

REPORT on 92C/10.15
EXPLORATION POSSIBILITIES in the
ALBERNI-BAMFIELD-PORT RENFREW AREA
VANCOUVER ISLAND, BRITISH COLUMBIA
for
MITSUI AND CO. (CANADA) LTD.
by: R.W. Phendler, B.Sc., P.Eng.
672883 April 30, 1970.

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R.W. PHENDLER, B.Sc., P.Eng.

Vancouver, B.C.

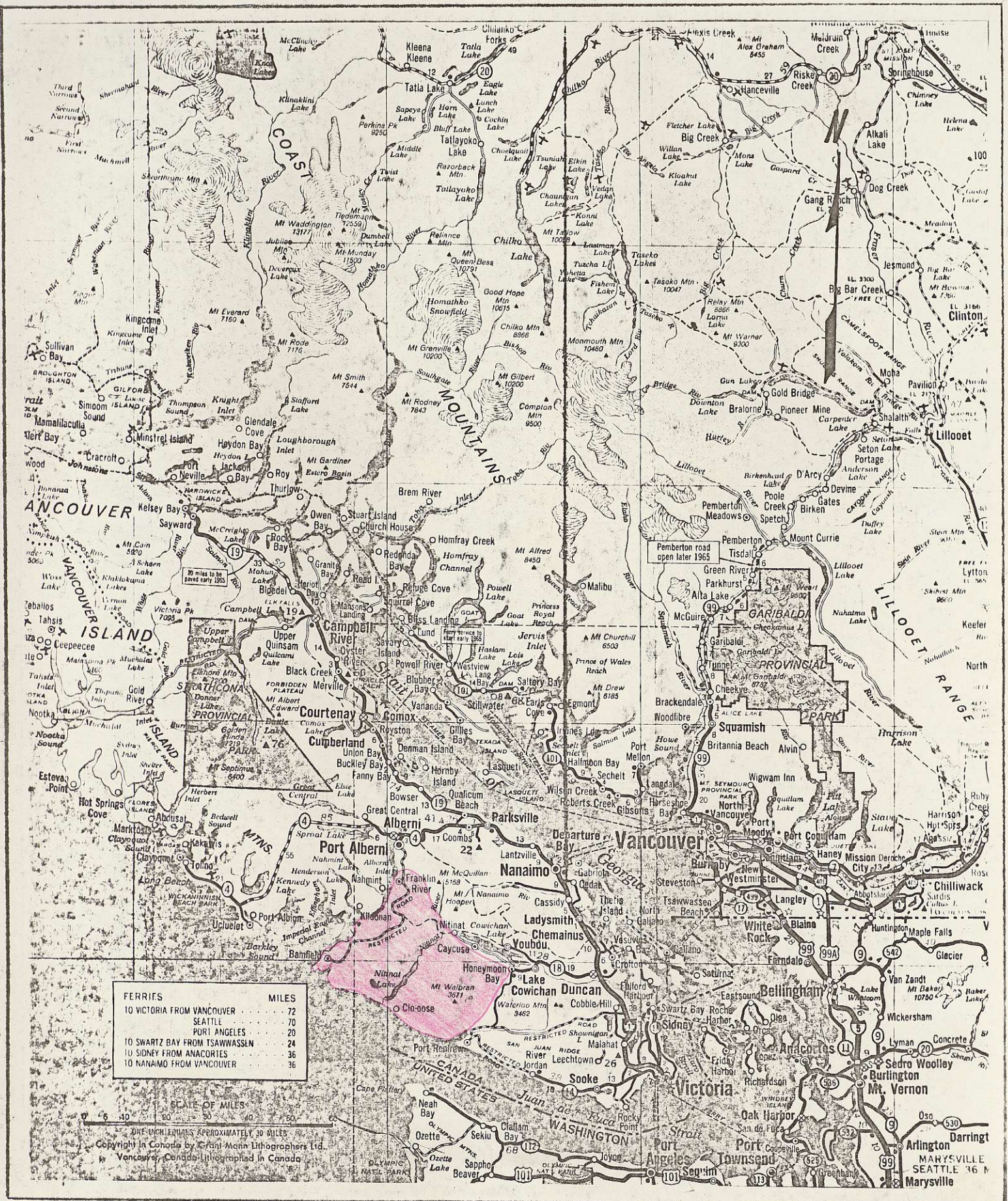
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TABLE OF CONTENTS

