIER
MT ST ELIAS
CAPE MENDENHALL
KUSKOKWIM BAY
GOODNEWS
DILLINGHAM
ILIAMNA
SELDOVIA
BLYING SOUND
MIDDLETON I
ICY BAY
YAKUTAT
SKAGWAY
ATLIN
PRIBILOF ISLANDS
HAGEMEISTER I
NUSHAGAK BAY
NAKNEK
MT KATMAI
AFOGNAK
MT FAIRWEATHER
JUNEAU
TAKU RIVER
BRISTOL BAY
UGASHIK
KARLUK
KODIAK
SITKA
SUMDUM
PETERSBURG
BRADFIELD CANAL
CHIGNIK
SUTWIK I
TRINITY ISLANDS
KAGUYAK
PORT ALEXANDER
CRAIG
KETCHIKAN
FT RANDALL
PORT MOLLER
STEPOVAK BAY
UNIMAK
FALSE PASS
SIMEONOF I
DIXON ENTRANCE
PRINCE RUPERT
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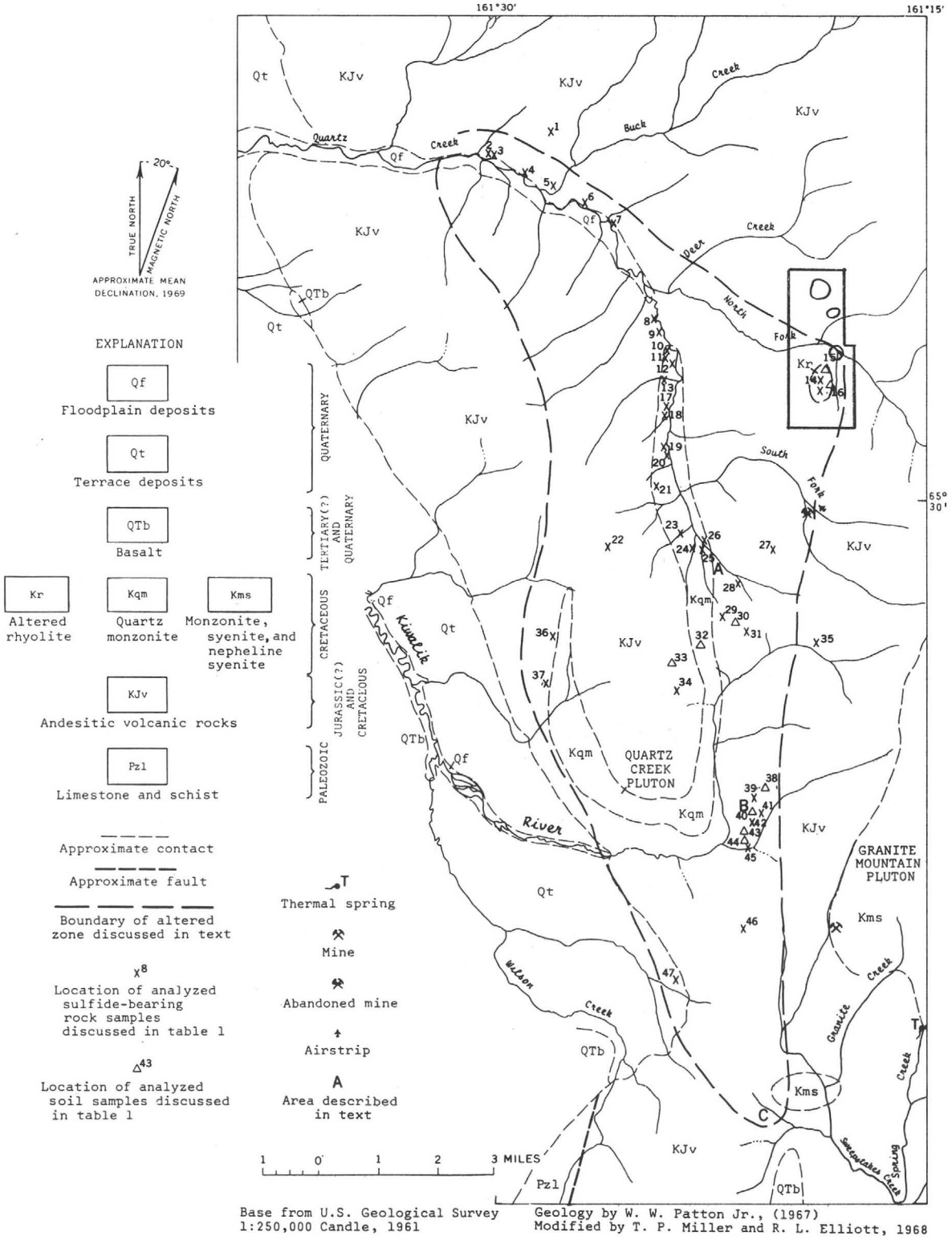
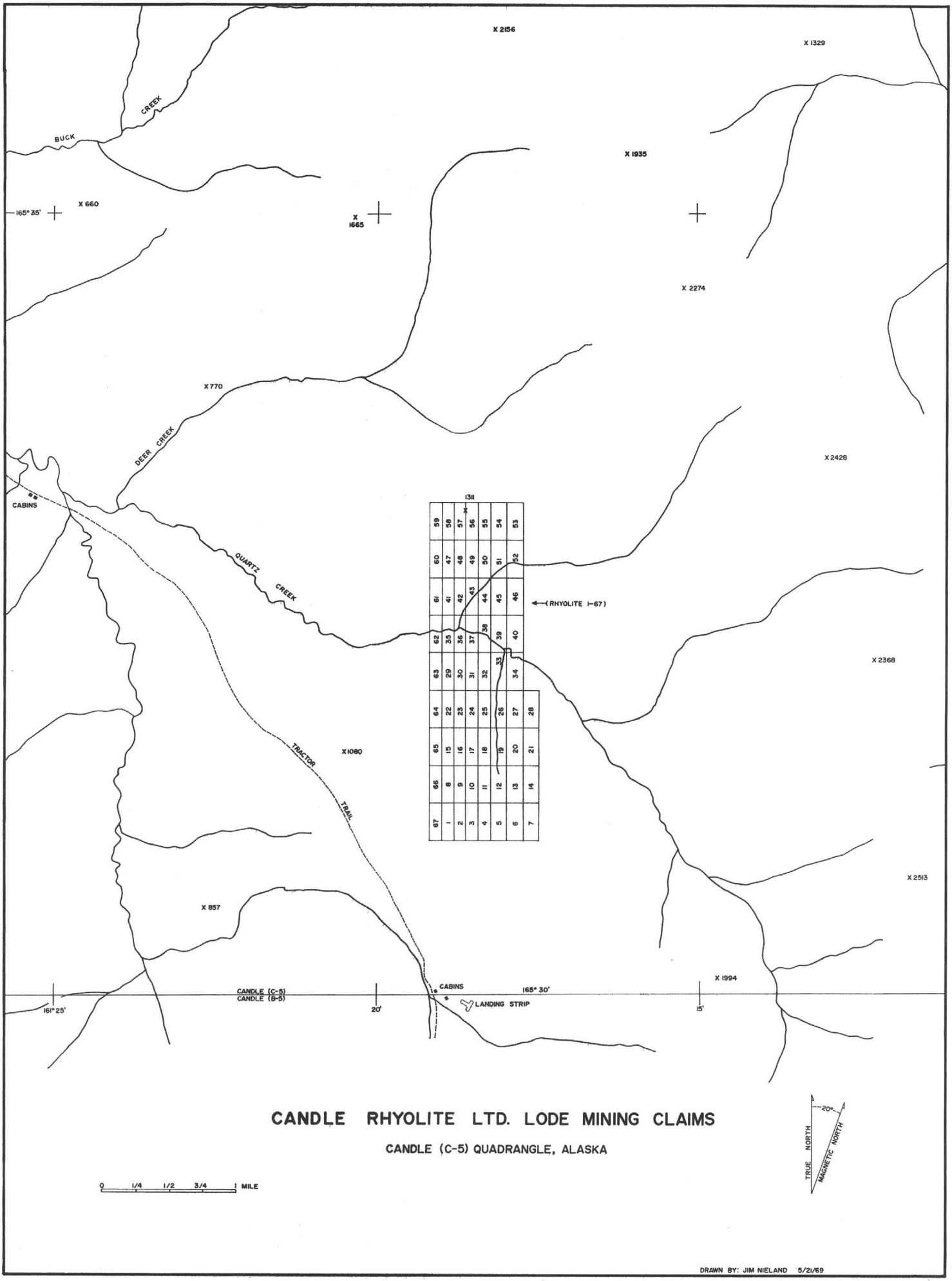


