



## FOREWORD

This is one of a series of summary reports that present the findings of reconnaissance-type mineral assessments of certain lands in Alaska. It is important to remember that Alaska has not been seriously prospected for minerals other than gold--except in a few relatively limited areas. These summary reports include data developed by both contract and Bureau studies; frequently a combination of both. As digests of more detailed reports that are still in preparation, these summaries omit the detailed findings that will be presented in the main reports, but the basic data and conclusions remain the same.

Assessing an area for its potential for buried mineral deposits is by far the most difficult of all natural resource assessments. This becomes more apparent when considering that no two deposits even of the same genesis and host rock conditions are identical. Moreover, judgments prior to drilling, the ultimate test, frequently vary among evaluators and continue to change as more detailed studies add to the understanding.

Included in these reports are estimates of the relative favorability for discovering metallic and related nonmetallic mineral deposits similar to those mined elsewhere. Favorability is estimated by evaluation of visible outcrops, and analyses of sampling data, including mineralogic characteristics and associated elements, in combination with an evaluation of the processes that have formed the rocks in which they occur. Essentially, it is a comparison of a related series of prospects and the environment in which they occur with the mineral deposits and environments in well-known mining districts. Recognition of a characteristic environment allows not only the delineation of a trend but also a rough estimate of the favorability of conditions in the trend for the formation of minable concentrations of mineral materials. This is a technique long used in the mineral industry to select areas for mineral exploration. Qualifying a trend or area as "highly favorable" for the discovery of mineral deposits indicates that the combination of outcrop samples, mineralogic data and geologic conditions that have been observed essentially duplicate the conditions in a recognized mining district elsewhere.

## TABLE OF CONTENTS

|                                                                                                 | <u>Page</u> |
|-------------------------------------------------------------------------------------------------|-------------|
| Abstract . . . . .                                                                              | 1           |
| Introduction . . . . .                                                                          | 2           |
| Exploration History in Northwestern Alaska . . . . .                                            | 3           |
| Rock type areas and associated mineralization . . . . .                                         | 6           |
| Paleozoic carbonate and clastic rocks . . . . .                                                 | 7           |
| Mafic and ultramafic intrusive rocks . . . . .                                                  | 10          |
| Placer gold . . . . .                                                                           | 11          |
| Basic volcanics . . . . .                                                                       | 11          |
| Granitic intrusive rocks . . . . .                                                              | 11          |
| Upper Paleozoic and younger carbonate and clastic rocks .                                       | 12          |
| Zones having rock structures favorable for discovery of<br>additional mineral deposits. . . . . | 13          |
| On-going studies . . . . .                                                                      | 13          |
| Conclusions. . . . .                                                                            | 13          |
| References . . . . .                                                                            | 16          |
| Appendix - Mineral Occurrences and trace element<br>anomalies in Northwestern Alaska . . . . .  | 18          |

## ILLUSTRATIONS

| <u>Figure</u>                                                                                                             | <u>Page</u> |
|---------------------------------------------------------------------------------------------------------------------------|-------------|
| 1. Index map of proposed Noatak National Arctic Range . . . . .                                                           | 4           |
| 2. Map of the proposed Noatak National Arctic Range . . . . .                                                             | 5           |
| 3. Rock types of the proposed Noatak National Arctic Range. . . .                                                         | 8           |
| 4. Mineral deposit map of the proposed Noatak National Arctic<br>Range. . . . .                                           | 9           |
| 5. Zones favorable for discovery of additional mineral deposits<br>in the proposed Noatak National Arctic Range . . . . . | 14          |

MINERAL DATA APPRAISAL OF THE PROPOSED  
NOATAK NATIONAL ECOLOGICAL PRESERVE, ALASKA  
A PRELIMINARY COMMENT

by

Staff, Alaska Field Operations Center

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ABSTRACT

The Bureau of Mines in 1975 started to assess the availability of locatable and leasable minerals in 19.2 million acres of the Western Brooks Range. This report is on the Noatak National Ecological Preserve. This is in the same region as the Noatak National Arctic Range, a 7.59 million acre tract outlined on the Bureau of Land Management map of Alaska dated 1974, that was used during this study. H.R. 39 and recent Administration proposals reduce the area by about 20 percent. Detailed maps of the new boundaries were not available when this report was compiled.

At least six environments are favorable for mineral exploration:

(1) Lower Paleozoic carbonate and clastic rocks - These rocks, present in the west central part of the study region, contain copper-zinc deposits similar to the Bornite (Ruby Creek) deposit and deposits of fluorite, lead, zinc, and barite.

(2) Mafic and ultramafic intrusive rocks - Large bodies of these rocks identified in the western and northwestern part of the study region are reported to contain chromite and sulfide mineralization. Copper, nickel, cobalt and platinum group metals are found within similar rock types worldwide and could be present here.

(3) Placer gold and tin - Placer gold has been mined in the southern part of the region in the Klery and Timber Creek areas as well as on many lesser drainages. Gold is reported to be present in the bars of the Noatak River and some tributaries. Placer tin has been identified in the Eli River near the western end of the study region.

(4) Basic volcanic rocks - These rocks occur in the western and northern parts of the study region spatially related to the ultramafic rocks. Copper occurs in similar rocks west of the study area in the Kivalina Valley. Chromium and copper, on the south side of the study region, may have been derived from these rocks. These rocks have not been investigated in the study region.

(5) Granitic rocks - In the southeastern part of the study region tin, tungsten, lead, zinc, copper, fluorite and a minor amount of uranium have been identified associated with the Kaluich granite body, one in a series of east-west trending, mineralized granitic intrusives in the Brooks Range.

(6) Upper Paleozoic and younger carbonate and clastic rocks - Lenses of solid sulfide deposits and disseminated high to medium grade deposits of lead, zinc, silver, and barite occur at the western edge of the study region and extend westward into the Wulik Valley. A trend of similar rock types extends across the western and northern sections of the study region into NPRA where similar deposits occur at Drenchwater Creek, 120 miles to the east.