	<u>Page</u>
SUMMARY AND CONCLUSIONS	1
RECOMMENDATIONS	3
LOCATION AND ACCESS	4
HISTORY	4
REGIONAL GEOLOGY	5
(1) Sicker Group - Paleozoic	5
(2) Vancouver Group - Triassic - Jurassic	6
Karmutsen Formation	6
Quatsino Formation	6
Bonanza Subgroup	6
(3) Granitic Intrusions	7
VANCOUVER ISLAND MINERAL DEPOSITS	8
(1) Porphyry Copper Deposits	8
(2) Iron and Copper Skarn Deposits	9
(3) Other Mineral Deposits	11
STRUCTURAL TRENDS - PROBABLE AND POSSIBLE	15
MINERAL CLAIMS	16
REFERENCES	17

LIST OF ILLUSTRATIONS

Fig. 1 - Location Map - 1" = 30 miles	Frontispiece
Fig. 2 - Geological Map - 1" = 8 miles	End of Report



LOCATION MAP

Fig. 1

SUMMARY AND CONCLUSIONS

Mining activity on Vancouver Island, B.C., commenced around 1850 in the Nanaimo coal fields. Prospecting was soon thereafter carried out in various other parts of the Island, and gold, copper and iron discoveries were made.

No significant orebodies have been found, however, in the Alberni-Bamfield-Port Renfrew area considered in this report. Access has been extremely difficult, although recent logging roads, most of which are not shown on published maps, cross many parts of the area. It is thought, therefore, that mining exploration to date has been quite limited in extent.

Vancouver Island is underlain by metamorphosed sediments and volcanics of from late Paleozoic to early Jurassic age, intruded by granitic rocks of Jurassic and Tertiary age.

Most mineral deposits found to date are associated with zones of Tertiary igneous activity, although the copper-molybdenum deposit of Island Copper Mines Ltd. near Port Hardy is related to Jurassic plutons. The iron-copper "skarn" deposits found on Vancouver Island are considered to be caused by Jurassic intrusions in association with Karmutsen greenstones and Quatsino limestone. Most porphyry copper deposits discovered to date on Vancouver Island (Catface Mountain, Mount Washington and others) are associated with Triassic quartz diorite and are confined to a northeasterly trending zone that may be a fault.

A second parallel zone of possibly Triassic intrusives with associated porphyry copper deposits extends into the Alberni-Bamfield-Port Renfrew area under consideration. A deposit at Corrigan Creek is situated within this zone; numerous minor gold quartz deposits, associated with Triassic intrusives, are found nearby.

The Noranda-owned Kennedy Lake magnetite deposit, which produced over 4 million tons of iron ore, is situated to the northwest of the proposed exploration area across Barclay Sound. It is to be noted that aeromagnetic surveying apparently failed to show any appreciable response over the Kennedy Lake deposit.

The Bugaboo magnetite deposit which, it is understood, contains over 50% iron, is in the Alberni-Bamfield-Port Renfrew area but has a sufficiently large sulphur content to preclude economic extraction using present technology.

Aeromagnetic surveys have been conducted over the proposed prospecting area, with inconclusive or negative results. Since the terrain is mountainous however and, in view of the Kennedy Lake results noted above, aeromagnetic surveying does not necessarily provide a final answer. Correspondingly, therefore, since the geology is favourable, it is felt that good possibilities for the discovery of new iron skarn deposits still exist.

It is noted that the distribution of Quatsino limestone, which is always associated with the iron-copper "skarn" deposits, is widespread in all parts of Vancouver Island, but the existing geological maps show few exposures in the area under consideration in this report.

More detailed mapping will undoubtedly, therefore, outline many other Quatsino limestone exposures with corresponding chances for magnetite occurrences of some merit.

RECOMMENDATIONS

The Alberni-Bamfield-Port Renfrew region is considered to be a good area for exploration and warrants ground examination. It is one of the few areas on Vancouver Island that has not been geologically mapped in detail or thoroughly prospected. For these reasons, it is recommended that a careful and detailed prospecting and geological mapping program be undertaken as soon as weather conditions permit.

It is felt that good possibilities exist for the discovery of magnetite-skarn zones and/or porphyry copper deposits of merit, particularly since the area lies on the strike of the zone of igneous activity in which the great majority of the presently known mineral deposits of Vancouver Island are located.

Respectfully submitted,

BACON & CROWHURST LTD.