FIGURE 2.—Geologic map of the Quartz Creek area.

Boundary lines of claim block of Rhyolite claims belonging to Candle Rhyolite Limited



CANDLE RHYOLITE LTD. LODE MINING CLAIMS

CANDLE (C-5) QUADRANGLE, ALASKA

DRAWN BY: JIM NIELAND 5/21/69

REPORT ON THE RHYOLITE GROUP OF LODE MINING CLAIMS

LOCATION AND ACCESS

The Rhyolite Group of sixty-seven lode claims is in the Fairhaven Recording District in the Candle Quadrangle, Eastern Part of the Seward Peninsula, Alaska. The claims can be reached from Nome, Alaska, by Wien Consolidated Airline on a three days per week schedule. The distance from Nome to the Granite Mountain airstrip is approximately 150 miles. The claims are approximately eight miles northwest of the airstrip. The Rhyolite claims are on the North Fork of Quartz Creek beginning one and one-quarter miles north of Quartz Creek placer mining camp. Quartz Creek is a tributary of the Kiwalik River.

In February 1969, the United States Geological Survey released Geological Survey Circular 614, "Metalliferous Deposits Near Granite Mountain, Eastern Seward Peninsula, Alaska," by Thomas P. Miller and Raymond L. Elliott. The Government's examination of this area was made as a part of its heavy minerals program. The Survey reported finding new deposits of lead, zinc and silver over a large mineralized area near Quartz Creek, west of Granite Mountain, in a large hydrothermal altered zone eighteen miles long and from two to five miles wide.

Pursuant to the instructions of Capital Exploration Corporation, the writer located the claims. He was assisted by Luther Nagaruk and Edwin Katongan, eskimos. Equipment used included a 12 HP Ski-Doo, and a 18 HP Ski Daddler, snow machines. On our staking trip, we operated from a base camp about four miles to the southwest.

About one-third of the snow that had covered the ground was gone at the time of staking. Rock samples were collected, numbered and located on a map for microscopic study.

GEOLOGY

The geology of the area is shown in Figure 2, Geologic Map of the Quartz Creek Area in Circular 614. The hydrothermal altered zone shown on the map consists of altered andesitic volcanic rocks of Jurassic and Cretaceous Age. The altered zone was intruded by felsic plutonic rocks. Metamorphic rocks lie to the west of the area and are reported as being of Paleozoic and Precambrian Age. Olivine basalt of Tertiary Age is in a few low-lying areas and caps some ridges. The Granite Mountain pluton to the east was mapped as a monzonite syenite and nepheline syenite. To the west, there is limestone and schist. The located claims include the rhyolite unit to the east of Area A, shown on Figure 2 of the map in the circular, plus a new rhyolite occurrence to the north. The mineral deposits in the area are related to the plutonic rocks and occur in both the intrusive rocks and in the surrounding country rocks. (Miller and Elliott).

In the hydrothermal altered zone, there is a rhyolite intrusion indicated by rubble samples which is anomalous in copper, antimony, and boron. It marks the beginning of a copper zone (Miller and Elliott). The rhyolite intruded and andesitic volcanic rocks on the claims and is from a quarter of a mile to a half mile in width, and roughly oval in its exposure. The rhyolite may be related to a volcanic neck on the northern boundary of the claims. The structure appears to extend north and south. The southern half of the claims are in the altered andesitic rock, and the northern half appears to be a continuation of the structure to the south. The rhyolite extrusion came from the north, as indicated from the rubble exposure and the presence of a volcanic neck immediately to the north.