#### INTRODUCTION

The Bureau of Mines in 1975 started to assess the availability of locatable and leasable minerals on 19.2 million acres in the western

Brooks Range. This study concerns the proposed Noatak National Ecological Preserve. The Bureau of Land Management map of Alaska, dated 1974 shows the Noatak National Arctic Range, as a 7.59 million acre tract in the Western Brooks Range (see Figures 1 and 2). This is the study region covered in this report. The Noatak National Ecological Preserve as shown on Administration proposals and in H.R. 39 is about 20 percent smaller but detailed maps of the new boundaries were not available when this report was compiled. The purpose of the investigation was to provide specific mineral information requested by Congressional committees and the Joint Federal-State Land Use Planning Commission for Alaska. The study was funded by a special Congressional appropriation.

A three-phase program was undertaken to (1) compile a list of known mineral occurrences and prospects within and adjacent to withdrawn lands; (2) sample, map and evaluate as many of the better prospects as possible with funds and time available; and (3) identify areas, on the basis of these findings, that are the most favorable for future mineral exploration.

Phases 1-3 of the program were contracted to WGM, Inc., a firm with minerals exploration and evaluation experience in this area. The Bureau of Mines undertook to search for and compile additional data on mineralized areas that might not be available to the contractors.

#### EXPLORATION HISTORY IN NORTHWESTERN ALASKA

To place the quantity and quality of minerals data available in the study region in perspective it should be recognized that prior to the 1950's exploration in Alaska was largely limited to individual prospectors and small groups interested principally in placer and lode gold

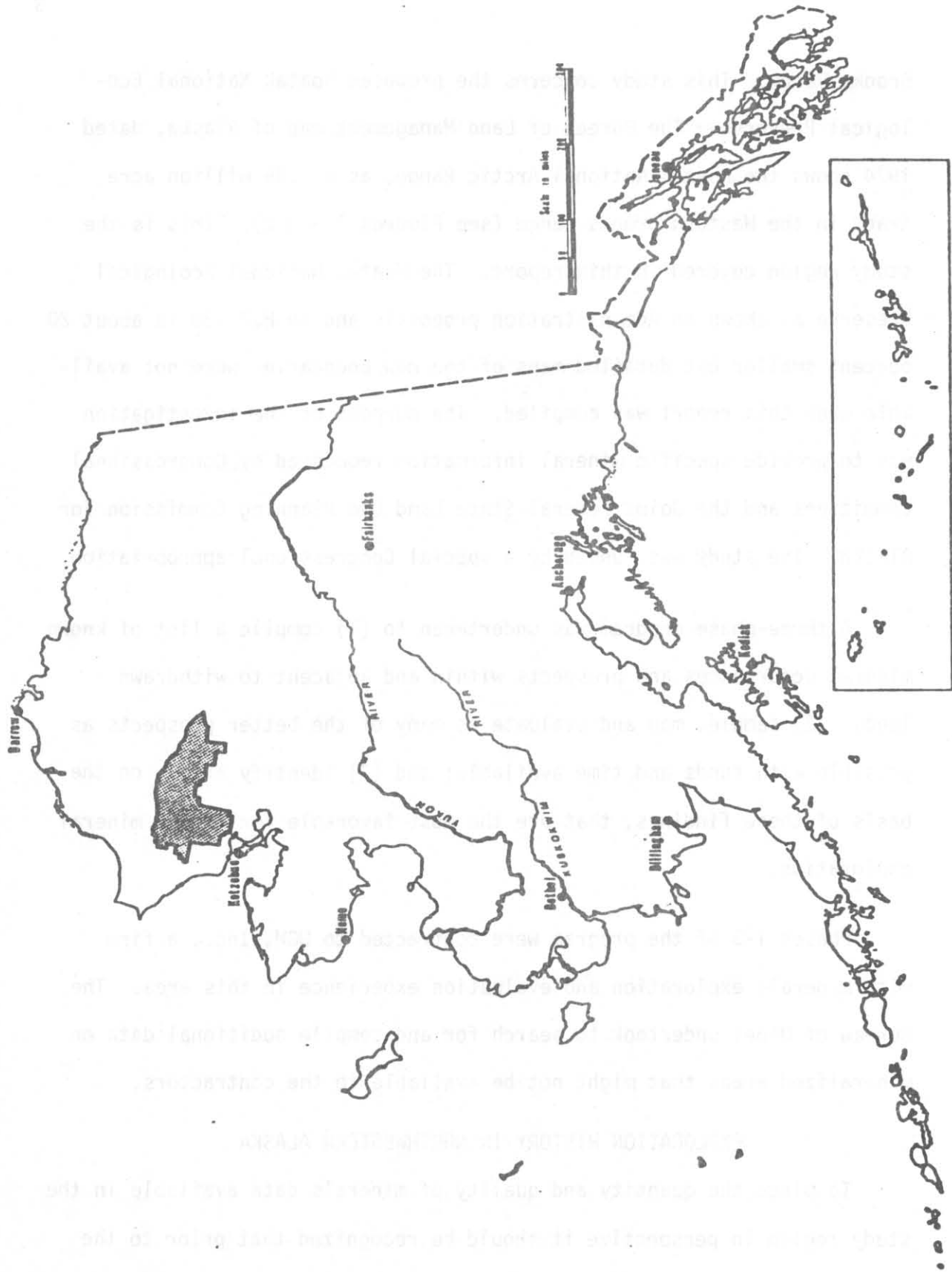


Figure 1 - Index Map of Proposed Noatak National Arctic Range

deposits. Since the 1950's exploration has been oriented towards finding base metal and other commodities. In the Brooks Range, this was carried out on a regional basis by only two groups, a major mining company in the early 1960's and an exploration syndicate in 1969. Since 1971 no systematic regional minerals exploration has been undertaken in the withdrawn lands.

In addition to the exploration work conducted by private industry, state and federal government agencies have been active intermittently, on a relatively limited basis. The work by the federal groups has been primarily mapping regional geology and is not specifically minerals discovery oriented. The state projects have focused more directly on areas of known mineralization and their possible extensions.

#### ROCK TYPE AREAS AND ASSOCIATED MINERALIZATION

The regional rock structure of the Brooks Range is only superficially known (4). 2/ Mapping on a quadrangle basis at a scale of four miles to the inch was initiated only recently (8). Therefore, the rock type relationships relevant to mineral resources within the withdrawn areas are not well known.