R. W. Phendler, P. Eng
R.W. Phendler, Sc., P.Eng.



LOCATION AND ACCESS

(See Fig. 1)

The Alberni-Bamfield-Port Renfrew area under consideration is situated on the southwest coast of Vancouver Island, between Barclay Sound and Port Renfrew (about 30 miles), and extends about 25 miles inland. It is possibly one of the least explored parts of the Island and has been one of the least accessible. However, logging roads from Alberni on the north, Cowichan on the east and Port Renfrew on the south now traverse the area.

A well-kept foot trail extends along the coast between Bamfield and Port Renfrew and is used for rescue work. A narrow strip along the shoreline has recently been designated a national park; it is believed that this park will be only a few hundred feet wide along the beaches.

HISTORY

The first recorded mining in British Columbia took place in the 1850's, in the Nanaimo coal fields. Prospecting was a natural result of this mining and, by 1890, many claims were staked as far west as Alberni, Bamfield and Tofino.

In more recent years (1930's) mining took place near Alberni at the Thistle copper property (see Fig. 2); about 7,000 tons of copper ore was produced between 1938 and 1942. Zeballos, situated on the northwest coast of Vancouver Island, was a thriving gold camp during the late 1930's.

Companies known to be actively engaged in exploration work in the area under consideration during the past 15 years include the following: Cowichan Copper Co. Ltd., Marshall Creek Mines Ltd., Gunnex Mining Ltd., Noranda Explorations Ltd., Consolidated Mining and Smelting Co. Ltd., "O. MacDonald" group of companies, Bralorne Pioneer Mines Ltd. and Dore Metals Ltd.

No production however has resulted from any prospect in the area under consideration, but the nearby Cowichan Copper property on the south shore of Cowichan Lake produced 273,000 tons of 2.7% Cu since 1950.

REGIONAL GEOLOGY

The Alberni-Bamfield-Port Renfrew area is underlain by (1) the Sicker Group (late Paleozoic), (2) the Vancouver Group (Triassic and Jurassic) which overlies the Sicker Group formations, and (3) Granitic intrusions (Jurassic and Tertiary).

(1) Sicker Group

This group, which is probably the oldest formation on Vancouver Island, consists of 5000 feet or more of volcanic tuff and breccia, often folded and sheared, overlain by argillites and limestones which form the top member of the group.

The orebodies of Western Mines Ltd., near Buttle Lake, and the Thistle Mine, near Alberni, are located within Sicker Group rocks.

(2) Vancouver Group

This group is the thickest and most widespread rock unit on Vancouver Island and is divided into three formations.

(a) The Karmutsen Formation is composed largely of pillowed and porphyritic basalt with pillow breccia and tuff and minor argillite and quartzite. The basalt is commonly amygdaloidal. This formation is not considered to be favourable for base metal occurrences except when found in contact with limestone and intrusive plutons where copper and iron "skarn" deposits have been found. Gold quartz veins have also been discovered within Karmutsen volcanics.

(b) The Quatsino Formation overlies the Karmutsen formation conformably and is composed of up to 3000' of limestone. It ranges upward from massive grey to thin-bedded black limestone, in places with an upper part of calcareous greywacke and limestone breccia. In some areas it is interbedded with Karmutsen type basaltic rocks. Granitic plutons are common within and near the Quatsino limestone, and near the contacts the limestone has been converted to coarse marble and "skarn". "Skarn" is a name applied to a rock rich in one or more silicate minerals such as epidote, garnet, amphibole and pyroxene and is often associated with occurrences of chalcopyrite, pyrrhotite and magnetite.

(c) The Bonanza Subgroup conformably overlies the Quatsino formation and consists of a lower member of altered basaltic to andesite tuff, breccia and lava, interbedded with greywacke and argillite. The upper member consists largely of commonly red-coloured felsitic lavas, tuffs, breccias and ignimbrites. Rocks of the Bonanza subgroup have been

metamorphosed in many places to a greenschist (chloritic) facies. The upper Bonanza may be as young as middle Jurassic and it is estimated to be 9000 feet thick in northern Vancouver Island. The Bonanza subgroup is in part correlative with the Hazelton group of mainland British Columbia.