METALLIZATION

The rocks taken from the claims and analysis of them are reported in

the circular. They are numbered on the geologic map and are as follows:

Extract of Sample Table, p. 16-17
U.S.G.S. Circular 614
Samples Related to Rhyolite Claims

Sample	B	Cu	Pb	Sb	Sc	Zn
14A	1000	500	50	100	50	L
14B	30	150	20	L	20	L
14C	50	150	10	N	20	N
15	300	150	150	N	50	L
16	300	100	15	N	50	N
Anomalous:	50	200	150	L	50	L

N = Not detected L = Present but below Limits of detection

A moderate copper, lead, antimony anomaly associated with a mapped, intensely altered structure.

QUOTATIONS FROM MILLER-ELLIOTT

P. 5 "A small body of intensely altered and oxidized rhyolite intrudes the andesite northwest of Granite Mountain (figures 1 and 2, map unit Kr). The rhyolite is tenatively assigned a cretaceous age, but its absolute age is unknown."

P. 7 "The Eastern edge of the copper anomaly begins in the North Fork of Quartz Creek near a small body of intensely altered rhyolite (map unit Kr, figure 2, figure 5), and composite grab samples of this rhyolite (samples 14, 15 and 16 in Table 1) show anomalous concentrations of copper, antimony, and boron. The copper persists in the stream sediments of Quartz Creek all the way to the Kiwalik River Valley (figure 2)."

P. 12 "Drilling would certainly be necessary to determine the extent of mineralization in the altered metalliferous rhyolite."

I might add that the rhyolite is much longer than Miller and Elliott mapped it according to my samples.

RECOMMENDED EXPLORATION

1. Map alteration target zones.

2. Collect rock and soil samples on a 200-foot grid pattern for geochemical testing.

3. Trench anomalies across the rhyolite and altered andesitic rock.

4. Delineate the sulphide zones and the plutonic rocks by geophysics.

5. Obtain colored aerial photographs to aid in mapping the geology and altered zones.

6. Delineate the deposit areas by either churn drilling or diamond core drilling.

For the foregoing reasons, the Rhyolite Claims are recommended for further exploration.

Don O. Roberts, Prospector
Nome, Alaska

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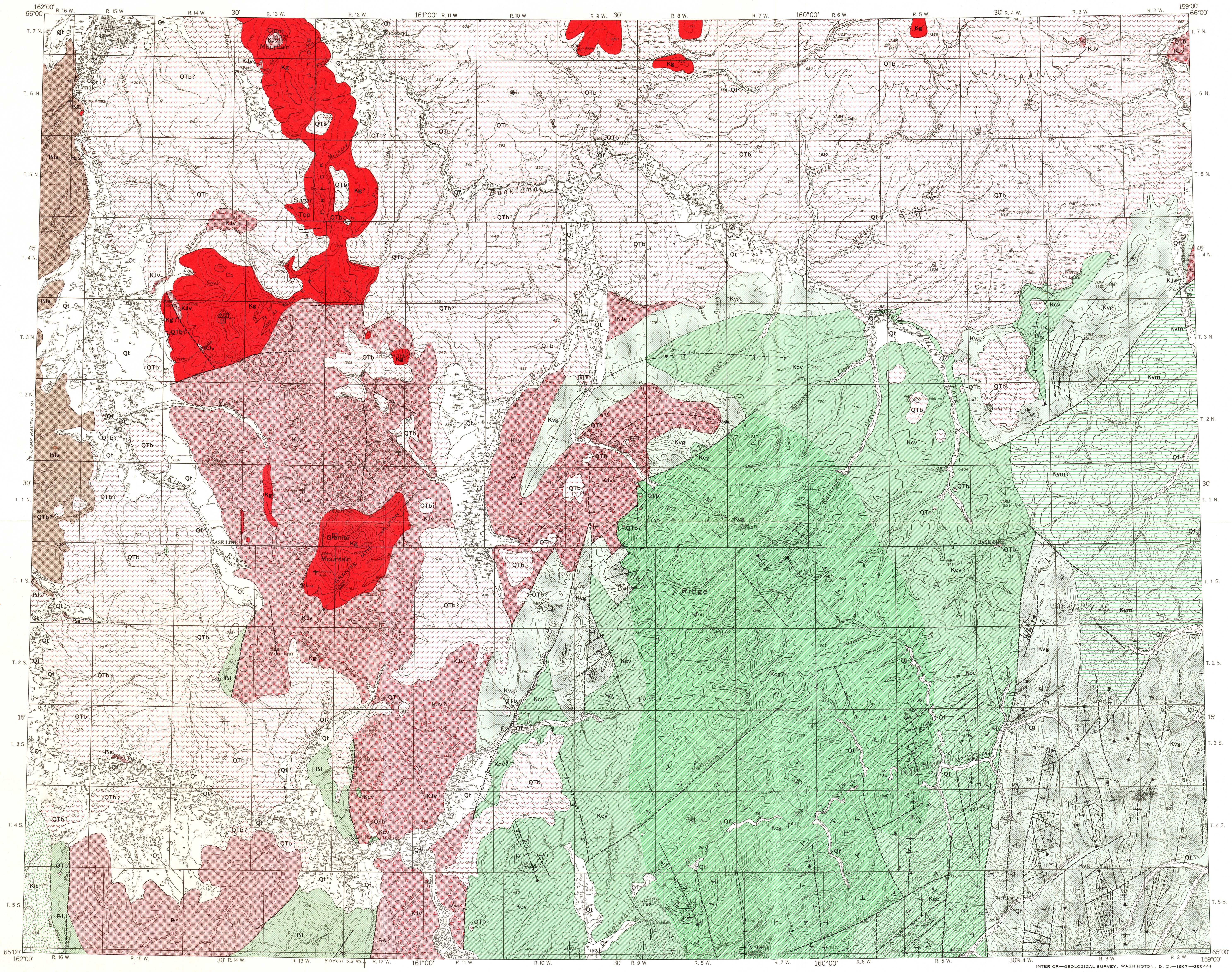
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-492



Base from U.S. Geological Survey topographic quadrangles, 1955

SCALE 1:250 000

CONTOUR INTERVAL 200 FEET
DOTTED LINES REPRESENT 100-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
1955 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 19°30' TO 21°30' EAST