In spite of the lack of detailed knowledge concerning area rock structures, some very general relationships between rock types and commodities can be discerned. The major rock units and trends persist regionally across the western Brooks Range. By plotting mineralized areas and zones of trace element anomalies on maps illustrating rock structure, generalized associations of mineralization in certain rock units become apparent. These rock type areas, known mineral localities

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2/ Underlined numbers in parentheses refer to references listed at the end of this report.

and trace element anomalies are shown on figure 3. Figure 4 shows mineral localities in the study area in relation to geographic features. Other details on the prospects and mineral occurrences, such as common name, location and minerals present are appended to this report.

Six rock type areas are recognized as warranting further investigation. These include: (1) Lower Paleozoic carbonate and clastic rocks, (2) mafic and ultramafic rocks, (3) placer gold and tin, (4) basic volcanics, (5) granitic intrusives, and (6) Upper Paleozoic and younger carbonate and clastic rocks. The relationships between rock type areas and mineral occurrences are shown on figure 3.

(1) Paleozoic Carbonate and Clastic Rocks - These rocks extend along the south flank of the Brooks Range and are present in the western part of the study region. Fifty to one hundred million tons (or more) of 1 percent copper are inferred to occur in these rocks in the Bornite (Ruby Creek) area (No. 196) outside the study area (10). The belt of carbonate rocks hosting these deposits apparently trends into the study region. Similar, perhaps equivalent rocks of similar age are exposed in the area of the Omar River, figure 3. The lack of rock structure mapping in this area makes it impossible to trace and correlate these units conclusively. Within the study region, copper or other mineralization in these rock types is known to be present at the Agashashok River headwaters (No. 15, 16), the Kavachurak-Ningyoyak Creek (No. 47, 50), and the Omar River area (No.'s 21, 22) (2).

In the Omar River area, visible surface mineralization was investigated in the mid-1960's at two prospects, the Omar (No. 21) and

the Frost (No. 22) (2). At the Omar prospect several mineralized fracture groups zones, up to 100 feet wide, contain material that assays up to 15.39 percent copper. The mineralized fracture zones are present in an area that measures 3,500 feet in width and extends at least 9,000 feet in length. Other mineralized samples taken along the 9,000 foot length of the fracture zones range in value from 0.1 percent to 2 percent copper (2).

The Frost prospect (No. 22), which lies about 6 miles east of the Omar prospect, has potential for barite and zinc. Minor amounts of lead, copper and fluorite may also be present (2). There are two apparently unrelated types of mineralization present. Barite is present as discontinuous pods or lenses along an outcrop length of about 5,000 feet. Zinc and copper sulfide mineralization is associated with quartz-calcite-barite veins, or lenses, that pinch and swell along strike. A representative sample from one of these "veins" assayed 13.2 percent zinc, 0.49 percent copper, and 20.7 percent barite.

(2) Mafic and Ultramafic Intrusive Rocks - These rocks are present in a trend along the western and northern parts of the study region. The Avan River (No. 10), Misheguk Mountain (No. 12), Asik Mountain (No. 7), and Siniktanneyak Mountain (No. 30) areas are in part underlain by chromite bearing ultramafic rocks (2, 4). Placer deposits in the Avan River contain minor platinum. Additional platinum may be present in the surrounding rocks. Sulfide mineralization has been recognized in the Avan River mafic rocks (7). None of these intrusives are known to have been evaluated for concentrations of chromium, platinum, nickel, cobalt, and copper despite the fact these types of mineralization are known to occur world-wide with these types of rocks.

(3) Placer Gold and Tin - The gold placer deposits in the western Brooks Range at Klery Creek (No. 23), Timber Creek (No. 24), and other drainages in the area have been mined intermittently from the turn of the century to the present time (9). Only the stream placer gravels have been mined; the bench gravels remain untested. The source rocks of this gold have not been identified.

Placer tin has been identified in the Eli River (No. 9) at the western edge of the withdrawn lands (1). The source of this tin is not known, nor has any systematic attempt been made to evaluate the tin content in the Eli River placers.

(4) Basic Volcanics - These rocks are related to the mafic and ultramafic intrusives and are principally present in the western and northern parts of the study region. The Maiyumerak Mountains appear to be underlain by an assemblage of predominantly volcanic rocks. Streams draining this area are known to contain anomalous amounts of chromium and copper (No. 6) (2). Copper mineralization has been identified at the Kivalina River in reportedly similar rocks located to the west of the withdrawn lands. There has been no systematic effort to evaluate the mineral potential of this assemblage or similar assemblages in the withdrawal area.

(5) Granitic Intrusive Rocks - Mineralized granitic rocks are present in an east-west trend in the study region and to the east of the study region on the adjacent lands. Sampling such rocks in the study area near Kaluich Creek (No. 44) resulted in the identification of

mineralized zones containing tin, tungsten, lead, zinc, copper, molybdenum, fluorine and silver (2). There has been no systematic evaluation of this prospect nor of the mineral potential of the granitic intrusive rocks of the study area.

(6) Upper Paleozoic and Younger Carbonate and Clastic Rocks -

Rocks of Mississippian to Triassic age are known to contain an unclaimed zone of lead, zinc, silver, and barite mineralization on lands west of the Kelly River (No.'s 1-5) (2, 12). This mineralization has been noted in private reports since at least 1965. The area was sampled in 1968 by the Geological Survey and the presence of anomalous concentrations of various elements was made public in 1970 (12). Bureau of Mines site specific work in 1975 revealed the presence of a 1/4 square mile zone of outcropping solid sulfide deposits and disseminated, high to medium grade deposits of lead-zinc sulfides and barite (2). This locality is now commonly referred to as the "Red Dog" prospect (No. 1).

Since 1975, industry's exploration to the west of the Red Dog site has revealed other zones of similar high grade mineralization on lands open for mineral entry (3). The general trend of rocks hosting this mineralization can be followed east to the high grade zinc, lead, and silver mineralization in the Drenchwater Creek area (No. 103) (11). This site is in the National Petroleum Reserve-Alaska, which lies about 120 miles northeast of Red Dog. In 1977, regional trace element surveys identified anomalous base metal concentrations in samples collected between the Red Dog and Drenchwater Creek prospects. This suggests that this mineralized trend crosses the western and northern parts of the study area.

## ZONES HAVING ROCK STRUCTURES FAVORABLE FOR DISCOVERY OF ADDITIONAL MINERAL DEPOSITS

An evaluation of the available information, the distribution of areas of known mineralization and trace element anomalies can be used to indicate the zones that may have potential for the discovery of additional mineralization. The trends or inferred zones favorable for mineral discovery are within the previously defined rock type areas. The areas favorable for the discovery of metallic and related mineral deposits are shown on figure 5. The identified trends are necessarily based on the scanty data and may not reflect other mineralized zones that remain to be identified within the study region.

