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GLACIER BAY NATIONAL MONUMENT EVALUATION OF MINERAL DEPOSITS

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Geologic map of Glacier Bay National Monument, Scale 1:250,000

Map compiled and modified from the bedrock geologic map and geochemical maps contained in U.S. Geological Survey Professional Paper 632, Mineral Resources of Glacier Bay National Monument, Alaska, E. M. MacKevett et al, and from metallic mineral resource maps of the Juneau, Fairweather, and Skagway quadrangles, maps MF 435, 424, and 436.

ABSTRACT

This report summarizes the metallic commodities of potential economic interest located within the boundaries of Glacier Bay National Monument. It also describes the oil potential of the Tertiary sediments that are restricted to the west side of the Fairweather fault.

The minerals of potential economic importance include copper, molybdenum, nickel, gold, silver, titanium, and iron. The Brady Glacier copper-nickel deposit and the Nunatak molybdenum prospects are both considered economic and development is considered necessary to insure adequate supplies of these metals. Other prospects have not been evaluated and the probability is high that several could be developed into large producers.

The high mountainous areas in the Fairweather range and the north part of the Muir province are glacier and snow covered and these areas have not been adequately explored. Modern geophysical methods applied to these areas may delineate large metallic deposits.

CONCLUSIONS

The Glacier Bay National Monument contains stratigraphic and structural relationships and host rocks favorable for the deposition of metallic minerals. There are numerous deposits of a wide spectrum of ores. Most have not been adequately explored using modern methods. The Brady Glacier nickel deposit is adequately large and rich enough to produce commercial ore. With 80 percent of the U.S. nickel consumption presently being imported, it would be prudent to examine ways of developing this prospect. Other deposits, including the Alaska Chief Prospect, have potential as large low-grade copper deposits.

The offshore petroleum potential along the southwestern part of the Monument is considered fair to moderate. The onshore Tertiary sediments are considered to have poor potential. The tentative boundaries of the Monument extend offshore to the three mile limit and include 224,960 acres of land normally considered as State of Alaska lands. From the State's viewpoint, this land is State domain.

Although a considerable amount of geochemical exploration work has been completed on stream samples, areas underlying ice fields and glaciers can not be adequately sampled for geochemical methods. Thus the Fairweather and Muir provinces are considered as being only partially explored.

INTRODUCTION

The Glacier Bay National Monument, about 3,900 square miles in area (excluding the offshore area included within the three mile limit), is in southeastern Alaska some 100 miles west-northwest of Juneau.

This report covers the generalized geology and emphasizes the known metallic mineral trends and deposits. The area is of special interest because of the large deposit of nickel-copper associated with the Crillon-LaPerouse intrusion which underlies part of Brady Glacier.

The western part of the Monument is dominated by the Fairweather Range where elevations rise abruptly from sea level to more than 13,000 feet in the space of a few miles. Brady Glacier occupies a large area within the range and bedrock exposures in the vicinity are limited to nunataks that protrude through the glacial ice and to narrow ridges extending into the glacier.

The eastern part of Glacier Bay National Monument extends into the Chilkat Range where elevations are lower and ice and snowfield cover is much less widespread.

The area has no all-weather roads or trails, so access is limited to boats, float planes and helicopters.

GEOLOGY

STRATIGRAPHY

The Glacier Bay National Monument is separated into five geologic provinces (geologic map). The Tertiary sediments of the Coastal province are discussed below:

Bedded rocks of Tertiary age in the Lituya district include marine and non-marine clastic and volcanic units totaling at least 12,000 feet, which unconformably overlie the Mesozoic basement. The sequence has been subdivided into three formations; the Cenotaph Volcanics and Topsy formations, both of post-early Oligocene(?) to pre-middle Micoene age and the Yakataga formation of Middle Miocene to early Pleistocene age (Plafker, 1967). The Topsy formation is about 75 percent hard calcareous concretionary siltstone and 25 percent fine- to medium-grained gray and greenish-gray argillaceous and carbonaceous sandstone. The Cenotaph Volcanics consist of at least 850 feet of green, red, and purple volcanic breccia and tuff overlain by 400 feet of interbedded green and red tuffaceous siltstone containing interbeds of green glauconitic sandstone and pebble-cobble conglomerate. The Yakataga formation disconformably overlies both formations and consists of a lower unit of interbedded siltstone and sandstone and an overlying upper unit consisting of sandy mudstone, siltstone, sandstone and minor conglomerate interbedded with abundant conglomeratic sandy mudstone (marine tillite).