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1967—G66441

Geology mapped by J. M. Hoare, W. W. Patton, Jr., Bond Taber, and I. L. Tailleur, 1958; W. W. Patton, Jr. and A. R. Tagg, 1960; W. W. Patton, Jr., N. W. Rutter, and A. R. Tagg, 1961 Petrographic studies by T. P. Miller and D. W. Hinckley

EXPLANATION

SEDIMENTARY ROCKS

Qf

Flood-plain deposits

Gravel, sand, and silt along flood-plains of major stream valleys. Characterized physiographically by bars, oxbow lakes, meander scrolls, abandoned channels, and other evidence of recent flood-plain building. Locally includes alluvial terrace and fan deposits along narrow valleys. Mapped almost entirely from aerial photographs

Qt

Terrace deposits

Terraced alluvial silt deposits in the Koyuk, Kiwalik, and Buckland lowlands. Some peat and gravel. Characterized by thermokarst topography and many small lakes. Mapped almost entirely from aerial photographs

Klc

Limestone conglomerate

Poorly sorted, locally derived nonmarine conglomerate overlying metamorphic rocks of Paleozoic age in southwestern corner of quadrangle. Conglomerate composed of pebble to boulder-size clasts chiefly of recrystallized limestone but also including some schist, greenstone, phyllite, and quartz. Interbedded micaceous sandy limestone (calcarenite). Plant fossils of Cretaceous age reported by Smith and Eakin (p. 56, 1911). Conglomerate may be a marginal facies of calcareous graywacke and mudstone (units Kcg, Kcv, Kcc*)*

Kcg / Kcv / Kcc

Calcareous graywacke and mudstone

Kcg, *rhythmically interbedded medium gray, yellowish-orange weathering, fine grained to gritty, highly calcareous graywacke (table 1, 58ATr108, 110) and micaceous, calcareous mudstone. Abundant carbonized plant debris. Mudstone characterized by fine, locally convolute, cross laminations and current-rippled partings. Unit appears to coarsen westward; abundance of detrital carbonate, quartz, mica, and metamorphic rock fragments suggests it was derived chiefly from the terrane of Paleozoic metasedimentary rocks in contrast to the underlying volcanic graywacke, conglomerate, and mudstone (units* Kvg, Kvm*) which were derived mainly from the terrane of Mesozoic volcanic and plutonic rocks. Crops out along Inglutalik River but elsewhere in the quadrangle exposures are confined to scattered patches of frost-riven rubble along ridge tops. Weathers more or less homogeneously and is expressed topographically by broad, even sloping, nearly flat topped interfluves. Estimated to be more than 5,000 feet thick in northwest-plunging syncline which crosses Inglutalik River 3 miles above Nigikmigoon River.*

Kcv, *mixed sequence of calcareous graywacke, calcareous mudstone, volcanic graywacke, and volcanic conglomerate. Lithologically transitional between units* Kvg *and* Kcg. *On Inglutalik River, chiefly medium gray to pale olive, yellowish-orange weathering, micaceous, highly calcareous graywacke (table 1, 58ATr92) with lenses of volcanic granule to cobble conglomerate. On Buckland River, dark greenish gray to pale olive, hard, slightly calcareous, volcanic graywacke (table 1, 61APa75) interbedded with medium to dark gray, fine to medium grained, calcareous graywacke and mudstone; volcanic graywacke conspicuously graded and sole marked. Unit appears to overlap the volcanic graywacke and conglomerate unit* (Kvg) *along western edge of Cretaceous sedimentary basin and near Dime Landing rests on andesitic volcanic rocks* (KJv). *Contact with* Kcg *gradational; distinguished from* Kcg *by presence of volcanic graywacke. Carbonized plant material abundant throughout locally forming thin coaly layers. Unit probably correlative with coal-bearing beds near Koyuk in the adjoining Norton Bay quadrangle, which have been assigned a Cretaceous age on the basis of pollen study by E. B. Leopold (written communication, 1963). Poorly exposed; outcrops confined chiefly to cutbanks.*

Kcc, *cyclically interbedded sequence of medium gray, yellowish-orange weathering, fine to coarse grained, calcareous graywacke; hard dark gray, fine to medium grained, carbonaceous, volcanic graywacke (table 1, 58ATr119); and dark carbonaceous mudstone. Graywacke typically graded and sole marked. Abundant carbonized plant debris. Unit appears to grade upward into* Kcg *and laterally into* Kcv; *probably distal facies of* Kcv. *Distinguished from* Kcg *and* Kcv *by abundance of dark fine-grained graywacke and mudstone. Well exposed in cutbanks on Inglutalik and Ungalik Rivers but poorly exposed elsewhere*

Kvg / Kvm

Volcanic graywacke, conglomerate, and mudstone

Kvg, *volcanic graywacke and conglomerate; composed chiefly of andesitic volcanic rock detritus but locally includes notable amounts of granitic rock detritus and fine-grained tuffaceous material. In the drainage areas of the Buckland and Koyuk Rivers chiefly massive, poorly stratified, pebble to boulder conglomerate interbedded with dark greenish-gray to pale olive graywacke (table 1, 61APa22) and subordinate dark gray finely laminated mudstone. Conglomerate composed of well-rounded clasts of andesitic volcanic and granitic rocks in a poorly sorted gritty matrix of assorted volcanic rock debris and potash feldspar. Many granitic clasts are lithologically identical with granitic rocks* (Kg) *of Granite Mountain and Hunter Creek plutons. Near contact with andesitic volcanic rocks* (KJv) *conglomerate and graywacke are hard and tuffaceous and seem to grade into volcanic breccias and agglomerates of unit* KJv. *In eastern part of quadrangle unit consists of mixed sequence of dark greenish gray to pale olive, fine to coarse grained graywacke (table 1, 58APa93); medium gray, calcareous, fine to medium grained graywacke; and dark gray laminated mudstone. Thin lenses of feldspar, chert, and quartz grit. Some graywacke is tuffaceous and characterized by conspicuous mottling due to partial zeolitization of volcanic material (Hoare and others, 1964). Thin beds of grayish yellow to pale olive felsic tuff locally in northeastern part of quadrangle. Unit well exposed in cutbanks on West Fork of Buckland and Ungalik Rivers; forms prominent rubble-covered ridges between West Fork of Buckland and East Fork of Koyuk and in southeastern corner of quadrangle. Age uncertain; believed to be approximately correlative with volcanic graywacke of late Early Cretaceous (Albian) age in Hughes (Patton and Miller, 1966) and Selawik (Patton, unpublished field data) quadrangles. Granitic boulders in conglomerate yield lead-alpha and potassium argon ages of 90± 10 m.y. to 120±15 m.y. (tables 2 and 3) and indicate that enclosing rocks are probably no older than late Early Cretaceous.*