## ON-GOING STUDIES

Regional as well as site-specific studies will be necessary if a reliable minerals evaluation of this area is to be made. Sufficient data are available to select some areas for additional study, although large areas still lack the most preliminary types of studies. The Bureau of Mines is proposing to undertake limited studies in the eastern half of the study area during 1978. In areas favorable for mineralization and in areas where trace element anomalies are indicated, these investigations will include the location and sampling of bedrock.

## CONCLUSIONS

Only the most preliminary type of modern exploration has been conducted in the study area, and this covers a very limited portion of the area. However, at least 13 specific commodities are known to be present. These include barium, chromium, copper, fluorite, gold, lead, molybdenum, platinum, silver, tin, tungsten, uranium, and zinc.

Systematic regional rock structure mapping as well as trace elements and geophysical surveys are lacking. Studies, ranging from the most basic type of examination, to follow-up trace element studies and detailed site-specific investigations are needed to make a technically sound mineral resource assessment. No such surveys have been made in the study area.

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12. Tailleux, I. L. and others, 1970, Lead, Zinc and Barite-Bearing Samples from the Western Brooks Range: Geological Survey Open-File Report 445, p. 17.

## APPENDIX\*

MINERAL OCCURRENCES AND TRACE ELEMENT ANOMALIES  
IN NORTHWESTERN ALASKA\*\*

\*\*Indicates localities in the proposed Noatak National Arctic Range

## \* DATA TAKEN FROM:

Grybeck, Donald, 1977, Maps showing known Mineral Deposits of the Brooks Range, Alaska: USGS Open File Report 77-166C.

Grybeck, Donald, 1977, Maps showing Geochemical Anomalies in the Brooks Range, Alaska: USGS Open File Report 77-166D.

Bureau of Mines Unpublished Data; and Private Reports

| <u>Map #</u> | <u>Name</u>       | <u>Location</u>                    | <u>Notes</u>                                                                                      |
|--------------|-------------------|------------------------------------|---------------------------------------------------------------------------------------------------|
| 1**          | Red Dog           | T 31N R 18W                        | Zinc, lead, silver, barite; solid sulfide and disseminated deposits; 1/4 square mile              |
| 2-5          | Color Anomalies   | T 31N R 19W                        | Geologic setting similar to Red Dog, high grade zinc, lead at one site drilled in 1977            |
| 6**          | Maiyumerak Mtns.  | Tps 27, 28N R 15, 16W              | Volcanic, ultramafic, mafic complex reported copper mineralization, anomalous chrome geochemistry |
| 7**          | Sour's Chrome     | T 24N R 17W                        | Mafic/ultramafic rocks identified bands of chromite bearing rocks                                 |
| 8**          | Eli River Tin     |                                    | Placer tin confirmed in 1940's                                                                    |
| 9**          | Lean Creek        |                                    | Lode and placer gold reported in literature                                                       |
| 10**         | Avan              | T 31, 32, 33, 34N<br>R 13, 14, 15W | Mafic, ultramafic rocks, chromite identified platinum found in placer                             |
| 11**         | Kugururok         | T 30N R 14W                        | High grade boulder of chromite found in river gravels                                             |
| 12**         | Misheguk Mountain | T 33N R 10, 11W                    | Ultramafic pluton, reported copper, asbestos, chromite mineralization                             |
| 13**         | Amaktukvik Pass   | T 33N R 7W                         | One claim staked; commodity unknown                                                               |
| 14**         | Loesche           | T 24N R 14W                        | Copper in carbonates, possibly similar to Bornite                                                 |
| 15**         | Agashashok River  | T 26N R 12W                        | Copper, 18 claims                                                                                 |
| 16**         | Agashashok River  | T 26N R 12W                        | Copper with vein quartz to 1% Cu                                                                  |
| 17**         | Agashashok River  | T 26N R 12W                        | Iron oxide stained zone, no mineralization noted in place                                         |

| <u>Map #</u> | <u>Name</u>              | <u>Location</u>    | <u>Notes</u>                                                                                       |
|--------------|--------------------------|--------------------|----------------------------------------------------------------------------------------------------|
| 18**         | Agashashok River         | T 26N R 12W        | Iron oxide zone, no mineralization noted in place                                                  |
| 19**         | Agashashok River<br>Zinc | T 25N R 14W        | 100'+ thick section of zinc bearing pyritiferous schists                                           |
| 20**         | Nakolikurok Creek        | T 26N R 8W         | Copper in quartz vein in greenstone sill                                                           |
| 21**         | Omar                     | T 24N R 10W        | High grade copper sulfides in large fracture zones in carbonate rocks                              |
| 22**         | Frost                    | T 24N R 9W         | Lenses of barite mineralization with zinc, lead, copper, and fluorite; discontinuous for 5000 feet |
| 23**         | Klery Creek              | T 19-24N R 7-9W    | Old placer gold district, gold still pannable in areas of previous placering                       |
| 24**         | Timber Creek             | T 24, 25N R 7-9W   | Old placer district                                                                                |
| 25**         | Chevron                  | T 29N R 5W         | Copper in quartz vein system, grades 0.02 oz. Au, 2.08% Cu over 4.3 feet or 0.5% over 10 feet      |
| 26           | Hub                      | T 27N R 4W         | Copper bearing quartz-calcite vein                                                                 |
| 27           | Temby                    | T 25N R 4W         | Copper bearing quartz vein. 1.5% Cu reported                                                       |
| 28           | Tundra                   | T 25N R 4, 5W      | Reported claims nature of mineralization not known                                                 |
| 29           | Salmon River             | T 26, 27, 28N R 5W | Placer gold                                                                                        |
| 30           | Salmon River             | T 26N R 5W         | Copper bearing quartz veins                                                                        |
| 31           | Copper Creek (Cu)        | T 27N R 5W         | Copper bearing quartz veins                                                                        |
| 32           | Copper Creek (Pb-Zn)     | T 27N R 4, 5W      | Lead, zinc in quartz veins                                                                         |
| 33           | Lena Creek               | T 29N R 8W (?)     | Barite reported in stream float, source unknown                                                    |