Plafker (1967) has studied the petroleum potential for the Tertiary rocks and concludes that the petroleum potential of the Tertiary sequence in the Monument is poor within the area of outcrop. He cites the lack of oil and gas seeps, deformation of the older siltstones and a low organic content in the less deformed younger siltstones in his reasoning.

The anticline just south of Lituya Bay probably does not have structural closure, and the shallow potential reservoir sands in the Cenotaph and Topsy formations are breached by erosion.

Offshore potential is unknown within the three mile limit. Structure and source potential may improve in an offshore direction but reservoir rocks are likely to become scarcer with increasing distance from shore.

The stratigraphy for the Fairweather, Geikie, Muir and Chilkat Provinces are discussed as a unit. Paleozoic rocks crop out through the east half of the Monument and are well exposed in the Chilkat Province. An estimated maximum of 30,000 feet of detrital clastic rocks, mostly graywacke and argillite of Silurian and possibly Devonian age, are present. To the north the rocks appear to be comparable, but with the addition of significant quantities of volcanic rocks. Carbonate and detrital clastic units of Middle Devonian age occur in the north-central and northwestern part of this province. Paleozoic rocks are not greatly metamorphosed throughout most of the Chilkat province. In the Geikie and Muir provinces these same rocks are highly metamorphosed, creating correlation problems.

Mesozoic strata are found in the Fairweather and Coastal provinces and include three definable units:

1. A low grade metamorphic unit derived from detrital clastic rocks and volcanic rocks found only west of the Fairweather fault.

2. An amphibolite unit which may be equivalent to volcanic rocks of Triassic age.

3. A biotite schist unit derived from a graywacke-shale sequence of Jurassic and Cretaceous age.

INTRUSIVE ROCKS

Intrusive rocks of late Mesozoic to perhaps early Tertiary age are commonly present in the Geikie and Muir geologic provinces and occur in all other provinces. Most of the intrusives in the Monument are diorites identified as hornblende quartz diorite, hornblende diorite, and biotite-hornblende quartz diorite. Some biotite-hornblende granodiorite also occurs. These rocks are generally foliated and most contain or are bordered by hornblende quartz diorite gneiss. In general these rocks appear to have been intruded before the end of the episode in which the country rocks were deformed.

The unfoliated rocks within the Monument are predominantly in the Geikie province with isolated bodies in the Chilkat, Muir and Fairweather provinces. These granitic rocks range from hornblende-biotite granodiorite to biotite granite and because they lack foliation are considered to have been intruded after deformation of the host rocks. Dike rocks ranging from aplites to lamprophyres have been mapped in the Monument. Many of the dikes are considered relatively young, and some have associated mineral deposits (MacKevett, 1971).

The most important intrusive from a commercial mineral aspect is the layered gabbro complex that occupies a part of the Fairweather province. This complex,

estimated to be 30,000 feet thick, locally contains the important Brady Glacier nickel-copper sulfide deposits. At least two other bodies of gabbro occur nearby and may contain sulfide deposits.

STRUCTURE

Structural generalizations for each province are listed below:

Coastal Province

1. The Tertiary sediments occupy two northwest-trending synclines and one anticline.

2. The prominent Fairweather fault which separates the Coastal and Fairweather province is part of an extensive high-angle fault system extending from Yakutat Bay to western Baranof Island to the south.

Fairweather Province

North and northwest-striking, steeply-dipping foliation is prominent in this province.

Geikie Province

1. Characterized by parallel north and northwest striking foliations in the country rocks.

2. Contains a prominent north-northwest striking zone of discontinuous faults.

3. Northwest strikes and steep westerly dips suggests that rocks in the Geikie province are stratigraphically lower than rock units in the Fairweather province.