Kvm, *chiefly medium- to dark-gray mudstone and medium-gray to dark greenish gray, calcareous and noncalcareous, fine to medium grained, volcanic graywacke (table 1, 58AHr62). Mudstone finely cross laminated. Unit poorly exposed. No fossils found in this unit in Candle quadrangle but possibly correlative rocks in the Nulato quadrangle contain* Gastroplites *of Early Cretaceous (Albian) age (Patton, 1966), (Bickel and Patton, 1957)*

Pzl / Pzs / Pzls

Limestone and schist

Pzl, *chiefly light gray, massively bedded, recrystallized limestone and dolomite. Subordinate calcareous mica schist and dark phyllite. Tentatively assigned a middle Paleozoic age based on possible correlation with fossiliferous carbonate rocks in the Solomon quadrangle (Smith and Eakin, 1911)*

Pzs, *chiefly quartz mica schist, mica schist, and quartzite. Locally includes calcareous, graphitic, and feldspathic schists, amphibolite schist, phyllite, and thin limestone. Age and stratigraphic relationship with limestone* (Pzl) *uncertain; contact gradational?*

Pzls, *undivided limestone and schist in areas of poor exposure*

QUATERNARY

CRETACEOUS

PALEOZOIC

IGNEOUS ROCKS

QTb

Basalt

Flows of gray to dark red vesicular olivine basalt. Some black, dense glassy basalt. Flows extruded over terrain of moderate relief; range in elevation from sea level to over 1,800 feet. More than 500 feet thick along incised tributaries of Buckland and Tagagawik Rivers. In Buckland, Kiwalik, and Koyuk lowlands generally covered by thick mantle of wind-blown silts. Flows horizontal or nearly horizontal; locally tilted as much as 35° on Buckland-Kiwalik divide and folded into several small flexures on Middle Fork of Buckland River. Mafic alkaline basalt with abundant peridotite inclusions forms partly dissected cone 10 miles SE of Buckland village and several prominent knobs at Sugar Top on Buckland-Kiwalik divide. Fine to medium crystalline trachybasalt intrusive (?) at VABM Boulder near head of Fish River and along axis of small anticlinal flexure on Middle Fork of Buckland River. Bulk of flows believed to correlate with Imuruk Volcanics (early ? and middle Pleistocene) in adjoining Bendeleben quadrangle (Hopkins, 1963); some flows may be as old as Tertiary. Mapped almost entirely from aerial photographs

TERTIARY(?) AND QUATERNARY

Kg

Granitic rocks

Chiefly hornblende and pyroxene monzonite and syenite. Some biotite quartz monzonite. Rocks from Hunter Creek and Granite Mountain plutons are assigned a mid-Cretaceous age based on lead-alpha age determinations of 90±10 and 100±15 m.y. and on a potassium-argon age determination of 102±5 m.y. (tables 2 and 3). Granitic rocks in the north-central part of the quadrangle belonging to the Selawik Hills pluton are also assigned a mid-Cretaceous age based on a potassium-argon age determination of 100±5 m.y. from a sample collected in the adjoining Selawik quadrangle (Miller and others, 1966)

CRETACEOUS

KJv

Andesitic volcanic rocks

Includes a wide variety of andesitic flows and volcaniclastic rocks. Chiefly andesitic and trachyandesitic crystal and lithic tuffs, tuffaceous volcanic graywacke, massive andesitic breccia, agglomerate, and conglomerate, and intercalated flows of porphyritic pyroxene andesite and basalt. Dark basalt flows (?) with exceptionally large phenocrysts of hornblende and augite occur abundantly on West Fork of Buckland River. In vicinity of granitic plutons volcanic rocks characteristically hornfelsic and propylitically altered to a hard, pale green aggregate of chlorite, epidote, calcite, and sodic plagioclase. Unit includes many small unmapped intrusive bodies of hybrid diorite, syenite, and monzonite in vicinity of granitic plutons. Bulk of unit believed to be of earliest Cretaceous (Neocomian) age and correlative with Buchia*-bearing andesitic volcanic rocks of the adjoining Kateel River quadrangle (Patton, 1966). A poorly preserved ammonite with ornamentation pattern strongly suggesting* Simbirskites *of Early Cretaceous (Hauterivian) age (D. L. Jones, personal communication, 1966) found on West Fork of Buckland River. A potassium-argon determination from basalt porphyry flow near West Fork of Buckland River also yields an Early Cretaceous age of 120± 3 m.y. (table 3). Some tuffs and breccias on West Fork of Buckland River appear to grade laterally into volcanic conglomerate and graywacke* (Kvg) *and may be mid-Cretaceous in age. Unit may also include rocks as old as Jurassic and correlative with altered mafic volcanic rocks recently reported in the Hughes quadrangle (Patton and Miller, 1966)*

JURASSIC(?) AND CRETACEOUS

Contact
Dashed where approximately located, inferred, or indefinite

Fault
Dashed where approximately located or inferred; dotted where concealed; queried where doubtful

Anticline
Showing crestline and direction of plunge. Dashed where approximately located or inferred

Syncline
Showing troughline and direction of plunge. Dashed where approximately located or inferred

Overturned syncline
Showing troughline, direction of dip of limbs, and direction of plunge. Dashed where approximately located or inferred

55
Strike and dip of beds

85
Strike and dip of overturned beds

90
Strike of vertical beds determined by field observation

Strike of vertical or near vertical beds based on photointerpretation

Strike and dip of beds based on photointerpretation
Probably includes some overturned beds