| <u>Map #</u> | <u>Name</u>       | <u>Location</u>       | <u>Notes</u>                                                                                                                              |
|--------------|-------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 34           | Tutuksuk River    | T 23N R 4W            | Lead reported in slate                                                                                                                    |
| 35           | Kallarichuk River | T 20, 21N R 5, 6W (?) | Reported placer gold                                                                                                                      |
| 36**         | Eskimo Venture    | T 34, 35N R 1, 2, 3E  | Chromite in ultramafic rocks                                                                                                              |
| 37**         | Kingsavik Mtns.   | T 32N R 5, 6W         | Reported gold                                                                                                                             |
| 38           | Malfiatti         | T 25N R 1W            | Reported copper mineralization in limestone-schists (?)                                                                                   |
| 39**         | Atongarak Creek   | T 29, 30N R 6, 7E     | Placer gold reported                                                                                                                      |
| 40           | Hunt River        | T 20N R 1W            | One placer claim on Kobuk River                                                                                                           |
| 41**         | Aniuk River       | T 31N R 7E            | Reported placer gold                                                                                                                      |
| 42**         | Aniuk River       | T 31N R 7, 8E         | Reported oil shale                                                                                                                        |
| 43           | Redstone River    | Vague location        | Reported placer gold                                                                                                                      |
| 44**         | Kaluich           | T 25N R 6E            | Lead, zinc, copper in and near contact, also fluorite and minor uranium with granitic intrusive. Tin, tungsten, and silver also reported. |
| 45**         | Otter Bar         | T 29N R 9E            | Copper in sedimentary rocks                                                                                                               |
| 46           | Imelyak River     | T 25N R 8E            | Reported gold mineralization and claims                                                                                                   |
| 47**         | Kav               | T 28N R 9E            | Copper, silver, antimony mineralization in quartz-calcite filled veinlets                                                                 |
| 48**         | Tunukuchiak Creek | T 27, 28N R 10E       | Reported placer gold similar to Midas Creek                                                                                               |
| 49**         | Douglas Creek     | T 29, 30N R 10, 11E   | Geology similar to Midas Creek                                                                                                            |

| <u>Map #</u> | <u>Name</u>          | <u>Location</u>     | <u>Notes</u>                                                                            |
|--------------|----------------------|---------------------|-----------------------------------------------------------------------------------------|
| 50**         | Ningyoyak Creek      | T 29N R 11E         | Copper mineralization in quartz calcite vein                                            |
| 51**         | Midas Creek          | T 28, 29N R 12E     | Placer gold deposit                                                                     |
| 52           | Shishakshinovik Pass | T 23, 24N R 11, 12E | Lead, zinc, silver, molybdenum, beryllium, tin, uranium in contact zone and float rock  |
| 53           | Gull Pass            | T 25N R 18E         | 0.32 oz. gold reported                                                                  |
| 54           | Kutarlak Creek       | T 23, 24N R 12, 13E | Geochemically anomalous zone reported, mineralization not located                       |
| 55           | Nigikpalvgururvrak   | T 27N R 13E         | Active placer gold mine                                                                 |
| 56           | Igning River         | T 24, 25, 26N R 13W | Geochemically anomalous zones for zinc and copper                                       |
| 57           | Ladanan Creek        | T 26N R 20E         | Copper reported                                                                         |
| 58           | Iyahuna Creek        | T 24, 25N R 15, 16E | Reported geochemically anomalous zone for lead and zinc                                 |
| 59           | Angunelechak Pass    | T 26N R 16E         | Reported silver mineralization, also geochemically anomalous lead and zinc              |
| 60           | Killik River         | T 29N R 17E         | Reported copper and antimony                                                            |
| 61           | Twelvemile Creek     | T 25, 26N R 17E     | Geochemically anomalous zone for lead and zinc                                          |
| 62           | Tupik Creek          | T 24, 25N R 17E     | Granite contact zone geochemically anomalous for lead, zinc, copper, silver             |
| 63           | Angiak Pass          | T 24N R 17E         | Granite, granite contact zone, geochemically anomalous in lead and copper               |
| 64           | Glacier Creek        | T 24N R 17, 18E     | Granite, granite contact zone geochemically anomalous in lead, zinc, copper, and silver |

| <u>Map #</u> | <u>Name</u>       | <u>Location</u>     | <u>Notes</u>                                                                  |
|--------------|-------------------|---------------------|-------------------------------------------------------------------------------|
| 65           | Mount Papiok      | T 25N R 17E         | Geochemically highly anomalous for lead, zinc, and silver                     |
| 66           | Lucky Six Creek   | T 25, 26N R 17, 18E | Quartz veins containing copper, antimony, gold; placer gold                   |
| 67           | Walker Lake West  | T 20N R 20E         | Schist belt rocks containing anomalous copper and 0.1 oz. gold                |
| 68           | Walker Lake West  | T 20N R 20E         | Schist belt rocks high in geochemical lead values                             |
| 69           | Walker Lake East  | T 21N R 21E         | Schist belt rocks with geochemically high zinc values                         |
| 70           | Arrigetch Peaks   | T 23, 24N R 21, 22E | Tactite zone to 450 feet long containing anomalous copper, zinc, and tungsten |
| 71           | Helpmejack Creek  | T 19N R 24E (?)     | Placer gold reported                                                          |
| 72           | Malamute          | T 19N R 25E (?)     | Placer gold reported                                                          |
| 73           | Alatna South      | T 20N R 25E (?)     | Placer gold reported                                                          |
| 74           | Quartz Hill       |                     | Placer gold, copper                                                           |
| 75           | Igikpak           | T 23N R 17E         | Reported placer gold in small drainages                                       |
| 76           | Walker Lake South | T 20N R 21E         | Placer gold on lake shore reported                                            |
| 77           | Pingaluk River    | T 24, 27N R 23, 24E | Placer gold along 8 mile length of river reported                             |
| 78           | Alatna North      | T 24, 25N R 20, 22E | Placer gold along 10 mile drainage                                            |
| 79           | Lake Selby        | T 17N R 14E         | Copper bearing quartz vein in conglomerate                                    |
| 80           | Angeta            | T 17N R 15E         | Gold                                                                          |