(3) Granitic Intrusions

The Sicker and the Vancouver group formations have been intruded by granitic rocks during two periods as follows:

1. The "Island" intrusions of middle to late Jurassic age.

These rocks are generally medium grained, pale pinkish-grey, granular hornblende and/or biotite granodiorite with minor quartz monzonite and quartz diorite near the peripheries of the plutons. The plagioclase crystals are generally cloudy. The rocks generally show strong alteration and are often gneissic but rarely porphyritic. They have not been considered to be favourable as regards mineralization, although the Island Copper Company (Port Hardy area) deposit of chalcopyrite and molybdenum stockwork discovered recently in volcanics is believed to be associated with a porphyritic phase of Jurassic granodiorite.

2. Tertiary intrusions of early to middle Tertiary age.

These rocks are of quartz diorite composition, light grey, and fine to medium grained in texture. They show negligible alteration, are rarely gneissic but commonly porphyritic and are often brecciated.

All porphyry copper deposits on Vancouver Island found to date are located within rocks of this type, and most are situated along a northeasterly trending zone that crosses Vancouver Island between Tofino and Campbell River. Gold-bearing quartz veins and fissure zones commonly occur close to the quartz diorite Tertiary plutons.

VANCOUVER ISLAND MINERAL DEPOSITS

(1) "Porphyry" Copper Deposits

One porphyry copper type of deposit found to date on Vancouver Island consists of large zones of low-grade (0.50%-1.00% copper) disseminated and fracture-filling copper mineralization within Tertiary intrusive plutons. The main ore mineral is chalcopyrite with minor bornite and molybdenite.

Examples of this type of copper deposit on Vancouver Island include the following: Catface Mountain, Mount Washington, Faith Lake, Gem Lake, the Big I and Corrigan Creek. Of these, to date, only Catface is of probable economic value and it is of considerable size. It has been known for at least 10 years but logging operations in the area have held up its development.

The intrusive bodies are Tertiary stocks and plugs consisting of quartz diorite and related porphyries. Most lie on a northeast trending zone mentioned previously; much exploration and development work has been carried out on them.

Investigations and studies completed during the preparation of this report indicate that a second northeast trending zone

of Tertiary plutons with associated porphyry copper deposits is present a few miles east of and parallel to the Alberni Canal.

An example is the mineral deposit on the Andy and Par group of claims of Noranda Explorations Ltd. on Corrigan Creek (Fig. 2). It consists of disseminated copper and molybdenum mineralization in a host rock of quartz diorite cut by numerous feldspar porphyry dykes. Exploration work, including diamond drilling, has been carried out on this prospect in 1966, 1967 and 1968.

A possible northern continuation of this zone lies in the China Creek area about 7 miles southeast of Port Alberni. Although the principal property in the area, the Thistle Mine (1930's) consisted of two chalcopyrite replacement orebodies within Sicker limestones, a line of feldspar porphyry intrusives has been discovered by subsequent exploration work. This zone parallels a band of quartz diorite which extends for five miles. It is well brecciated and cemented with mineralized quartz veins on both contacts. This area was considered by J.S. Stevenson of the British Columbia Department of Mines to be good prospecting ground (See Minister of Mines report 1944).

(2) Iron and Copper "Skarn" Deposits

Iron and copper skarn deposits are found in many locations on Vancouver Island and most of the known larger deposits yielded ore. Iron ore has been produced from Kennedy Lake, Empire Development, Nimpkish, Zeballos and others. All these, except Kennedy Lake, are in the northwest part of Vancouver Island while the Kennedy Lake deposit is near Tofino. This property was worked between 1962 and 1968, total

ore milled being 4,300,000 tons of magnetite ore, containing approximately 50%-52% iron.

The Bugaboo magnetite property of Noranda Explorations Ltd. is located about ten miles north of Port Renfrew in the southern part of Vancouver Island. Like all iron skarn deposits of Vancouver Island, it is associated with Quatsino limestone, Jurassic intrusions and volcanic rocks. It is reportedly of sizeable dimensions but high in sulphur content.

The copper-iron skarn deposit of Coast Copper Co. Ltd. in northern Vancouver Island lies in the upper part of the Karmutsen volcanic formation in a layer of skarn immediately below the Quatsino limestone. The magnetite-chalcopyrite-bornite mineralization is in intrusive diorite believed to be related to the nearby diorite-gabbro Coast Copper stock.

In general, these Vancouver Island copper-iron skarn deposits have the following characteristics:

1. The mineralization is accompanied with skarn in which brown garnet is the dominant mineral.
2. The deposits occur along or close to contacts between folded metamorphosed rocks and Jurassic (Island) intrusives. Limestone is invariably present and it seems probable that the composition of this rock has in some manner, either structural or chemical, influenced the deposition of the magnetite and chalcopyrite. Thus, limestone assumes the utmost significance in any search for new magnetite deposits.