Trace of conspicuous bed

2
Location of lead-alpha age sample
Number refers to sample list in table 2

2
Location of potassium-argon age sample
Number refers to sample list in table 3

Placer gold mine

Volcanic cone

T
Thermal spring

Structure

The pre-Cenozoic rocks of the Candle quadrangle are nearly everywhere highly deformed. Only locally, however, can the folds and faults be mapped at a regional scale owing to the scarcity of exposures and extensive frost riving. Most of the structural features shown on the map have been interpreted from aerial photographs. In the southeastern part of the quadrangle, where the Cretaceous sedimentary rocks are best exposed, the structure is characterized by tight north-trending folds locally overturned to the east. Some synclinal axes can be traced for several miles or more but anticlinal axes generally are faulted out by pervasive north-trending high angle faults. The fold axes are offset by numerous closely spaced northeast- and east-trending faults, only a few of which are shown on the map. In the Buckland and Tagagawik drainages exposures of Cretaceous sedimentary rocks are sparse but the general distribution of map units suggests the presence of several broad east- and northeast-trending flexures. Aeromagnetic data (Zietz and others, 1959) indicate that the northern margin of the Cretaceous sedimentary basin extends east-northeast beneath the cover of Cenozoic volcanic rocks from the West Fork of the Buckland River to the Tagagawik River near lat. 65°50'N

TABLE 1. MINERALOGICAL COMPOSITION (IN PERCENT) OF 8 CRETACEOUS GRAYWACKE SAMPLES FROM THE CENTRAL AND EASTERN PART OF THE CANDLE QUADRANGLE

[Based on modal analyses; counts of 600 points per thin section]

Sample No.	58ATr108	58ATr110	58ATr92	61APa75	58ATr119	61APa22	58APa93	58AHr62
Unit	Kcg	Kcg	Kcv	Kcv	Kcc	Kvg	Kvg	Kvm
Quartz, quartzite	20	15	15	10	7	8	4	7
Chert	<1	<1	2	2	2	<1	3	2
Feldspar	7[1]	13[2]	10[2]	25[1]	28[2]	44[2]	16[2]	26[1]
Volcanic rock fragments	<1	8	10	16	19	9	15	24
Sedimentary rock fragments	---	1	<1	3	<1	<1	1	1
Metamorphic rock fragments (except carbonate and quartzite)	5	8	8	2	3	---	2	1
Granitic rock fragments	---	<1	---	2	2	<1	---	<1
Mica	3	2	4	---	---	---	---	---
Carbonate (including detrital fragments)	51	36	43	4	2	---	---	5
Argillaceous material (<.02mm.)	6	12	5	32	31	30	44	27
Miscellaneous[3]	6	6	4	5	6	9	16[4]	6

[Analyses by T. P. Miller]

[1] Chiefly plagioclase, less than one third potash feldspar
[2] Estimated to be between one third and two thirds potash feldspar
[3] Chiefly detrital ferromagnesium and heavy minerals
[4] Approximately half zeolite

TABLE 2. LEAD-ALPHA AGES OF ZIRCON FROM GRANITIC ROCKS (Kg) AND FROM BOULDERS IN CONGLOMERATE (Kvg)

Sample localities are shown on map as 2

Sample No.	Field No.	Lat. and Long.	Unit	α/mg-hr	Pb (ppm)	Age (m.y.)
1	61ARu24	65°27'N 161°13'W	Kg	489	19.7	100±15
2	61ATg40	65°41'N 161°31'W	Kg	707	25.4	90±10
3	61APa58	65°41'N 161°31'W	Kg	750	26.0	90±10
4	61APa59a	65°36'N 160°35'W	Kvg	1341	65.6	120±15
5	61APa59b	65°36'N 160°35'W	Kvg	433	15.0	90±10
6	61APa60	65°24'N 160°39'W	Kvg	533	19.7	90±10

[Alpha-activity measurements by T. W. Stern; spectrographic analyses of lead by Harold Westley and I. H. Barlow, U.S. Geological Survey, 1963]

Pb—α ages (rounded to nearest 10 m.y.) were calculated from the equation: $t = \frac{C\,Pb}{\alpha}$, where t is the calculated age, in millions of years; C is a constant based upon the ratio Th/U, which was assumed to be 1 in the zircon samples dated, and has a value of 2,485; Pb is the lead content, in parts per million, and α is the alpha counts per milligram per hour

TABLE 3. POTASSIUM-ARGON AGE DETERMINATION FOR GRANITIC ROCKS (Kg), FOR BOULDERS IN CONGLOMERATE (Kvg), AND FOR BASALT PORPHYRY FROM ANDESITIC VOLCANIC UNIT (KJv)