| <u>Map #</u> | <u>Name</u>        | <u>Location</u>     | <u>Notes</u>                                                    |
|--------------|--------------------|---------------------|-----------------------------------------------------------------|
| 81           | Sheep Creek        | T 32N R 20W         | Fault controlled copper mineralization in carbonates            |
| 82           | Tobin              | T 33N R 18W         | Pyritiferous phyllite float with reported high zinc geochemical |
| 83           | Kinnorutin         | T 36N R 13W         | Volcanics with reported high geochemical values                 |
| 84           | St. Patricks Creek | T 35N R 13W         | High copper in volcanics                                        |
| 85           | Rabbit Creek       | T 26N R 21W         | Zinc, lead, silver reported                                     |
| 86           | Nauyoaruk          | T 22N R 19, 20W     | Placer gold, tin claims                                         |
| 87           | Shiliak Creek      | T 21N R 14, 15W     | Cupriferous pyritiferous schists                                |
| 88           | Mt. Kaksurok       | T 21N R 21W         | Ultramafics with chromite and nickel geochemistry               |
| 89           | Redstone Pluton    | T 24N R 8E          | Iron and lead in granite contact zone                           |
| 90           | Ambler River       | T 25N R 9, 10E      | Copper mineral locality                                         |
| 91           | Ambler River       | T 25N R 10E         | Copper mineral locality                                         |
| 92           | Igning River       | T 24, 25N R 13, 14E | Magnetite occurrence                                            |
| 93           | East Oyukak Mtn.   | T 25N R 16E         | Copper mineralization and anomaly                               |
| 94           | East Oyukak Mtn.   | T 25N R 16E         | Iron in granite contact zone                                    |
| 95           | Portage Creek      | T 26N R 16E         | Copper, silver mineralization                                   |
| 96           | Reed River         | T 22N R 17E         | Pyrite in skarn zone                                            |
| 97           | South Mt. Chitiok  | T 23N R 15E         | Chalcocite reported                                             |

| <u>Map #</u> | <u>Name</u>        | <u>Location</u>     | <u>Notes</u>                                                                                                                  |
|--------------|--------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 98           | Pass Hematite      | T 23N R 16E         | Hematite in granite contact zone                                                                                              |
| 99           | Divide Copper      | T 25N R 18E         | Copper iron mineralization                                                                                                    |
| 100          | Awlinskyak Creek   | T 23, 24N R 20E     | Lead copper occurrence                                                                                                        |
| 101**        | Kugururok          | T 33, 34N R 12, 13W | Black Siltstone, Shublik (?) Fm, 5% P <sub>2</sub> O <sub>5</sub>                                                             |
| 102          |                    | T 8S R 8W           | Black Siltstone, strat. position unknown<br>0.2% P <sub>2</sub> O <sub>5</sub>                                                |
| 103          | Drenchwater Creek  | T 9S R 29W          | Black to gray siltstone. Lisburne Group,<br>5% P <sub>2</sub> O <sub>5</sub> ; .001% eU                                       |
| 104          | Kiligwa River      | T 10S R 28W         | Shale, possibly Alapah Limestone of Lisburne<br>Group, 5% P <sub>2</sub> O <sub>5</sub> ; to 0.002% eU                        |
| 105          | Mount Bupto        | T 11S R 24W         | Phosphatic calcareous mudstone, probably Alapah<br>Limestone of Lisburne Group, 13.7% P <sub>2</sub> O <sub>5</sub> ; .004% U |
| 106          |                    | T 10S R 21W         | Shale. 5% P <sub>2</sub> O <sub>5</sub> ; .001% U                                                                             |
| 107          |                    | T 9, 10S R 20, 21W  | Phosphate rock, 8 foot zone, 24.8% P <sub>2</sub> O <sub>5</sub> , 0.17%<br>V <sub>2</sub> O <sub>5</sub> , .008% U           |
| 108          |                    | T 10S R 21W         | Black limestone, 5% P <sub>2</sub> O <sub>5</sub> ; 0.001% eU                                                                 |
| 109          |                    | T 34N R 9E          | Limestone to calcareous silty shale, 5% P <sub>2</sub> O <sub>5</sub> ;<br>.001% eU                                           |
| 110          | Nigu River         | T 11S R 19W         | Calcareous mudstone, 5+% P <sub>2</sub> O <sub>5</sub> ; .004% eU                                                             |
| 111          | Oolamnagavik River | T 10S R 12W         | Black siltstone, 1.4% P <sub>2</sub> O <sub>5</sub> ; .005% eU                                                                |
| 112          | Killik River       | T 12S R 10W         | Phosphatic limestone, 0.4% P <sub>2</sub> O <sub>5</sub> ; 0.004% eU                                                          |
| 113          | Kiruktagiak        | T 12S R 10W         | Phosphatic limestone, 0.4% P <sub>2</sub> O <sub>5</sub> ; 0.004% eU                                                          |

| <u>Map #</u> | <u>Name</u>      | <u>Location</u> | <u>Notes</u>                                                                                                              |
|--------------|------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
| 114          |                  | T 12S R 3W      | Oolitic phosphate rock, 25.6% $P_2O_5$ ; 0.02% $V_2O_5$ ; 0.009% eU                                                       |
| 115          | Tiglukupuk Creek | T 13S R 1E      | Phosphatic zone, 36 foot thick zone averages 8% $P_2O_5$ . Small samples contain to 30% $P_2O_5$                          |
| 116          |                  | T 13S R 1E      | Black shaly limestone, 5% $P_2O_5$ ; 0.008% eU                                                                            |
| 117          |                  | T 13S R 2E      | Phosphate rock, 27.9% $P_2O_5$ ; 0.020% eU                                                                                |
| 118          |                  | T 13S R 2E      | Phosphate rock, 15+% $P_2O_5$ ; 0.009% eU                                                                                 |
| 119          |                  | T 13S R 3E      | Phosphate rock, 21.4% $P_2O_5$ ; 0.014% eU                                                                                |
| 120          |                  | T 12S R 5E      | Dark limestone, 5% $P_2O_5$ ; 0.001% eU                                                                                   |
| 121          |                  | T 33N R 24W     | Copper sulfides and malachite in Devonian slate and phyllite                                                              |
| 122          | Hunt Fork        | T 35N R 22W     | Lead bearing quartz veins in Devonian slate and phyllite                                                                  |
| 123          | John River       |                 | Antimony lode. Chalcopyrite and bornite reported in river gravels, source not known                                       |
| 124          |                  | T 27N R 24W     | Copper and zinc, possibly stratiform deposits. Geology and geochemistry apparently similar to Arctic schist belt deposits |
| 125          |                  | T 27N R 24W     | Copper and zinc, possibly stratiform deposits similar to Arctic schist belt deposits                                      |
| 126          |                  | T 27N R 23W     | Copper and zinc, possibly stratiform deposits similar to Arctic schist belt deposits                                      |
| 127          | Ann Claims       | T 30N R 24W     | Zinc and lead mineralization in carbonate rocks                                                                           |