3. The deposits tend to occur in local areas of intense folding.
4. The magnetite deposits rarely occur singly, are highly irregular and generally terminate abruptly.

It is thought that the magnetite was derived from the basic volcanic rocks of the Karmutsen formation as the Jurassic granitic magmas intruded themselves upwards into the hospitable limestone environment.

It should be noted that the area under consideration in this report has apparently not been thoroughly mapped geologically, unless this has been carried out by independent exploration companies. Available Government maps are based on reconnaissance work done by Clapp in 1917. Reports indicate that many limestone-iron skarn occurrences exist but none, as yet, have developed into commercial deposits. The area has not been aeromagnetically surveyed by Government agencies but it is understood that Noranda Explorations Ltd. (and/or McIntyre-Porcupine) carried this out in the early 1960's. Reports are that the deposit at Kennedy Lake gave very low anomalous magnetic readings. Consequently, negative results may not be conclusive.

(3) Other Mineral Deposits

(a) Western Mines Ltd.

Western Mines Ltd. copper-zinc deposits near Buttle Lake are tabular, irregularly-shaped ore zones within sheared cherty tuffs and volcanic breccias of the Sicker group. No known intrusives are located within two miles of the deposits. Extensive exploration has

taken place in other areas on Vancouver Island underlain by Sicker group volcanics in a search for similar deposits but little of interest regarding new deposits has been discovered to date.

It should be noted that the Twin "J" (formerly the "Tyee" - "Lenora" - "Richard the Third" mines) copper-zinc deposits appear to be similar to the Western Mines orebodies and are in the Sicker group of rocks.

(b) Island Copper

The Island Copper deposit of Utah Mining and Construction Co. is located near Port Hardy on the northern end of Vancouver Island. It is reported to contain more than 180 million tons grading 0.52% Cu and 0.25% molybdenite (MoS_2). The mineralization is in silicified andesitic volcanics (similar to those at the Ingerbelle and Copper Mountain deposits near Princeton, B.C.) and greywackes of the Bonanza subgroup. It is spatially and probably genetically related to a Jurassic granodiorite porphyry stock. Consequently, exploration for similar deposits (copper-molybdenum stockworks) should place due emphasis on the Bonanza subgroup particularly in the vicinity of intrusions (preferably porphyritic).

(c) China Creek

The numerous gold-quartz veins found in the China Creek area are related to quartz diorite porphyry intrusives. Many of the other known gold-quartz veins throughout Vancouver Island are within or alongside the same quartz diorite plugs and stocks that contain the porphyry copper deposits (Mount Washington, Catface Mountain).

(d) Gordon River

Disseminated chalcopyrite mineralization has been discovered in quartz diorite near Gordon River (15 miles north of Port Renfrew) on a 300 claim group held by Dore Metals Ltd. of Victoria. It is reported that little exploration has been done since the writer examined the prospect in 1969, but it is felt that the property deserves further exploration.

(e) Jordan River

The Sunro Mine copper deposits near Jordan River on the southern coast of Vancouver Island are found near the contact of Tertiary gabbroic intrusives and basalts. There are at least thirteen zones of disseminated chalcopyrite mineralization, only a few of which have been developed. Similar deposits may be found close to the Sunro Mine but no possibilities exist in the area under consideration in this report because the rocks are of a different age.

(f) Gold Quartz Veins

Gold quartz veins of various parts of Vancouver Island are remarkably alike in all respects, although in some areas such as Zeballos, they are more persistent along strike than in other areas. The veins generally occur in zones of Tertiary igneous activity and many are close to porphyry copper deposits. Structural controls are fractures in rocks of widely varying types including those of the Sicker group, Karmutsen formation and Bonanza subgroup. The Zeballos veins are related to Jurassic intrusives and are among the few that yielded appreciable quantities of gold and silver.

In the region under consideration in this report, there are no reported gold quartz veins. However, in the China Creek area previously mentioned in this report, numerous deposits of this kind occur. Their association with potential porphyry copper deposits is significant and can be used as a guide in locating favourable granitic intrusives.

(g) Molybdenum Deposits

Marshall Creek Mines Ltd. carried out extensive exploration work on a property about 20 miles northeast of Banfield in 1966 and 1967. The deposit consisted of low-grade molybdenum mineralization in fractures, shears and quartz veins in altered granite and quartz monzonite.