Muir Province

1. Contacts and foliations strike west to northwest and dip moderately to steeply to the north.

2. The change from northerly trends near Muir Inlet to westerly trends just north suggests that major structural discontinuities occur in this area.

Chilkat Province

1. A change in strike, similar to that seen in the Muir province, has been mapped in the northern part of the Chilkat province. This change is associated with an east-west fault zone and, in the western part of the province, by a high-angle reverse fault.

2. Other than the structural complications mentioned, the Chilkat province contains rocks characterized by northwest strike with moderate to steep northeast dips and large magnitude folds overturned to the southwest.

GEOCHEMICAL STUDIES

Geochemical studies in Glacier Bay National Monument consist of an analysis and interpretation of 2,700+ stream and soil samples collected by the U.S. Geological Survey (MacKevett, 1971). The geochemical studies show both many local concentrations of metals in stream sediments and geographic distributions for individual elements. A summary of the results of this study is included below:

Total Heavy Metals (Copper, Lead, Zinc)

Total heavy metals (THM) values are generally higher in the relatively unmetamorphosed detrital clastic rocks of the Chilkat province.

Specific areas of high THM values are:

1. Head of Excursion River
2. Near Miller Peak and Sandy Cove
3. Northwest of Tidal Inlet near Mt. Merriam.

Copper

No copper anomalies were found in the Muir province (not necessarily negative since this province is extensively covered with glaciers and has few flowing streams from which stream samples could be collected).

The Geikie province contains several copper anomalies.

Specific localities are:

1. East of Dundas Bay
2. Near head of Taylor Bay
3. Samples collected east and west of the central part of the Reid Inlet area have an anomalous copper content.
4. An isolated sample on the west side of Tarr Inlet had a high copper content
5. A single sample between Tarr and Reindeer Inlet contained a slight copper anomaly.

Lead

There are broad areas of anomalous lead concentrations in the southern part of the Chilkat province.

Samples from the northern and southern parts of the Geikie province were anomalous for lead.

Specific localities are:

1. South of Snow Dome
2. Reid Inlet gold areas
3. Drainages on the Lamplugh Glacier side of the Reid Inlet gold areas
4. The highest lead value found is from the west shore of Tarr Inlet
5. Other minor anomalous areas include drainages entering the south side of Johns Hopkins Inlet and also east of the Tarr Inlet.

Molybdenum

The largest area of anomalous molybdenum content is in the northernmost Chilkat province near Mount Marian.

Other areas of possible significance are near Miller Peak and Sandy Cove and near the head of Dundas Bay.

Detailed soil sampling disclosed anomalous molybdenum values near the Nunatak molybdenum deposit.

Chromium and Nickel

The largest chromium anomaly in the Chilkat province is in upper Berg Creek. Other chromium indications are found along a tributary on the west side of Queen Inlet, and near Mount Wright.

Other Elements

A tungsten anomaly is located at the head of Dundas Bay and a silver anomaly at Tarr Inlet and south of Margerie Glacier.

Specific areas of interest related to geochemical sampling are:

1. Eastern Dundas Bay area; a small area east of Dundas Bay contains two THM anomalies
2. Miller Peak-Sandy Cove area; located on the east side of Glacier Bay, south of Mount Wright. The samples are characterized by relatively high values in THM, copper, chromium and nickel. These anomalies are interpreted as being derived from dike and small scale vein mineralization in altered adjacent country rock. Streams farther east drain a mixed sedimentary terrain, including limestone, and zinc anomalies may be related to mineralized carbonate rock. Samples east of Beartrack River show relatively high volumes of THM and copper. Origin of these anomalies is unknown
3. Mount Merriam area; a complex area in which many of the streams contain anomalous concentrations of molybdenum and THM. THM values apparently are due to zinc for neither lead nor copper is abundant. The highest concentrations of molybdenum are found in a small area east of Campsite Island. Reid Inlet gold area contains the main gold deposits of the Monument, but it is not well marked by geochemical patterns. The anomalous areas for copper and nickel have been indicated on the geologic map of the Monument.