| <u>Map #</u> | <u>Name</u>                 | <u>Location</u> | <u>Notes</u>                                                                           |
|--------------|-----------------------------|-----------------|----------------------------------------------------------------------------------------|
| 128          |                             | T 30N R 23W     | Zinc and lead mineralization in carbonate rocks                                        |
| 129          |                             | T 30N R 23W     | Zinc and lead mineralization in carbonate rocks                                        |
| 130          |                             | T 31N R 21W     | Copper sulfides in Skajit Limestone                                                    |
| 131          |                             | T 31N R 20W     | Copper sulfides at fault contact between Devonian limestone and phyllite and siltstone |
| 132          |                             | T 32N R 19(29)W | Copper and lead sulfides along thrust fault                                            |
| 133          |                             | T 31N R 19W     | Copper sulfides in Skajit Limestone                                                    |
| 134          |                             | T 31N R 19W     | Copper sulfides in Devonian phyllite and siltstone                                     |
| 135          |                             | T 31N R 18W     | Copper sulfides in quartz vein                                                         |
| 136          |                             | T 31N R 18W     | Copper and lead mineralization in quartz stockworks                                    |
| 137          |                             | T 31N R 18W     | Copper sulfides in vein quartz, at at least 3 locations                                |
| 138          |                             | T 31N R 18W     | Copper and lead mineralization in vein quartz                                          |
| 139          | Spring Creek/<br>Lake Creek | T 31N R 18W     | Placer gold, previous production                                                       |
| 140          | Matthews Dome               | T 31N R 18W     | Copper sulfides in calc-schist and vein quartz                                         |
| 141          | Bird Creek                  | T 30N R 17W     | Placer gold, previous production                                                       |
| 142          | Jay/Rye/Lucky Creek         | T 30N R 17W     | Placer gold, previous production                                                       |
| 143          | Kay Creek                   | T 30N R 16W     | Placer gold, previous production                                                       |
| 144          | Bourbon Creek               | T 28N R 16W     | Placer gold, previous production                                                       |

| <u>Map #</u> | <u>Name</u>                                     | <u>Location</u> | <u>Notes</u>                                                                                    |
|--------------|-------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------|
| 145          |                                                 | T 29N R 17W     | Lode claims, commodity unknown                                                                  |
| 146          | Galena Creek                                    | T 29N R 17W     | Lead sulfide (galena) found in creek, reported lode mineralization in area                      |
| 147          | Michigan Creek                                  | T 28,29N R 17W  | Argentiferous galena in quartz vein in sedimentary rocks                                        |
| 148          | Allen River                                     | T 30N R 20W     | Copper sulfides in Devonian black phyllites and slates                                          |
| 149          | Crevice Creek                                   | T 20N R 19, 20N | Lead and copper sulfides in Skajit Limestone                                                    |
| 150          |                                                 | T 29N R 21W     | Lead, zinc, copper and iron sulfides; stratiform in interbedded schist, quartzite and limestone |
| 151          |                                                 | T 31N R 15W     | Lead sulfide bearing quartz vein in Devonian slate, phyllite and siltstone                      |
| 152          | Vermont Dome                                    | T 31N R 12W     | Copper sulfides and vein quartz with minor copper and zinc in Devonian phyllite and siltstone   |
| 153          | Vermont Creek/<br>Hammond Ridge/<br>Swift Gulch | T 31N R 12W     | Placer gold, previous production                                                                |
| 154          | Nolan Creek etc.                                | T 31N R 12W     | Placer gold, Nolan River and tributaries, previous production                                   |
| 155          | Ferguson, etc.                                  | T 30, 31N R 12W | Numerous antimony, gold quartz veins; previous production                                       |
| 156          | Union Gulch                                     | T 30N R 11W     | Placer gold, previous production                                                                |
| 157          | Mascot Creek                                    | T 31N R 13W     | Placer gold, previous production                                                                |

| <u>Map #</u> | <u>Name</u>                 | <u>Location</u> | <u>Notes</u>                                                                           |
|--------------|-----------------------------|-----------------|----------------------------------------------------------------------------------------|
| 158          | Cow Creek                   | T 30N R 12W     | Copper sulfides in quartz vein in Devonian schists and marble                          |
| 159          | Emma Dome                   | T 29N R 13W     | Gold and silver in quartz vein                                                         |
| 160          | Emma Creek                  | T 29N R 12W     | Placer gold, previous production                                                       |
| 161          | Slate Creek                 | T 28N R 13W     | Placer gold, previous production                                                       |
| 162          | Myrtle Creek                | T 28N R 11W     | Placer gold, previous production                                                       |
| 163          | Slate Creek                 | T 28N R 11W     | Placer gold, previous production                                                       |
| 164          |                             | T 28N R 10W     | Copper sulfides in Devonian (?) micaceous greywacke                                    |
| 165          | Howard Creek                | T 30N R 11W     | Lead and copper sulfides in masses of iron sulfides in Devonian chloritic schists      |
| 166          | Gold Creek/<br>Magnet Creek | T 31N R 10W     | Placer gold, previous production                                                       |
| 167          |                             | T 32N R 11W     | Copper sulfides in Upper Devonian siltstone and grit unit                              |
| 168          | Big Jim Creek               | T 35N R 11W     | Lead and copper sulfides in Upper Devonian phyllite                                    |
| 169          |                             | T 36N R 10W     | Copper sulfides in Skagit Formation                                                    |
| 170          | Snowden Creek               | T 34N R 10W     | Copper sulfides in vein quartz float near contact of Devonian limestone and greenstone |
| 171          |                             | T 35N R 8,9W    | Claim staked, commodity unknown                                                        |
| 172          |                             | T 33N R 9W      | Claims staked, commodity unknown                                                       |