Sample localities are shown on map as 2

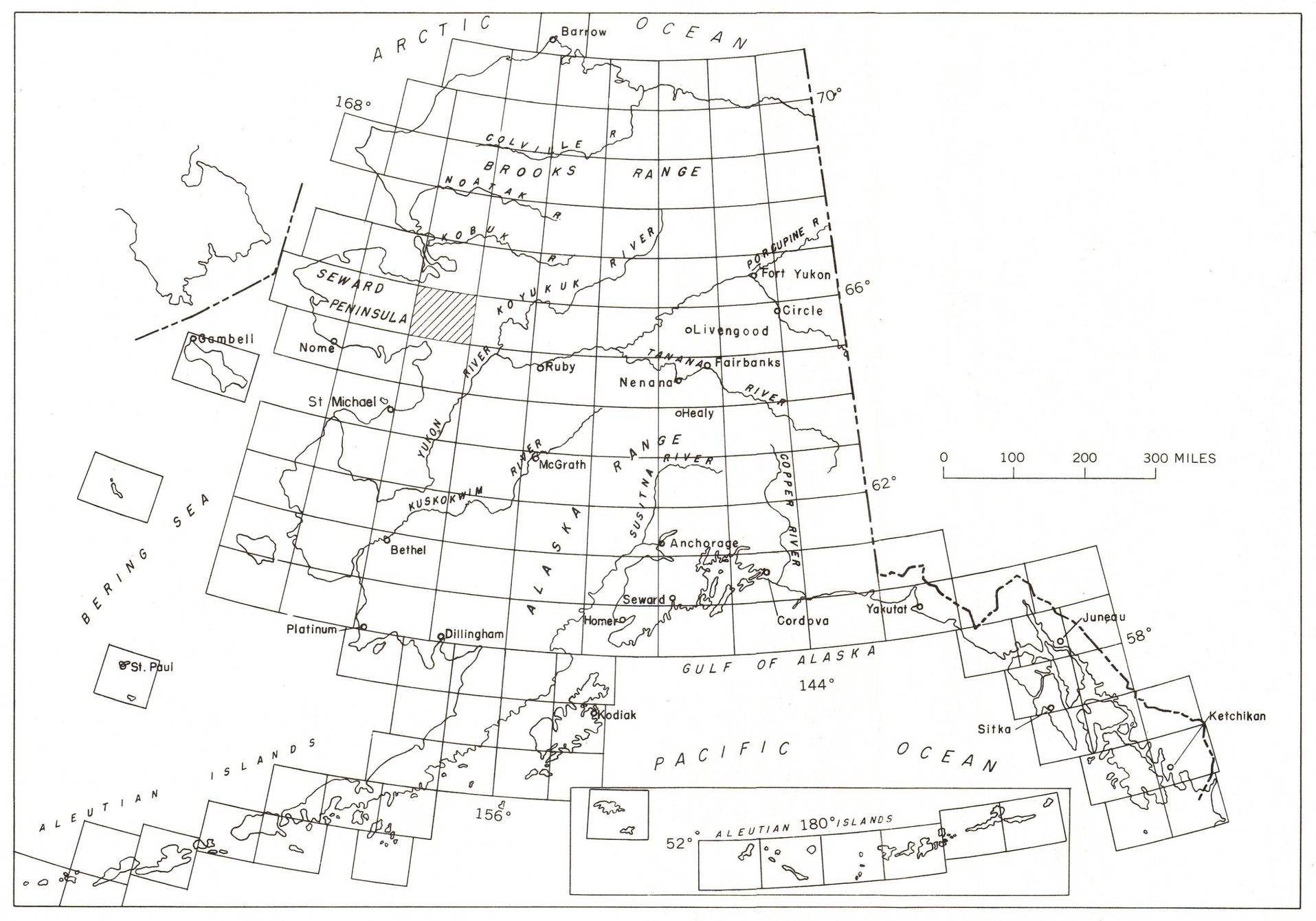
Sample No.	Field No.	Mineral	Lat. and Long.	Unit	K_2O percent	Moles Ar^{40}_{rad}/gm	Ar^{40}_{rad} (percent)	Age (m.y.)
2[1]	61ATg40	hornblende	65°41'N 161°31'W	Kg	1.54	2.38441×10^{-10}	94	102±5
7[1]	61APa59	biotite	65°36'N 160°35'W	Kvg	5.30	8.80704×10^{-10}	95	110±5
8[2]	58ATb129	hornblende	65°30'N 160°45'W	KJv	0.733	1.41423×10^{-10}	86	120±3

[1] H. H. Thomas, R. F. Marvin, Paul Elmore, analysts, U.S. Geological Survey, 1963, 1964
[2] M. A. Lanphere, analyst, U. S. Geological Survey, 1966

Constants: $K^{40}\ \lambda_\epsilon = 0.585 \times 10^{-10}$/yr; $\lambda_\beta = 4.72 \times 10^{-10}$/yr; K^{40}/K total $= 1.19 \times 10^{-4}$ mole/mole

MAP OF CANDLE QUADRANGLE SHOWING LOCATION OF FIELD OBSERVATION POINTS AND CONTINUOUS FOOT TRAVERSES

Geology extended between field stations by aerial reconnaissance and by interpretation of aerial photographs



INDEX MAP OF ALASKA SHOWING LOCATION OF CANDLE QUADRANGLE

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REGIONAL GEOLOGIC MAP OF THE CANDLE QUADRANGLE, ALASKA

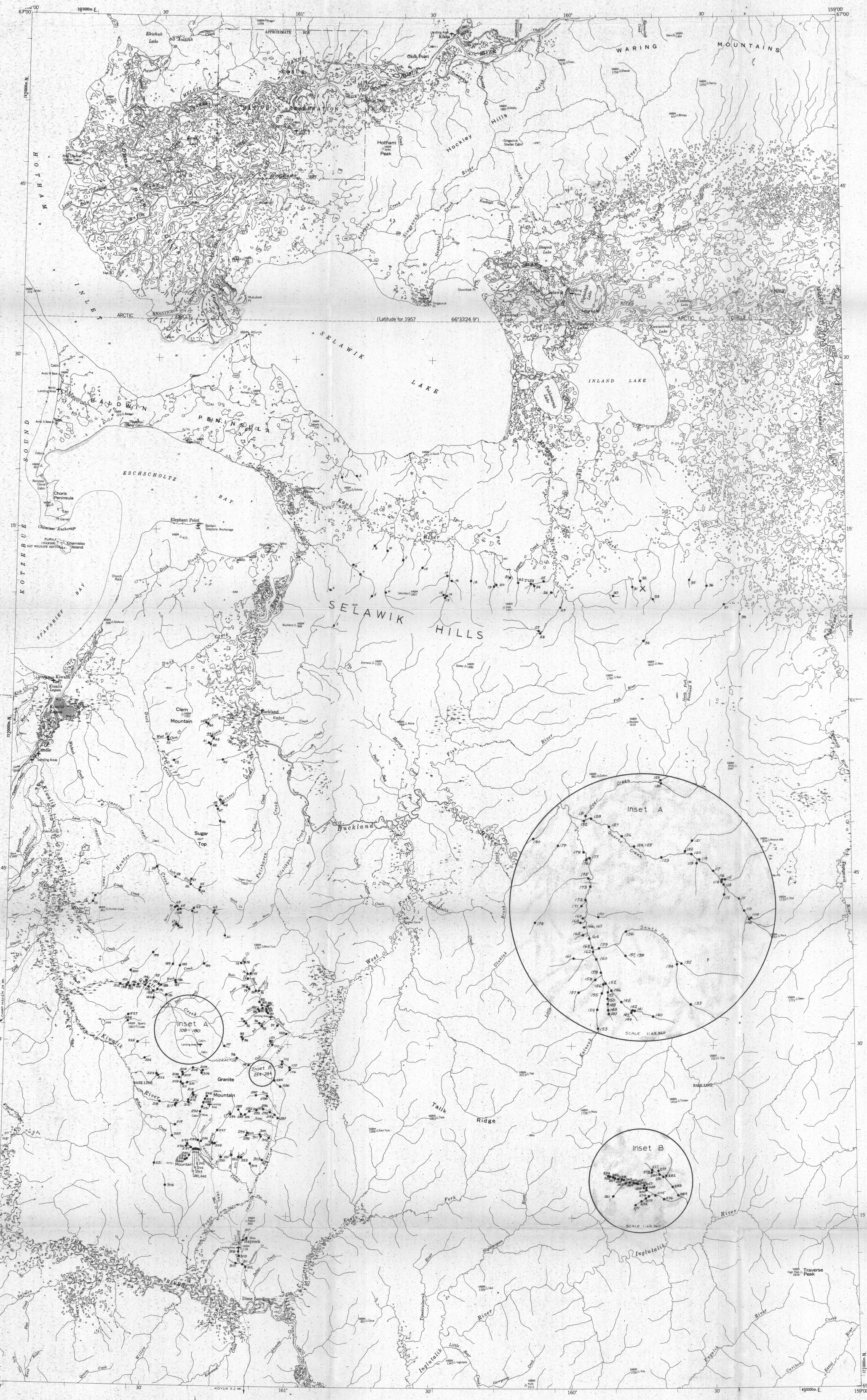
By
William W. Patton, Jr.