The work consisted of tractor trenching and stripping and diamond drilling. It is reported that little of economic significance was found.

(h) Miscellaneous

It is reported that Marshall Creek Mines Ltd. recently optioned seventy-seven claims covering a zone of widespread sulphide mineralization within Bonanza subgroup rocks, located in the Nitinat Lake area. Jurassic intrusions are believed to outcrop in the vicinity. No other information is at present available.

STRUCTURAL TRENDS - PROBABLE AND POSSIBLE

Many mineral deposits on Vancouver Island are related to zones of known Tertiary igneous activity. This clearly defined zone extends for several miles from the northeast coast to Victoria in the south, and coincides with the distribution of plutonic rocks, both Jurassic and Tertiary.

The Alberni-Bamfield-Port Renfrew area lies on the zone as described above, although few Tertiary plutons are known to exist. This is undoubtedly due to the fact that little detailed geological mapping has been done and comprehensive maps are not available.

The northeasterly trending zone of Tertiary plutons, with which most porphyry copper deposits are related, extends from Tofino to Campbell River. A second zone with a similar strike may be present extending through the China Creek area southwesterly to Nitinat Lake.

The exposures of Quatsino limestone and related skarn deposits appear to be concentrated along the southwest coast of Vancouver Island. The area under consideration in this report is known to contain exposures of Quatsino limestone but nothing is known of the distribution. Geological reconnaissance will therefore undoubtedly disclose the presence of favourable Quatsino limestone in conjunction with granitic plutons.

MINERAL CLAIMS

Recent Department of Mines mineral claims maps have been acquired and show the following:

1. About 100 claims are in good standing along the east side of Nitinat Lake, presumably covering the showings of Marshall Creek Mines Ltd. and others. Apparently, no other claims exist for at least ten miles to the east from Nitinat Lake.
2. A large block of claims (about 400) are in good standing on the east side of the Nitinat River near the west end of Cowichan Lake. The Nadina and Skarn showings (copper skarn) are located in this area.
3. A few hundred claims exist in the area up to 3 miles east of Sarita River on the Alberni Canal. These cover molybdenum stockworks in granitic rocks discovered by Marshall Creek Mines Ltd.
4. Most of the claims in the China Creek area around the Thistle Mine are void.
5. The area between Nitinat Lake and Bamfield contains few claims. It is relatively inaccessible.

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GREAT CENTRAL LAKE

PARKSVILLE

NANAIMO
8 MILES

ALBERNI

VANCOUVER ISLAND
Gold - Qtz. Vein

SPROUT LAKE

NAHMINT LAKE

FRANKLIN RIVER

KENNEDY LAKE

HENDERSON LAKE

THISTLE
Copper Skarn

KENNEDY LAKE
Magnetite Skarn

MARY - Copper
in Shear Zone

CORRIGAN CREEK
PORPHYRY COPPER

TOFINO
20 MILES

SECHART
Mag. Skarn

FRANKLIN RIVER
CAMP "B"

SKARN
Copper Skarn

BARCLAY SOUND

SARITA LAKE

NADIRA
Copper Skarn

NITINAT

COWICHAN LAKE

BAMFIELD

MARSHALL CREEK
MoS₂ Veining

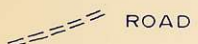
SKARN - NORANDA
Copper Skarn

BLUE GROUSE
ORIGINAL
COWICHAN MINE
Copper Skarn



LEGEND

- 6 INTRUSIVES
- 5 BONANZA SUBGROUP
- 4 QUATSINO FORMATION
- 3 KARMUTSEN FORMATION
- 2 SICKER GROUP
- 1 METAMORPHIC COMPLEX



ROAD

JUAN DE FUCA STRAIT

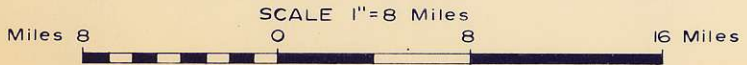
PORT RENFREW

JORDAN RIVER
4 MILES

CANADA
U.S.A.

OLYMPIA PENINSULA

BACON & CROWHURST LTD.
 MITSUI AND CO. (CANADA) LTD.
GEOLOGICAL MAP
 ALBERNI-BAMFIELD-PORT RENFREW AREA
 VANCOUVER ISLAND, BRITISH COLUMBIA



APRIL, 1970

FIG. 2