ECONOMIC PETROLEUM POTENTIAL

Areas within the boundaries of the Glacier Bay National Monument with obvious potential for oil and gas are the onshore belt of coastal lowlands and foothills about four (4) miles wide and forty (40) miles long, southwest of the Fairweather fault, and the Tertiary sediments that probably underlie all the adjacent offshore areas within the indefinite boundaries of the Monument.

The descriptions of the structure and stratigraphy are based on detailed mapping by Miller and others (153, 1961).

The sequence of bedded rocks of Tertiary age in the Lituya district includes marine and non-marine volcanic and clastic sediments at least 12,000 feet thick which unconformably overlie the Mesozoic basement rocks.

The Topsy formation and Cenotaph Volcanics may be partially age equivalent because of their apparent interfingering. Neither formation, where exposed on land, appears to have suitable reservoir character for hydrocarbon accumulation.

The Yakataga formation (8,400 feet thick) comprises two units; a lower unit of interbedded siltstone and sandstone and an overlying unit of sandy siltstone with abundant conglomeratic sandy mudstone (marine till or tillite).

The lack of organic source rocks and the poor reservoir characteristics of the onshore Tertiary rocks preclude the probability of commercial oil or gas production from them.

Structure -- South of Lituya Bay, the Tertiary rocks are folded into a shallow syncline and an asymmetric anticline with a steep west flank. A thrust fault paralleling the coast separates the onshore sequence from the thicker offshore sequence of Tertiary rocks. This anticline may not have structural closure (Plafker, 1971) and is breached into the potential reservoir sands in the upper Cenotaph and Topsy formations.

The structural and stratigraphic character of the Tertiary rocks may extend from the onshore Tertiary section to the thicker offshore Tertiary sequence. It is possible that petroleum source rock potential and reservoir character may improve in a seaward direction. For these reasons, the offshore petroleum potential should not be considered as unfavorable.

METALLIC MINERALS

Deposits of gold, silver, iron, molybdenum, nickel, titanium, copper and other metals are known within the boundaries of Glacier Bay National Monument. The description of the geology and deposits of each locality are contained in the Mineral Resources of Glacier Bay National Monument (U.S. Geol. Survey Professional Paper 632). Edward H. Cobb has listed the location of mineral deposits for the Mount Fairweather, Juneau and Skagway quadrangles and these locations have been plotted on the basic geologic map. In addition, localities listed by MacKevett and not included on Cobb's maps have been plotted on the geologic map. Stream sediment samples in which anomalous copper and nickel values were obtained were plotted to determines areas where high mineral concentrations might be expected; thus the map combines most of the data as to known mineral locations and geochemical prospects. The lack of information in the Brady Glacier area and surrounding high mountainous country is due to the absence of stream sediment sources. Thus, most of the highlands of the Mount Fairweather quadrangle and the northern part of the Muir province have not been evaluated. Significant undiscovered deposits may be found by using modern geophysical methods, particularly in the covered parts of the Fairweather Range.

INDIVIDUAL DEPOSITS

Several individual deposits that appear to contain commercial ores or that have attracted a major exploratory effort are listed below:

1. Nunatak Prospect (Molybdenum) - Located east of Muir Inlet, this is the largest known molybdenum deposit in the Monument. This prospect consists of stockworks of molybdenite-bearing quartz veins, disseminated molybdenite and a mineralized fault zone. They occur mainly in a monzonite porphyry hornfels but locally occur in a quartz monzonite porphyry. Twenhofel's (1946) reserve and grade estimates are: 540,000 tons of 0.169 percent molybdenum in the fault deposit, and 8,500,000 tons of 0.125 percent grade in the stockworks.

2. Brady Glacier Prospect (Nickel-Copper) - Massive and disseminated nickel-copper sulfides were discovered in 1958 by the Fremont Mining Company near the west edge of Brady Glacier. The sulfides occur at the southwest margin of a large layered(?) lopolithic intrusion of gabbro and peridotite called the Crillon-LaPerouse stock. (See attached map.) The sulfides occur as disseminated grains and lenticular masses. The grains and small patches of sulfides are scattered through most of the host rock. Although the sulfides are widely distributed throughout the nunataks, the overall average grade would probably be less than 0.5 percent nickel and 0.5 percent copper. Assays of the enriched sulfide masses run 2-3% nickel and 1-1.4% copper. The large reserves and grade indicate a commercial deposit. Also, by analogy with known commercial deposits of similar characteristics, it is very possible that as the basal contact ot the ultramafic complex is approached, higher grades of nickel and copper mineralization will likely be found. Exploration has included sampling and diamond drill holes and results have been optimistic.