1967

For sale by U.S. Geological Survey, price $1.00

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE MAP



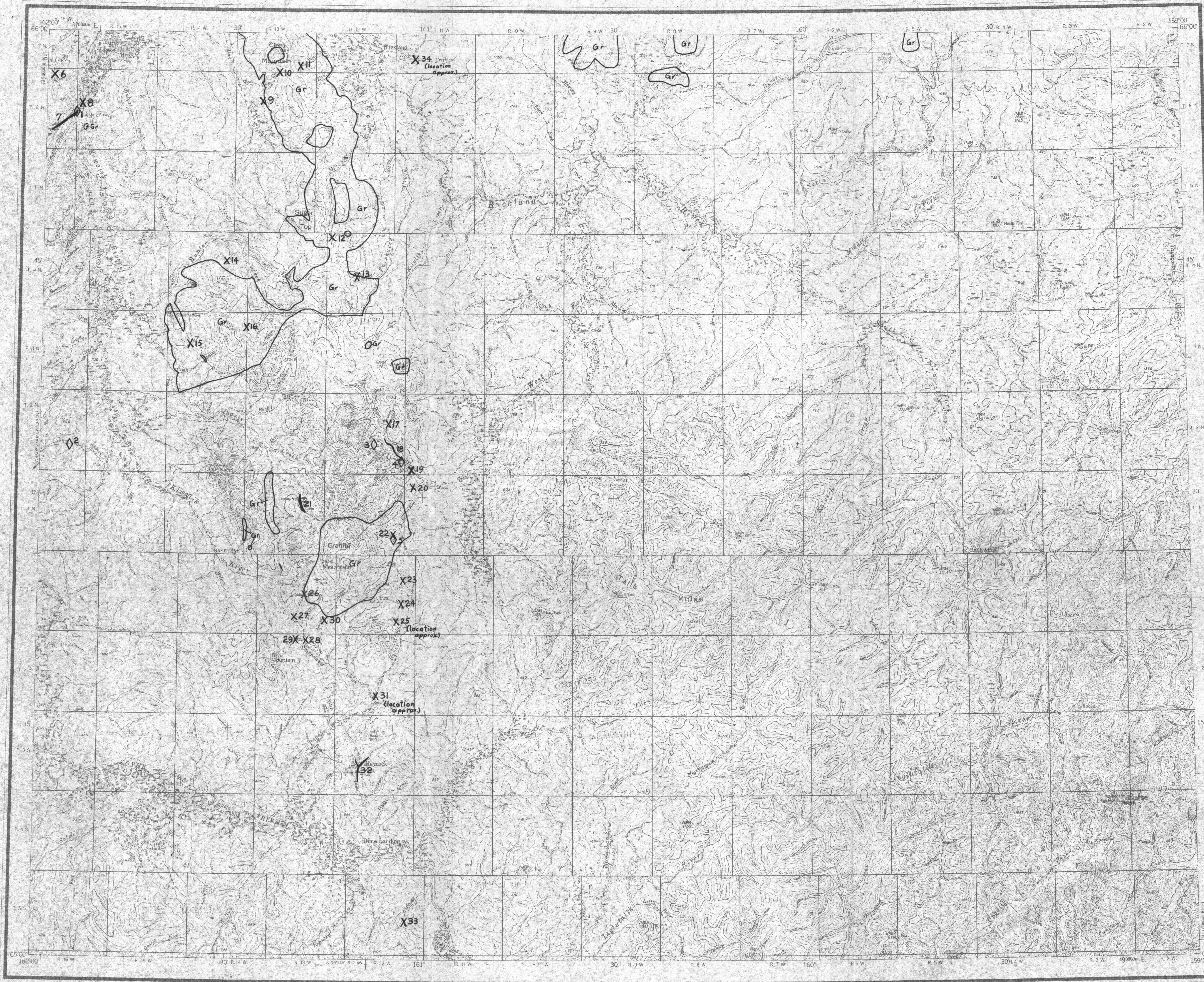
Base from U.S.Geological Survey 1:250,000 topographical series: CANDLE,1955, SELAWIK, 1957, Alaska. Compiled Menlo Park, Base Map Unit. 11-21-68

FIGURE I. LOCATION OF STREAM SEDIMENT SAMPLES, CANDLE AND SELAWIK QUADRANGLES, ALASKA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANDLE

OPEN-FILE MAP



MAPPED, EDITED, AND PUBLISHED BY THE GEOLOGICAL SURVEY

CONTOUR INTERVAL 200 FEET
DOTTED LINES REPRESENT 100 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

EXPLANATION

Gr — Granitic rocks

◇3 — Lode deposit

X10, ⟨21 — Placer deposit

(numbers refer to accompanying list)

This map is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

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METALLIC MINERAL RESOURCES MAP OF THE CANDLE QUADRANGLE, ALASKA

Compiled by
Edward H. Cobb
1967