| <u>Map #</u> | <u>Name</u>        | <u>Location</u> | <u>Notes</u>                                                                                       |
|--------------|--------------------|-----------------|----------------------------------------------------------------------------------------------------|
| 173          | Matthews River     | T 33N R 9W      | Auriferous copper, lead, zinc sulfides in quartz veins in Devonian (?) greenstone and greenschists |
| 174          | Jade Mountains     | T 21N R 3E      | Copper and lead bearing vein in limestone                                                          |
| 175          | Jade Mountains (?) | T 21N R 4E      | Jade and asbestos in ultramafic body                                                               |
| 176          | Jade Mountains     | T 21N R 5E      | Nickel, asbestos, jade with ultramafic body                                                        |
| 177          | Smucker            | T 22N R 8E      | Argentiferous zinc, copper sulfide mineralization; reportedly similar to Arctic Camp               |
| 178          | Horse Creek        | T 22N R 10E     | Argentiferous zinc, copper deposits; reportedly similar to Arctic Camp                             |
| 179          | Sunshine Creek     | T 21N R 10E     | Argentiferous zinc, copper deposits; reportedly similar to Arctic Camp                             |
| 180          | Dead Creek         | T 21N R 11E     | Argentiferous zinc, copper deposits; reportedly similar to Arctic Camp                             |
| 181          | Diane Creek        | T 20N R 12E     | Copper and zinc sulfide mineralization in calcareous schist and skarn                              |
| 182          | Que Creek          | T 20N R 12E     | Copper mineralization in muscovite quartz schist over large areas                                  |
| 183          |                    | T 21N R 13E     | Lead and zinc sulfide in highly mineralized carbonate unit                                         |
| 184          | Sharp Creek        | T 21N R 14E     | Copper sulfide mineralization in chlorite-muscovite-quartz schist                                  |
| 185          | Jerry Creek        | T 20N R 13E     | Zinc and copper sulfide mineralization along some trend as Arctic Camp deposit                     |

| <u>Map #</u> | <u>Name</u>       | <u>Location</u> | <u>Notes</u>                                                                         |
|--------------|-------------------|-----------------|--------------------------------------------------------------------------------------|
| 186          |                   | T 20N R 14E     | Mineralized rock containing geochemically anomalous gold, silver, copper, lead, zinc |
| 187          |                   | T 20N R 14E     | Copper in chlorite-quartz schist                                                     |
| 188          |                   | T 20N R 16E     | Copper in chlorite-quartz schist                                                     |
| 189          |                   | T 19N R 16E     | Claims staked, commodity unknown                                                     |
| 190          |                   | T 20N R 17E     | Auriferous rock samples                                                              |
| 191          |                   | T 20N R 17E     | Auriferous rock samples                                                              |
| 192          |                   | T 20N R 18E     | Auriferous rock samples                                                              |
| 193          | Picnic Creek      | T 29N R 17,18E  | Zinc, copper mineralization, some drilling                                           |
| 194          | Riley Creek       | T 19N R 9,10E   | Claims staked, commodity unknown                                                     |
| 195          | Asbestos Mountain | T 19N R 9E      | Asbestos and jade in ultramafic rocks                                                |
| 196          | Bornite           | T 19N R 9E      | Copper, zinc, uranium in carbonate rocks                                             |
| 197          | Partner Hill      | T 18N R 8E      | Copper mineralization in carbonates                                                  |
| 198          | Cosmos Creek      | T 19N R 8E      | Asbestos, jade in ultramafic terrane                                                 |
| 199          | Aurora Mountain   | T 19,20N R 8E   | Copper in carbonate rocks                                                            |
| 200          | Bismark Mountain  | T 19N R 7E      | Asbestos in ultramafic rocks                                                         |
| 201          | Shungnak River    | T 19N R 7E      | Placer gold; jade and asbestos in ultramafic rocks                                   |
| 202          |                   | T 21N R 1E      | Coal                                                                                 |
| 203          |                   | T 20N R 6W      | Coal                                                                                 |

| <u>Map #</u> | <u>Name</u>  | <u>Location</u> | <u>Notes</u>                                                         |
|--------------|--------------|-----------------|----------------------------------------------------------------------|
| 204          |              | T 21N R 9E      | Coal                                                                 |
| 205          | Shovel Creek | T 11N R 5E      | Placer gold, previous production                                     |
| 206          | Hawk River   | T 10N R 6E      | Copper, lead, and silver veins in volcanic rocks                     |
| 207          |              | T 7,8N R 9,10W  | Uranium with acid intrusives                                         |
| 208          |              | T 8,9N R 9,10W  | Uranium, disseminated and in veins, in acid intrusive rock           |
| 209          |              | T 8,9N R 9,10W  | Uranium, disseminated and in veins, in acid intrusive rock           |
| 210          |              | T 9N R 9W       | Fluorite, cementing brecciated intrusive rock                        |
| 211          |              | T 8,9N R 9,10W  | Uranium, disseminated and in veins, in acid intrusive rock           |
| 212          |              | T 7,8N R 9,10W  | Uranium claims                                                       |
| 213          |              | T 7,8N R 9,10W  | Uranium, disseminated and in veins, in acid intrusive rock           |
| 214          |              | T 8,9N R 8W     | Uranium claims                                                       |
| 215          |              | T 8,9N R 9,10W  | Uranium, in veins and disseminated, in acid intrusive rock           |
| 216          | Hunt Creek   | T 9N R 5W       | Lead and zinc, in veins, in intrusive rock                           |
| 217          | Cosmos Creek | T 18N R 8E      | Jade placers, previous production                                    |
| 218          | Wesley Creek | T 18N R 8E      | Lead in carbonate rocks; asbestos and jade in mafic/ultramafic rocks |

| <u>Map #</u> | <u>Name</u>      | <u>Location</u> | <u>Notes</u>                                                                                           |
|--------------|------------------|-----------------|--------------------------------------------------------------------------------------------------------|
| 219          | Dahl Creek       | T 18N R 9E      | Placer gold, previous production. Jade in float.<br>Asbestos                                           |
| 220          | California Creek | T 18N R 10E     | Placer gold, previous production                                                                       |
| 221          | Arctic Camp      | T 21N R 11W     | Drilled deposits of zinc, copper, lead, silver, and<br>gold mineralization; 35 million tons, 4% copper |
| 222          | Nantuk Mountain  | T 24N R 26E     | Reported zinc-silver mineralized float                                                                 |