3. Margerie Prospect - Located south of Margerie Glacier, the deposits are in light colored granodiorite and hornfels. They consist of mineralized quartz veins, shear zones, and pyrophyllite-rich massive sulfide bodies. Samples from the quartz veins carry as much as 2,000 ppm copper and 0.145 ounce per ton of gold. High tungsten values were noted in float. MacKevett, 1971, believed the prospect and its environs warrant a more thorough examination.

4. Alaska Chief Prospect (Copper, Silver) - This prospect is located northwest of the mouth of Glacier Bay. The prospect is in calcareous contact rocks east of a granodiorite pluton. Reserve estimates based on incomplete data approach 56,000 tons of one percent copper but inferred reserves of unknown tonnage and grade extend beyond the lateral and depth limits on which the 56,000 tons of ore was calculated. This is an example of a deposit which through exploration could become a large low grade commercial copper mine.

5. Reid Inlet (Gold) - The Reid Inlet lode gold area includes the ridge south of Glacier Bay which is bordered by Reid and Lamplugh Glaciers and by Reid Inlet. A total of $250,000 in gold has been produced from six mines (estimated at $20 per ounce). Production has been from thin non-persistent quartz veins and narrow altered zones contiguous to the quartz veins.

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Attachment I

AOFR #47

ALTERED AND MINERALIZED ZONES REPORTED IN

GEOLOGICAL SURVEY PROFESSIONAL PAPER 632 (MacKevett, 1971)

Map Symbol ②	Location	Geologic Setting
1.	Lituya Bay Placers	
2.	Southeast Lituya Bay	Hydrothermally altered zones with minor gold values
3.	North Crillon Glacier	Copper-bearing float in moraine
4.	Northwest edge of Crillon-LaPerouse stock adjacent to North Crillon Glacier	Layered mafic intrusive rocks in contact with schist (iron)
5.	North of Mount Marchainville	Iron stained zones in layered mafic intrusive rocks near contact with metamorphic rocks
6.	West of Tarr Inlet south of Margerie Glacier	Altered and brecciated zones in granodiorite
7.	South shore of Johns Hopkins Inlet	Hornfels with disseminated sulfides throughout an extensive zone
8.	South side of Johns Hopkins Inlet west of Lamplugh Glacier	Oxidized pyrite-bearing igneous complex
9.	South side of Johns Hopkins Inlet west of Lamplugh Glacier	Altered granitic rocks with copper-stained fractures
10.	West of Lamplugh Glacier	Hornfels containing disseminated pyrite
11.	Southwest of Lamplugh Glacier	Copper-stained hornfels cut by quartz veins. Zone is more than a half mile long and a quarter mile wide
12.	West of Reid Glacier	Altered zones in metamorphic rocks
13.	East of Reid Glacier	Altered zones as much as 25 feet thick in strongly folded metamorphic rocks, mainly marble
14.	North of Carrel Glacier	Joint coatings in diorite rock throughout a large area

15.	East of Upper Muir Inlet	Iron stained breccia and shear zones between 1 and 12 feet thick
16.	East of Muir Inlet	Small pyrite-rich pods less than six feet long and 1 foot thick in limestone
17.	East of Muir Inlet	Altered granite rock
18.	Near East border of Monument	Bleached and altered zone 20 feet thick in granodiorite
19.	West of the head of Geikie Inlet	Molybdenite associated with garnet in tactite (reported by Smith, 1942, p. 178)

Attachment II

AOFR #47

METALLIC MINERAL LOCATIONS COMPILED BY COBB, 1972

Map Symbol ▲

Map No.	Name and Principal Reference	Commodity
1	Margerie: MacKevett and others, 1971, p. 43	Co, Cu, Au, W
2	Tarr Inlet: MacKevett and others, 1971, p. 43	Cu
3	Reid Glacier: MacKevett and others, 1971, p. 43	Cu
4	Gable Mountain: MacKevett and others, 1971, p. 43	Cu, Ag
5	Minnesota Ridge: MacKevett and others, 1971, p. 43	Cu
6	Mount Brack: MacKevett and others, 1971, p. 4, 40, 54-55	Cd, Pb, Ag, Zn
7	McBride Glacier: MacKevett and others, 1971, p. 66-67	Au
8	Casement Glacier: MacKevett and others, 1971, p. 74	Cu, Mo
9	Adams Inlet: MacKevett and others, 1971, p. 41-42	Co, Cu
10	White Glacier: MacKevett and others, 1971, p. 42	Cd, Cu, Ag, Zn
11	Sandy Cove: Reed, 1938, p. 65-68; MacKevett and others, 1971, p. 64-66	Cu, Fe, Au, RE, Ag
12	Berg Mountain: Lathram, Loney, and others, 1959	RE
13	Unnames occurrence: Lathram, Loney and others, 1959	Co, Cu
14	Unnamed occurrence: Lathram, Loney and others, 1959	Cu
15	Mount Young: MacKevett and others, 1971, p. 41	Cu, Ag, Zn
16	Mount Young: Lathram, Loney and others, 1959	Cu
17	Unnamed occurrence: Lathram, Loney and others, 1959	Cu
18	Lituya Bay: Kennedy and Walton, 1946, p. 71	Cu
19	Lituya Bay: MacKevett and others, 1971, p. 64	Au
20	South Crillon Glacier: Kennedy and Walton, 1946, p. 71; MacKevett and others, 1971, p. 53	Cu, Fe
21	North Crillon Glacier: Kennedy and Walton, 1946, p. 71	Cu

22 & 23	North Crillon Glacier: MacKevett and others, 1971, p. 52	Cu
24	Tarr Inlet: MacKevett and others, 1971, p. 51	Cu
25	Johns Hopkins Inlet: MacKevett and others, 1971, p. 41	Cu
26	Johns Hopkins Inlet: Reed, 1938, p. 51-52; MacKevett and others, 1971, p. 51-52	Cu, Ag
27	Tarr Inlet: MacKevett and others, 1971, p. 41	Cu
28	Johns Hopkins Inlet: MacKevett and others, 1971, p. 41	Cu
29	Johns Hopkins Inlet: MacKevett and others, 1971, p. 52	Cu
30	Parker, Twenhofel, Reed, and Gates, 1949, p. 33-34	Au, Pb
31	LeRoy, Twenhofel, Reed, and Gates, 1949, p. 32-34; Roseman, 1959a, p. 45-46; MacKevett and others, 1971, p. 55-59	Cd, Cu, Au, Pb, Ag, Zn
32	Rainbow, Twenhofel, Reed and Gates, 1949, p. 31, 33-34; MacKevett and others, 1971, p. 59-60	Au, Pb, Ag, Zn
33	Ptarmigan Creek: Rossman, 1959a, p. 55-56	Zn
34	Monarch: Rossman, 1959a, p. 48-52; MacKevett and others, 1971, p. 60-62	Au, Pb, RE
35	Sentinel: Rossman, 1959a, p. 54; MacKevett and others, 1971, p. 60	Au, Pb
36	Incas: Rossman, 1959a, p. 46-48; MacKevett and others, 1971, p. 62	Au
37	Rambler: Rossman, 1959a, p. 55; MacKevett and others, 1971, p. 64	Au, Pb, Ag, Zn
38	Highland Chief: Rossman, 1959a, p. 54-55	Au
39	Galena: Twenhofel, Reed and Gates, 1949, p. 31,33; MacKevett and others, 1971, p. 63	Au, Pb, Ag, Zn
40	Sunrise: MacKevett and others, 1971, p. 62-63	Au, Ag, W
41	Itopalong and Whirlaway: Rossman, 1959a, p. 56	Au
	Unnamed occurrence: Rossman, 1959a, p. 56	Au
42	Lamplugh Glacier: MacKevett and others, 1971, p. 79	Cu
43	Gilbert Island: Rossman, 1963b, p. K40	Mo

44	Gilbert Island: Rossman, 1963b, p. K50; MacKevett and others, 1971, p. 50-51	Cu, Au, Pb, Mo, Ag, Zn
45	Unnamed island: MacKevett and others, 1971, p. 50-51	Cu, Mo
46	Bluemouse Cove: Rossman, 1963b, p. K50; MacKevett and others, 1971, p. 50	Au, Ag, Zn
47	Tidal Inlet: MacKevett and others, 1971, p. 50	Co, Cu, Ni
48	Russel Island: MacKevett and others, 1971, p. 67	Au
49	Rendu Inlet: MacKevett and others, 1971, p. 79	Cu, Mo
50	Rendu Inlet: Rossman, 1963b, p. K48-K49; MacKevett and others, 1971, p. 69	Cu, Ag
51	Rendu Inlet: MacKevett and others, 1971, p. 70	Co, Fe
52	Rendu Inlet: MacKevett and others, 1971, p. 50, 73	Co, Ni
53	Triangle Island: Rossman, 1963b, p. K49	Mo
54	Queen Inlet: MacKevett and others, 1971, p. 70-72	Co, Cu, Fe
55	Wachusett Inlet (Plateau Glacier): MacKevett and others, 1971, p. 78	Cu, Mo
56	Bruce Hills: Rossman, 1963b, p. K49-K50; MacKevett and others, 1971, p. 48-50	Cu, Pb, Mo, Zn
57	Nunatak: Twenhofel, Robinson, and Gault, 1946, p. 9-18; Rossman, 1963b, p. K49; MacKevett and others, 1971, p. 74-78	Cu, Au, Mo, Ag
58	Red Mountain: MacKevett and others, 1971, p. 55	Cd, Zn
59	Adams Inlet: Smith, 1942, p. 178	Mo
60	North Marble Island: Rossman, 1936b, p. K51; MacKevett and others, 1971, p. 44	Cu, Fe, Zn
61	South Marble Island: Reed, 1938, p. 69, 79	Cu
62	Willoughby Island: Reed, 1938, p. 70	Cu
63	Willoughby Island: Reed, 1930, p. 70-72; Rossman, 1963b, p. K48	Sb, Cu, Au, Pb, Ag
64	Francis Island: Buddington, 1926, p. 56: MacKevett and others, 1971, p. 45	Cu, Au, Ag
65	Shag Cove: MacKevett and others, 1971, p. 51	Co, Cu

66	Brady Glacier: Cornwall, 1971	Co, Cu, Ni
67	Mount Marchainville: MacKevett and others, 1971, p. 52	Cu
68	Astrolabe Peninsula: Rossman, 1963a, p. F44-F45	Fe
69	Abyss Lake: MacKevett and others, 1971, p. 72	Cu, Fe
70	Brady Glacier: Rossman, 1963a, p. K50	Au
71	Dundas Bay, west arm: MacKevett and others, 1971, p. 51	Cu
72	Unnamed occurrence: MacKevett and others, 1971, p. 48	Cu
73 & 74	Dundas Bay: MacKevett and others, 1971, p. 48	Cu
75	Alaska Chief: MacKevett and others, 1971, p. 45-48	Co, Cu, Au, Ni, Ag, Zn
76	Dundas Bay: MacKevett and others, 1971, p. 70	Fe
77	Dundas River: MacKevett and others, 1971, p. 62	Au (placer)
78	Taylor Bay (Brady Glacier): Rossman, 1963b, p. K50-51	Au (placer)
79	Oregon King Consolidated: MacKevett and others, 1971, p. 67-68	Au (placer)
80 & 81	Lituya Bay: Mertie, 1933, p. 133-135; Rossman, 1957	Au, Pt (beach placers)
82	Woodlake (Dundas River): Rossman, 1936b, p. K50	Au (placer)
82a	Geikie Inlet: Smith, 1942, p. 178	Cu, Fe